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HELMs

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THESE TABS  
ARE FOR THE

# **TAURUS/SABLE SHOP MANUAL**



# **1987 TAURUS / SABLE SHOP MANUAL**

# Important Safety Notice

Appropriate service methods and proper repair procedures are essential for the safe, reliable operation of all motor vehicles as well as the personal safety of the individual doing the work. This Shop Manual provides general directions for accomplishing service and repair work with tested, effective techniques. Following them will help assure reliability.

There are numerous variations in procedures, techniques, tools, and parts for servicing vehicles, as well as in the skill of the individual doing the work. This Manual cannot possibly anticipate all such variations and provide advice or cautions as to each. Accordingly, anyone who departs from the instructions provided in this Manual must first establish that he compromises neither his personal safety nor the vehicle integrity by his choice of methods, tools or parts.

## Notes, Cautions, and Warnings

As you read through the procedures, you will come across NOTES, CAUTIONS, and WARNINGS. Each one is there for a specific purpose. NOTES give you added information that will help you to complete a particular procedure. CAUTIONS are given to prevent you from making an error that could damage the vehicle. WARNINGS remind you to be especially careful in those areas where carelessness can cause personal injury. The following list contains some general WARNINGS that you should follow when you work on a vehicle.

- Always wear safety glasses for eye protection.
- Use safety stands whenever a procedure requires you to be under the vehicle.
- Be sure that the ignition switch is always in the OFF position, unless otherwise required by the procedure.
- Set the parking brake when working on the vehicle. If you have an automatic transmission, set it in PARK unless instructed otherwise for a specific operation. If you have a manual transmission, it should be in REVERSE (engine OFF) or NEUTRAL (engine ON) unless instructed otherwise for a specific operation. Place wood blocks (4" x 4" or larger) to the front and rear surfaces of the tires to provide further restraint from inadvertent vehicle movement.
- Operate the engine only in a well-ventilated area to avoid the danger of carbon monoxide.
- Keep yourself and your clothing away from moving parts, when the engine is running, especially the fan and belts.
- To prevent serious burns, avoid contact with hot metal parts such as the radiator, exhaust manifold, tail pipe, catalytic converter and muffler.
- Do not smoke while working on a vehicle.
- To avoid injury, always remove rings, watches, loose hanging jewelry, and loose clothing before beginning to work on a vehicle.
- If it is necessary to work under the hood, keep hands and other objects clear of the radiator fan blades! The electric cooling fan can start to operate any time by an increase in underhood temperature. For this reason care should be taken to ensure that the electric cooling fan motor is completely disconnected when working under the hood.

# Foreword

This 1987 Car Shop Manual provides information covering normal service, repairs, and maintenance for Body, Chassis, Electrical, Powertrain, Maintenance and Lubrication systems for 1987 Taurus/Sable passenger cars manufactured in the United States and Canada.

This manual is organized into Groups covering general systems. Within each Group, the information is further divided into Sections. There is one Section for each component or sub-system. Some Groups contain a Service Section to cover procedures common to several components or sub-systems within the Group. In general, each Section contains the Description, Operation, Diagnosis and Testing, Removal and Installation, and Disassembly and Assembly procedures for the component covered in the Section. Diagnosis Charts are also included in some Sections to help you systematically locate and correct problems encountered. In most cases, specifications are included at the end of each Section.

To aid in locating specific subjects in this manual, use the Table of Contents on the following pages, or the Alphabetical Subject Index in the back of this manual.

As a further aid, there is an index on the first page of each Group which lists the Section title and Section number for each component covered within the group. The first page of each Section also contains an index to locate service operations covered in that Section. This Group-Section breakdown is also indicated in the page number located at the top of each page.

**Example: 11-02-3 = (Group) 11 — (Section) 02 — (Page) 3**

The descriptions and specifications contained in this manual were in effect at the time this manual was approved for printing. Ford Motor Company reserves the right to discontinue models at any time, or change specifications or design without notice and without incurring obligation.

For service information on specific car lines for Body, Chassis and Electrical; Powertrains; Emissions; and/or Pre-Delivery, refer to the Cross Index in the front of this manual.



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Training and Publications Department**

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# Cross Index

Manual	Content	Vehicle Lines
<b>A</b>	Body, Chassis, Electrical .....	Lincoln Town Car, Ford Crown Victoria/ Mercury Grand Marquis
<b>B</b>	Body, Chassis, Electrical .....	Mark VII/Continental Thunderbird/Cougar Mustang
<b>C</b>	Body, Chassis, Electrical .....	Tempo/Topaz Escort/Lynx
<b>D</b>	Powertrain, Lubrication, Maintenance ..	Lincoln Town Car, Ford Crown Victoria Mercury Grand Marquis Mark VII/Continental, Thunderbird/Cougar Mustang
<b>E</b>	Powertrain, Lubrication, Maintenance ..	Tempo/Topaz Escort/Lynx, EXP
<b>F</b>	Pre-Delivery .....	All Models
<b>G</b>	Body, Chassis, Electrical, Powertrain, Maintenance, Lubrication .....	Taurus/Sable
<b>H</b>	Engine/Emissions Diagnosis .....	All Car & Truck Models

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# IDENTIFICATION CODES

## GROUP **10**

### SECTION 10-01 Vehicle Identification

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#### VEHICLE APPLICATION

Taurus/Sable.

#### DESCRIPTION

##### Official Vehicle Identification Number

The official Vehicle Identification Number (VIN) for title and registration purposes is stamped on a metal tab that is fastened to the instrument panel close to the windshield on the driver's side of the vehicle and is visible from outside.

##### Vehicle Certification Label

The Vehicle Certification Label (V.C. Label) is affixed on the LH front door lock panel or door pillar. The upper half of the label contains the name of manufacturer, month and year of manufacture, Gross Vehicle Weight Rating (GVWR), Gross Axle Weight Rating (GAWR), and the certification statement.

The V.C. label also contains a 17 character Vehicle Identification Number. This number is used for warranty identification of the vehicle, and indicates: manufacturer, type of restraint system, line, series, body type, engine, model year and consecutive unit number.

The last six digits of the Vehicle Identification Number indicate the Consecutive Unit Number of each unit built at each assembly plant. The Consecutive Unit Numbers begin as follows:

100 001 thru 600 000: Ford Division Vehicles.

600 001 thru 999 999: Lincoln/Mercury Division Vehicles.

The remaining information on the V.C. Label consists of the following vehicle identification codes: color and body type, vinyl roof, moulding, and interior trim. Additional codes indicate vehicles equipped with air conditioning, radio type, sun roof type (if any), as well as axle, transmission, spring, district and special order codes.

The following charts provide various codes and their respective identification.



## IDENTIFICATION CODES

WORLD MANUFACTURER IDENTIFIER  
(VIN POSITIONS 1, 2 AND 3)

1FA BP43M2HX100001

Code	Manufacturer	Make	Type
1FA	Ford Motor Company, USA	Ford	Passenger Car
1ME	Ford Motor Company, USA	Mercury	Passenger Car
1LN	Ford Motor Company, USA	Lincoln	Passenger Car
1MR	Ford Motor Company, USA	Continental	Passenger Car
1FD	Ford Motor Company, USA	Ford	Incomplete Vehicle
1MH	Ford Motor Company, USA	Mercury	Incomplete Vehicle
2FA	Ford Motor Company, of Canada, Ltd.	Ford	Passenger Car
2ME	Ford Motor Company of Canada, Ltd.	Mercury	Passenger Car
2FD	Ford Motor Company of Canada, Ltd.	Ford	Incomplete Vehicle
2MH	Ford Motor Company of Canada, Ltd.	Mercury	Incomplete Vehicle
1FF	Ford Motor Company, USA	Ford	Motor Vehicle Equipment Without Engine/Powertrain (Glider)
2FF	Ford Motor Company of Canada, Ltd.	Ford	Motor Vehicle Equipment Without Engine/Powertrain (Glider)

CY2202-G

VIN CHECK DIGIT FOR ALL VEHICLES  
(VIN POSITION 9)

1FABP43M 2 HX100001

CY2207-F

## VIN POSITIONS

1FAB P 43M2HX100001

Constant — P (Passenger Car Only)

CY2204-F

PRODUCTION SEQUENCE NUMBER  
(VIN POSITIONS 12 THROUGH 17)

1FABP43M2HX 100001

Sequence Number
100,001 through 600,000 — Ford Division Vehicles
600,001 through 999,999 — Lincoln/Mercury Division Vehicles

CY2210-G

RESTRAINT SYSTEM TYPE  
(PASSENGER CARS ONLY)

(VIN POSITION 4)

1FA B P43H2FZ100001

Description	VIN Code
Active Belts	B
Passive Belts (Front)	P
Active Belts and Driver Air Bag (and Active Belt)	C

CY2203-E

VEHICLE MODEL YEAR  
FOR ALL VEHICLES  
(VIN POSITION 10)

1FABP43M2 H X100001

VIN Code	Year
C .....	1982
D .....	1983
E .....	1984
F .....	1985
G .....	1986
H .....	1987

CY2208-G

## IDENTIFICATION CODES (Continued)

## LINE, SERIES, BODY TYPE FOR PASSENGER CARS

(VIN POSITIONS 6 AND 7)

1FABP 18 F2FZ100001

VIN Code	Line	Series	Additional Optional Exterior Nameplates	Body Type	Body Code
Make — Ford					
29	Taurus	(Base)	LX, MTS, L, GL	4-Dr. Sedan	54D
30	Taurus	(Base)	LX, MTS, L, GL	4-Dr. Station Wagon	74D
Make — Mercury					
87	Sable	GS	LS	4-Dr. Sedan	54D
88	Sable	GS	LS	4-Dr. Station Wagon	74D

CY2637-A

## BODY TYPE CODES

2A  
EXTERIOR PAINT COLORSF0276  
R0141  
482450  
DSO

BODY	VR	MLDG.	INT. TRIM	A/C	R	S	AX	TR
54K	YB	84A	GB	A	2	B	8	TBBBB

VIN Code	Line	Series	Additional Optional Exterior Nameplates	Body Type	Body Code
Make — Ford					
29	Taurus	(Base)	LX, MTS, L, GL	4-Dr. Sedan	54D
30	Taurus	(Base)	LX, MTS, L, GL	4-Dr. Station Wagon	74D
Make — Mercury					
87	Sable	GS	LS	4-Dr. Sedan	54D
88	Sable	GS	LS	4-Dr. Station Wagon	74D

CY2638-A

## IDENTIFICATION CODES (Continued)

## EXTERIOR PAINT COLOR CODES

2A

## EXTERIOR PAINT COLORS

BODY	VR	MLDG.	INT. TRIM	A/C	R	S	AX	TR
54K	YB	84A	GB	A	2	B	8	TBBBB

F0276  
R0141  
482450  
DSO

CODE	COLOR	SPEC	REF	CODE	COLOR	SPEC	REF
1C	Black	JASAXXA	1724A	CLEAR COAT M6001 AND POLYESTER CLEAR COAT M6000			
1E	Silver Met.	4PLCXXA	5967A	1J	Graphite Met.	6PREWWA	6045A
1D	Smoke Met.	6POCXXA	6044A	1L	Crystal	6PJEWXA	6069A
1K	Smoke	6PUAXXA	6062A	1Q	Silver Met.	3P3CWWA	5909A
2C	Mid. Canyon Red Met.	4DRCXXA	5925A	1R	Black	4ASAWXA	6018A
2D	Light Canyon Red	4DLAXXA	5944A	1V	Titanium	6PNCWWA	6117A
2H	Mid. Canyon Red	4DRAXXA	5928A	14	Silver Met. Hi Solid	3P3CWWA	6041A
3U	Mid. Regatta Blue	5B5AXXA	6008A	18	Smoke Met. Hi Solid	5PQCWWA	6091A
3R	Med. Shadow Blue Met.	6B8CXXA	6225A	2N	Dk. Cabernet	7DREWWA	6237A
5A	Taupe	6FJAXXA	6057A	2Z	Mid. Cabernet	7ASAWXA	6163A
6H	Jonquil	6VJAXXA	6072A	26	Bright Red Hi Solid	7DMEWWA	6185A
7A	Spinnaker Blue	6BLAXXA	6047A	3S	Pastel Regatta Blue Met.	5BHCWWA	6004A
7B	Shadow Blue Met.	6B6CXXA	6048A	33	Lt. Regatta Blue Met. H.S.	5BHCWWA	6111A
7H	Bright Reg. Blue Met.	589CXXA	5979A	4L	Prairie Mist Met.	7GPCWWA	6159A
7N	Dk. Shadow Blue Met.	7BRCXXA	6188A	48	Med. Aegean Met. H.S.	6KNCWWA	6093A
8A	Med. Sand Beige	6TLAXXA	5068A	5B	Driftwood Met. H.S.	6TFCWWA	6094A
8L	Sand Beige	5TKAXXA	5978A	5Q	Deep Taupe	6FRCWWA	6149A
8R	Light Sandalwood	7ZLAXXA	6170A	5W	Light Taupe Hi Solid	6FHCWWA	6059A
8Y	Dk. Sable Met.	5ZRCXXA	5973A	55	Med. Taupe Met. H.S.	6FQCWWA	6095A
9L	Oxford White	4WFAXXA	5920A	7P	Med. Shadow Blue	7BNCWWA	6180A
				7Q	Dark Shadow Blue	7BRCWWA	6196A
				77	Med. Shadow Blue Hi Solid	7BNCWWA	6181A
				8D	Deep Sandalwood Met.	6TRCWWA	6056A
				8H	Light Sandalwood	5TTCWWA	6010A
				8Z	Sandalwood	5TPCWWA	6114A

CY2211-G

## IDENTIFICATION CODES (Continued)

## VINYL BODYSIDE MOULDING CODES

2A  
EXTERIOR PAINT COLORSF0276  
R0141  
482450  
DSO

BODY	YR	MLDG.	INT. TRIM	A/C	R	S	AX	TR
54K	YB	84A	GB	A	2	B	8	TBBBB

CODE	COLOR	SPEC	GRAIN	CODE	COLOR	SPEC	GRAIN
22A	Black	JASABBH	Suede	47K	Medium Aegean	6KNCAXA	Insert Smooth
57A	Black	JASABBG	Suede	76K	Dark Slate	5KQABBG	Suede
76A	Black	JASAXXA	Insert Smooth	AEP	Silver	4PKQBB	Suede
80A	Black	JASABB	Suede	AMP	Medium Grey	6PVCXXA	Smooth Painted
84A	Black	JASABN	Camera Case	BBP	Graphite Metallic	6PRCXXA	Insert Smooth
89A	Midnight Black Clear Coat	JAREBB	Suede	BCP	Smoke	GPUAXXA	Insert Smooth
51B	L. Regatta Blue Metallic	5BHCBB	Suede	L8P	Dark Charcoal	XPSABBH	Suede
52B	Regatta Blue Metallic	5BNCBB	Suede	S6P	Light Charcoal	4PLABBG	Suede
94B	P. Reg. Blue Metallic	5BHCAXA	Insert Smooth	S9P	Light Oxford Gray	4PLABN	Camera Case
A6B	Dp. Sh. Blue Metallic	6BSCBB	Suede	Y5P	Silver Metallic	3P3CAXXA	Insert Smooth
B1B	Deep Shadow Blue	6BSABBG	Suede	Y7P	Smoke	GPUABB	Suede
B8B	Light Regatta Blue	5BHABBG	Suede	Y8P	Graphite	6PRCBB	Suede
C6B	Medium Regatta Blue	6BTCXXA	Smooth Painted	Z7P	Smoke	6PCABBG	Suede
E7B	Deep Shadow Blue Metallic	6BSCAXA	Insert Smooth	B3T	Deep Sandlewood Metallic	6TRCBB	Suede
F9B	Dark Smoke	6PPABBG	Suede	B6T	Deep Sandlewood	6TRABBG	Suede
H2B	Shadow Blue	6BQABN	Camera Case	B8T	Sand Beige	5TGABBG	Suede
S3B	Dark Blue	5BRABBG	Suede	C7T	Buckskin	6TNCXXA	Smooth Painted
YZD	Medium Canyon Red	4DPABBG	Suede	E5T	Deep Sandlewood Metallic	6TRCAXA	Insert Smooth
Z5D	Dark Canyon Red Metallic	5DQCAXA	Insert Smooth	F1T	Medium Sand Beige	6TLABN	Camera Case
03D	Dark Canyon Red	5D6ABBG	Suede	H2T	Medium Sandelwood Clear Coat	6TQCBB	Suede
26D	Dark Canyon Red Metallic	5DQCBB	Suede	19T	Sand Beige Metallic	5TGCBB	Suede
85D	Midnight Canyon Red	4DRABN	Camera Case	20T	Medium Beige Metallic	5TMCBB	Suede
E5F	Light Taupe	6FHCBB	Suede	82T	Medium Sand Beige	5TNABBG	Suede
E6F	Dark Taupe Metallic	6LFSCBB	Suede	96T	Medium Sand Beige Met.	5TMCAXA	Insert Smooth
F2F	Light Taupe	6FHABBG	Suede	03W	Oxford White	4WGABB	Suede
F3F	Dark Taupe	6FSABBG	Suede	11W	Oxford White	4WGABBE	Suede
G2F	Taupe	6FMCXXA	Smooth Painted	31W	Oxford White	4WFABN	Camera Case
29F	Light Taupe Metallic	6FHCAXA	Insert Smooth	34W	Oxford White	4WFABBG	Suede
30F	Dark Taupe Metallic	6FSCAXA	Insert Smooth	37W	Oxford White	4WFAAXA	Insert Smooth
19K	Light Aegean Metallic	6KHCBB	Suede	E2Z	Dark Sable	5ZRABN	Camera Case
22K	Medium Aegean	6KNABBG	Suede				
23K	Medium Aegean	6KNCBB	Suede				

CY2214-G

ASSEMBLY PLANT  
(VIN POSITION 11)

1FABP43MZH X 100001

VIN Code	
A	Atlanta
B	Oakville
F	Dearborn
G	Chicago
H	Lorain
K	Kansas City
T	Edison
W	Wayne
X	St. Thomas
Y	Wixom

CY2209-G

## IDENTIFICATION CODES (Continued)

## TRIM SCHEME

2A

## EXTERIOR PAINT COLORS

BODY	VR	MLDG.	INT. TRIM	A/C	R	S	AX	TR
54K	YB	84A	D GB	A	2	B	8	TB888

F0276  
R0141  
482450  
DSO

Code	Trim Scheme Fabric	Seat Type	Code	Trim Scheme Fabric	Seat Type
<b>Taurus</b>			<b>Sable</b>		
B	Vinyl	Individual	B	Vinyl	Individual
C	Vinyl	Flight Bench	C	Vinyl	Flight Bench
D	Vinyl	Split Bench	D	Vinyl	Split Bench
E-W	B/Cloth	Individual	P	B/Cloth	Individual
F	B/Cloth	Split Bench	Q	B/Cloth	Flight Bench
H	B/Cloth	Flight Bench	R	B/Cloth	Split Bench
K	B/Cloth	Individual	S	B/Cloth	Individual
L	Leather	Individual	T	Leather	Individual
M	B/Cloth	Split Bench	U	B/Cloth	Split Bench
N	Leather	Split Bench	V	Leather	Split Bench

CY2639-A

## SUNROOF/MOONROOF CODES

2A

## EXTERIOR PAINT COLORS

BODY	VR	MLDG.	INT. TRIM	A/C	R	S	AX	TR
54K	YB	84A	GB	A	2	C	8	TB88

F0276  
R0141  
482450  
DSO

## CODES

- B — Sunroof Glass  
C — Sunroof Removable Glass  
D — "T" Roof

CY2219-D

## AIR CONDITIONER CODE

2A

## EXTERIOR PAINT COLORS

BODY	VR	MLDG.	INT. TRIM	A/C	R	S	AX	TR
54K	YB	84A	GB	A	2	B	8	TB888

F0276  
R0141  
482450  
DSO

## A/C Air Conditioner

If Installed Use Letter "A"  
Less Air Conditioner Remains Blank

CY2217-D

## RADIO TYPE CODES

2A

## EXTERIOR PAINT COLORS

BODY	VR	MLDG.	INT. TRIM	A/C	R	S	AX	TR
54K	YB	84A	GB	A	2	B	8	TB888

F0276  
R0141  
482450  
DSO

Codes	
2	Radio AM
4	Radio AM/FM Multiplex
6	Radio AM/FM/MPX, Electronic Premium Cassette
7	Radio AM/FM/MPX, Cassette
F	Radio AM/FM Stereo, Electronic Tune Seek
H	Radio AM/FM Stereo/Cassette, Electronic
Y	Radio Delete
9	Radio AM/FM MPX Clock/Cassette Electronic

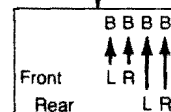
CY2218-G



## IDENTIFICATION CODES (Continued)

SUSPENSION SPRING CODES  
FRONT L & R, REAR L & RNOTE: SPRING CODES WILL APPEAR DIRECTLY AFTER  
THE TRANSMISSION CODE.2A  
EXTERIOR PAINT COLORS

BODY	YR	MLDG.	INT. TRIM	A/C	R	S	AX	TR
54K	YB	84A	GB	A	2	B	8	T BBB

F0276  
R0141  
482450  
DSO

Coding	Part No.	Catch-Word	9270 (LH/RH)	Coding	Part No.	Catch-Word	9270 (LH/RH)
Front Springs '5310' — Left (267), Right (268)				Rear Springs '5560'			
A	E0AC-AA	AS	8CG/9CG	1	D9AC-AAA	LUG	8QK/9QK
B	E1AC-AA	FAW	8BQ/9BQ	2	D9AC-ABA	WAG	8TC/9TC
4	D9AC-ALA	LOB	8AE/9AE	3	D9AC-ACA	IRA	8TJ/9TJ
5	D9AC-AMA	MIM	8AF/9AF	4	D9AC-ADA	SPA	8TL/9TL
6	D9AC-ANA	NUL	8AG/9AG	5	D9AC-AEA	TOW	8TM/9TM
H	D9AC-HA	HIP	8EN/9EN	6	E4AC-AA	AAD	8T2/9T2
J	D9AC-JA	JOG	8EJ/9EJ	7	E4AC-BA	BAU	8T3/9T3
G	D9AC-GA	GAJ	8EH/9EH	8	E4AC-CA	CAU	8T4/9T4
L	D9AC-LA	LYL	8EL/9EL	9	E4AC-DA	DAE	8T5/9T5
M	D9AC-MA	MAL	8EM/9EM	B	D9AC-BA	HUT	8TG/9TG
N	D9AC-NA	NAT	8ES/9ES	C	D9AC-CA	IKE	8TP/9TP
R	D9AC-RA	RIM	8ET/9ET	D	D9AC-DA	LES	85Q/9TO
S	D9AC-SA	SAP	8EU/9EU	G	E5AC-BA	SIG	8T7/9T7
T	D9AC-KA	KIL	8BU/9BU	H	E0AC-HA	RIK	8QM/9QM
				J	E0AC-JA	TAN	8QN/9QN
				L	D9AC-LA	VIS	8TX/9TX
				N	D9AC-NA	QYK	8T6/9T6
				S	D9AC-SA	QAL	8QD/9QD
				T	E5AC-DA	SHU	8T9/9T9
				U	E0AC-CA	QOT	8P39P3
				W	E0AC-KA	WIX	8QR9QR
				X	E0AC-LA	WAJ	8QX9QX
				Y	D9AC-YA	PER	8QA/9QH

CY2222-F

## IDENTIFICATION CODES (Continued)

## TRIM SCHEME COLOR CODE

2A  
EXTERIOR PAINT COLORS

BODY	VR	MLDG.	INT. TRIM	A/C	R	S	AX	TR
54K	YB	84A	G <b>B</b>	A	2	B	8	TBBBB

Code	Trim Color
B	Regatta Blue
D	Scarlet
E	Taupe
G	Smoke
Y	Sand Beige

CY2640-B

## TRANSMISSION

2A  
EXTERIOR PAINT COLORS

BODY	VR	MLDG.	INT. TRIM	A/C	R	S	AX	TR
54K	YB	84A	GB	A	2	B	8 <b>T</b>	B88B

Code	Manual
D	5-Speed MTX III
	Automatic
B	ATX (Batavia)
T	AXOD

CY2641-A

## SPECIAL ORDER

2A  
EXTERIOR PAINT COLORS

BODY	VR	MLDG.	INT. TRIM	A/C	R	S	AX	TR
54K	YB	84A	GB	A	2	B	8	TBBBB

IF UNIT IS BUILT ON A D.S.O., F.S.O., P.T.O. (SPECIAL ORDERS), THE COMPLETE ORDER NUMBER IS TO APPEAR AFTER THE DISTRICT CODE.

CY2224-D

ENGINE TYPE — DISPLACEMENT, CYLINDERS,  
FUEL TYPE, AND MANUFACTURER

(VIN POSITION 8)

1FABP18 **H** 2FZ100001

VIN Code	Displacement		Cylinders	Fuel	Manufacturer
	Liter	CID			
D	2.5 HSC CFI	153	4	Gasoline	Ford
U	3.0 EFI	182	6	Gasoline	Ford

CY2642-A

## IDENTIFICATION CODES (Continued)

## DISTRICT CODES

2A  
EXTERIOR PAINT COLORS

BODY	YR	MLDG.	INT. TRIM	A/C	R	S	AX	TR
66K	YD	68D	DD	A	2	B	8	TBBBB

The D.S.O. Space will Show a Two Digit Code Number of the District Sales Office Which Ordered the Unit. This Code will Appear on all Units, Domestic — Special Order — Export — Etc.

F0276  
R0141  
482450  
DSO

Ford Division				L-M Division	
Code	District	Code	District	Code	District
00	Special	52	Dallas	00	Special
11	Boston	53	Kansas City	11	Boston
12	Buffalo	54	Omaha	15	New York
14	Pittsburgh	55	St. Louis	16	Philadelphia
15	New York	57	Houston	17	Washington
16	Philadelphia	58	Twin Cities		
17	Washington			21	Atlanta
		71	Los Angeles	22	Dallas
21	Atlanta	72	San Jose	23	Jacksonville
22	Charlotte	73	Salt Lake City	26	Memphis
23	Memphis	74	Seattle		
24	Jacksonville	75	Phoenix	32	Cincinnati
25	Richmond	76	Denver	33	Cleveland
26	New Orleans			34	Detroit
28	Louisville	83	Government		
		84	Home Office Reserve	41	Chicago
41	Chicago	85	American Red Cross	42	St. Louis
42	Cleveland	86	Recreational Vehicle Pool		
43	Milwaukee	87	Body Company	51	Denver
46	Indianapolis	89	Transportation Services	52	Los Angeles
47	Cincinnati			53	Oakland
48	Detroit	90's	Export	83	Government
				84	Home Office Reserve
				85	American Red Cross
				90's	Export

Ford Of Canada							
Code	Mercury Regions	Code	Mercury Regions	Code	Ford Regions	Code	Ford Regions
A1	Central	A6	Western	B1	Central	B6	Western
A2	Eastern	A7	Pacific	B2	Eastern	B7	Pacific
A3	Atlantic	A8	Great Lakes	B3	Atlantic	B8	Great Lakes
A4	Midwestern	I1	Export	B4	Midwestern	I1	Export

CY2223-D

## IDENTIFICATION CODES (Continued)

VEHICLE	ENGINE	Fuel Metering				Transmission						Axle				
		1949 <sup>①</sup>	7200 (VV)	Electronic Fuel Injection	Mechanical Fuel Injection	Manual		Automatic				Integral (7.5)	Traction-Lok (7.5)	Integral (8.8)	Traction-Lok (8.8)	Transaxle
						T50D	MTX	AOD	AXOD	A4LD	C-5	ATX				
Escort/Lynx, EXP	1.9L CFI			•			•					•				•
	1.9L HO EFI			•			•					•				•
	2.0L Diesel <sup>③</sup>				•		•									•
Tempo/Topaz	2.3L & CFI			•			•					•				•
	2.3L CFI			•			•					•				•
	2.3L HSC 2V	•					•					•				•
	2.0L Diesel				•		•									•
Taurus/Sable	2.5L HSC CFI			•			•					•				•
	3.0L EFI			•					•							•
Mustang	2.3L EFI									•		•	•			
	5.0L HO SEFI					•									•	
	5.0L HO & SEFI			•						•					•	
Thunderbird/Cougar	2.3L Turbo			•	•					•		•	•			
	3.8L CFI			•				•			•	•	•			
	5.0L SEFI			•				•				•	•			
Mark VII/Continental	5.0L HO & SEFI			•				•						•	•	
	5.0L SEFI			•				•				•		•	•	
Ford Crown Victoria/Mercury Grand Marquis	5.0L SEFI		•	•				•						•	•	
	5.8L VV HO <sup>①</sup> <sup>②</sup>		•					•						•	•	
Lincoln Town Car	5.0L SEFI			•				•						•	•	

① Canada Only

② Police

③ Not Available on EXP.

CY2544-B



# WHEELS AND TIRES

## GROUP **11** (1000 & 2000)

SECTION TITLE	PAGE	SECTION TITLE	PAGE
WHEEL HUBS AND BEARINGS—FRONT .....	11-12-1	WHEELS AND TIRES .....	11-02-1
WHEEL HUBS AND BEARINGS—REAR .....	11-15-1	WHEELS AND TIRES—SERVICE .....	11-01-1

## SECTION 11-01 Wheels and Tires—Service

SUBJECT	PAGE	SUBJECT	PAGE
<b>CLEANING AND INSPECTION</b>		<b>MAINTENANCE (Cont'd.)</b>	
Spare Tire .....	11-01-8	Tire Inflation .....	11-01-4
Temporal Spare Tire—Standard .....	11-01-8	Tire Maintenance .....	11-01-4
Tire Inspection .....	11-01-8	Tire Rotation .....	11-01-4
Tire Sizes .....	11-01-7	Tread Wear Indicators .....	11-01-5
Wheel Inspection .....	11-01-7	<b>SERVICE</b>	
<b>DESCRIPTION</b>		Tire and Wheel Balance .....	11-01-6
Tires .....	11-01-1	Off-Vehicle Balancing .....	11-01-6
Wheel Lug Nuts .....	11-01-3	On-Vehicle Balancing .....	11-01-7
Wheelcovers .....	11-01-2	Tire Replacement .....	11-01-5
Wheels .....	11-01-2	Tire Service .....	11-01-5
<b>MAINTENANCE</b>		Vibration .....	11-01-7
Steel Wheels .....	11-01-4	Tire and Wheel Runout .....	11-01-7
Aluminum Wheels—Wheelcovers, Wheel .....	11-01-4	<b>SPECIAL SERVICE TOOLS</b> .....	11-01-9
Air Leaks .....	11-01-4	<b>SPECIFICATIONS</b> .....	11-01-9
Appearance .....	11-01-4	<b>VEHICLE APPLICATION</b> .....	11-01-1

### VEHICLE APPLICATION

Taurus/Sable.

### DESCRIPTION

Factory installed tires and wheels are designed to operate satisfactorily with loads up to and including full-rated load capacity when inflated to recommended inflation pressures.

Correct tire pressures and driving techniques have an important influence on tire life. Heavy cornering, excessively rapid acceleration and unnecessary sharp braking increase tire wear.

### Tires

When replacing tires, only the size, load range, and construction type (radial) originally installed on the vehicle are recommended. Use of any other tire size or type may seriously affect ride, handling, speedometer/odometer calibration, vehicle ground clearance, and tire clearance to the body and chassis.

**DESCRIPTION (Continued)**

**WARNING: DO NOT MIX DIFFERENT TYPES OF TIRES ON THE SAME VEHICLE SUCH AS RADIAL, BIAS, OR BIAS-BELTED TIRES EXCEPT IN EMERGENCIES (TEMPORAL SPARE USAGE), BECAUSE VEHICLE HANDLING MAY BE SERIOUSLY AFFECTED AND MAY RESULT IN LOSS OF CONTROL.**

Consider the following when replacing tires:

1. To achieve best all around vehicle performance, tires of different construction should not be mixed on the same vehicle.
2. It is recommended that new tires be installed in pairs.
3. When replacing only one tire, it should be paired with the tire having the most tread, to equalize braking traction.
4. Snow tires should be of a size and type equivalent to other tires on the vehicle as recommended on the tire decal.

**Wheels**

Wheels must be replaced when they are bent, dented, heavily rusted, have air leaks (aluminum wheels can, in most cases, be serviced using the procedure under Maintenance) or elongated bolt holes, and have excessive lateral or radial runout. Wheels with a lateral or radial runout greater than the recommended specification may cause an objectionable, high-speed vehicle vibration.

Replacement wheels must be equal to the original equipment wheels in load capacity, diameter, width, offset and mounting configuration. An improper wheel may affect wheel and bearing life, ground and tire clearance, or speedometer and odometer calibrations.

Corrosion buildup can result in wheels sticking to the axle or rotor flange after extensive service. To prevent this from recurring once the wheels are removed, use the following procedure:

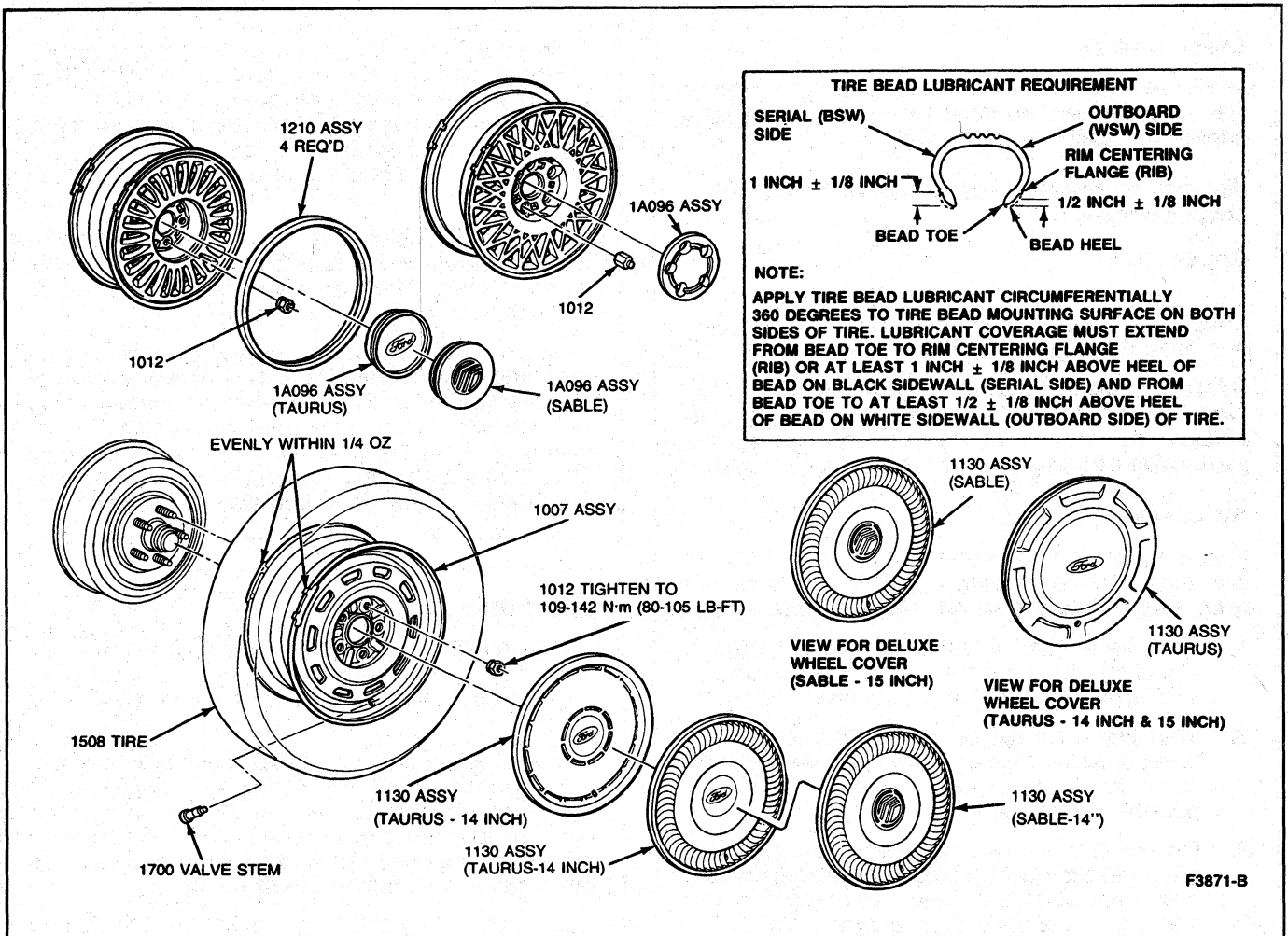
1. Clean axle/rotor flange and wheel bore of corrosion with wire brush, steel wool, or suitable material.
2. Coat wheel bore with Disc Brake Caliper Slide Grease D7AZ-19590-A or equivalent. Do not apply grease to lug nut seats or wheel studs.
3. Install wheel on vehicle.

**Wheelcovers****Ornament Applique Replacement (All Types Using Medallions—Except Snap-On Type Ornaments)**

If a wheelcover is not damaged but is missing its ornament applique, the applique should be replaced by using the following procedure:

1. Remove any old mastic present in wheelcover ornament cavity.
2. Thoroughly clean contact area on wheelcover with Spot Remover B7A-19521-A or equivalent.
3. Apply three dime-sized daubs of Ford Rubber Sealer and Filler C3AZ-195C2-A or B, or equivalent to wheelcover or ornament.
4. Install ornament applique with slight twisting pressure to ensure proper seating. Ideal curing time before installing wheelcover is 24 hours.

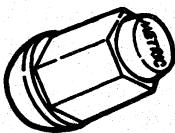
## DESCRIPTION (Continued)



## Wheel Lug Nuts

All vehicles use metric (M-12) lug nuts. Replacement of lug nuts must be of the same type and thread size. All metric (M-12) lug nuts are identified by the word METRIC stamped on the top surface of the nut.

**NOTE:** Aluminum wheels must use special "bulge" type metric (M-12) lug nuts with enlarged chamfers, or distortion of the aluminum wheel lug nut seat will result.



F3494-B

## Anti-Theft Wheel Lug Nuts

Optional aluminum wheels on vehicles are equipped with anti-theft wheel lug nuts (one per wheel) that are installed during vehicle pre-delivery. The key is attached to the lug wrench, stowed with the spare tire. To allow vehicle service in the event the key has been misplaced, a Rotunda Locking Lug Nut Master Key Set 013-00001 is available at most Ford and Lincoln/Mercury dealer service departments. The key has a circular keyway that is matched to the female slot in the anti-theft wheel lug nut.

To remove or install the anti-theft wheel lug nut, insert the key into the slot of the lug nut, place the lug nut wrench on the key, and while applying pressure on the key, remove or install the lug nut.

**CAUTION:** Make sure the key is held square to the nut. If the key is on an angle, it may damage the key and the anti-theft wheel lug nut. DO NOT use a power impact wrench on the lug nut key.

An additional balance weight has been placed 180 degrees  $\pm$  10 degrees opposite of the anti-theft wheel lug nut on all vehicles. To maintain proper wheel balance, the anti-theft wheel lug nut should always be installed to its original wheel bolt hole location after service.



## MAINTENANCE

### Steel Wheels

Wheel services that use welding, heating or peening are not approved. An inner tube is not acceptable service for leaky wheels or tires.

### Aluminum Wheels—Wheelcovers, Wheel Ornamentation

#### Appearance

To clean wheels, wheelcovers and wheel ornamentation use a mild soap and water solution, and rinse thoroughly with clear water.

**CAUTION: Do not use steel wool, abrasive type cleaner or strong detergents containing high alkaline or caustic agents as damage to the protective coating and discoloration may result.**

#### Air Leaks

If air pressure in an aluminum wheel is found to be low, the following procedure should be performed **prior to considering wheel replacement.**

1. Remove tire and wheel assembly, and inspect wheel for structural damage. If none exists, go to Step 2. If the wheel is damaged, replace.
2. With tire mounted on wheel, locate air leak using a water bath or equivalent method, and mark location. Check complete wheel for possible additional leaks.
3. On tire side of leak, use sandpaper of about 80-grit to thoroughly remove all contamination, and score surface of wheel to improve sealer adhesion. Adequate area around leak should be prepared to ensure covering the leak.
4. Use a clean cloth to remove all sanding dust.
5. With wheel at room temperature, apply a generous portion of Silicone Rubber D6AZ-19562-A or B or equivalent to the leak area.
6. Using a spatula or similar tool, spread sealer over entire suspect area, forming a thin coat.
7. Allow to cure for approximately six hours before remounting tire.
8. Repeat Step 2 to verify repair.
9. When the repair is complete, inflate properly, balance the assembly and install on vehicle.

**NOTE:** Caution must be exercised when mounting the tire so as not to damage the sealer.

### Tire Maintenance

To maximize tire performance, inspect tires for signs of improper inflation and uneven wear, which may indicate a need for balancing, rotation, or front suspension alignment.

Tires should also be checked frequently for cuts, stone bruises, abrasions, blisters and for objects that may have become imbedded in the tread. More frequent inspections are recommended when rapid or extreme temperature changes occur, or where road surfaces are rough or occasionally littered with debris.

As a further visible check of tire condition, tread wear indicators are moulded into the bottom of the tread grooves. The tire should be replaced when these indicator bands become visible.

To clean tires, use a mild soap and water solution only, and rinse thoroughly with clear water. Do not use any caustic solutions or abrasive materials. Do not use steel wool, wire brushes, gasoline, paint thinner or similar materials having a mineral oil base. These materials are harmful to tires and will eventually discolor the whitewalls and raised letters.

### Tire Inflation

Tire inflation pressure is carefully calculated to give the vehicle satisfactory ride and steering characteristics without compromising long tire tread life.

A vehicle tire pressure decal, located on the rear door RH lock pillar below the rear door striker, gives the recommended cold tire inflation pressure. The cold tire inflation pressure can be measured after the vehicle has been parked for three hours or has been driven less than 5 km (3 miles).

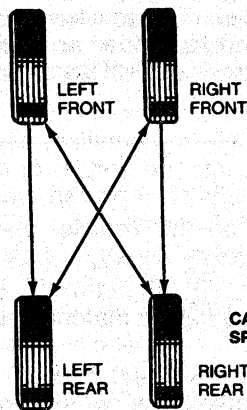
A higher tire inflation pressure than the recommended pressure can cause a hard ride, tire bruising, carcass damage and rapid wear at the center of the tire. Low tire pressure can produce tire squeal, hard steering, rim dents, high temperatures and rapid wear on the outer edges of the tires. Unequal pressures can cause uneven braking and reduced handling.

**WARNING: OVER- OR UNDER-INFLATED TIRES CAN REDUCE TIRE LIFE, ADVERSELY AFFECT VEHICLE HANDLING, AND POSSIBLY LEAD TO A SUDDEN FAILURE THAT COULD RESULT IN THE LOSS OF VEHICLE CONTROL WITHOUT WARNING.**

### Tire Rotation

Front and rear tires perform different jobs and can wear differently depending on the type of vehicle and driving habits. To equalize wear and optimize tire life, rotate tires at approximately 12,000 km (7,500 miles) and then each 24,000 km (15,000 miles) thereafter.

If abnormal wear is detected, find and correct the cause, and rotate the tires following the diagram to allow more even wear.

**MAINTENANCE (Continued)****FOUR TIRE ROTATION****FOUR TIRE ROTATION**

ROTATE THE LEFT REAR TIRE TO THE RIGHT FRONT POSITION AND THE RIGHT REAR TO THE LEFT FRONT POSITION. ROTATE THE LEFT FRONT TO THE LEFT REAR AND THE RIGHT FRONT TO THE RIGHT REAR POSITION.

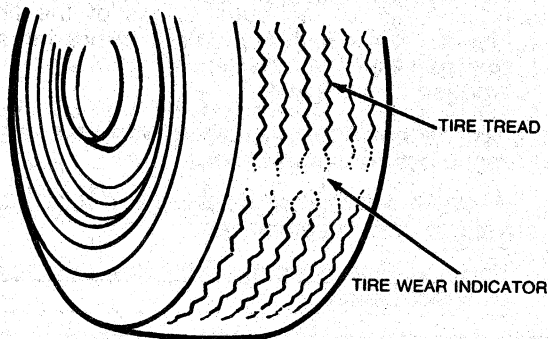
**CAUTION: DO NOT USE TEMPORAL SPARE TIRES IN THE TIRE ROTATION.**

F3647-B

**CAUTION: Never use the temporal spare for tire rotation or as a regular tire.**

**Tread Wear Indicators**

Original equipment tires have built-in tread wear indicators to show when tires need replacement. These indicators will appear as 12.7mm (1/2-inch) wide bands when the tire tread depth becomes 1.58mm (1/16-inch). When the indicators appear in two or more adjacent grooves, at three locations around the tire, or when cord or fabric is exposed, tire replacement due to tread wear is recommended.



F2890-C

**SERVICE****Tire Replacement**

Use the Rotunda Tire Changer 084-00001 or equivalent to mount or demount tires. Follow the equipment manufacturer's instructions. Do not use hand tools or tire irons alone to change tire as this may cause damage to the tire beads or wheel rim.

Rim bead seats on steel wheels should be cleaned with a wire brush or coarse steel wool to remove lubricants, old rubber, and light rust. Aluminum wheel rim bead seats should be cleaned with a non-abrasive cleaner to remove tire mounting lubricants and old rubber. Before mounting or demounting a tire, bead area should be well lubricated with Rubber Lubricant D9AZ-19583-A or equivalent.

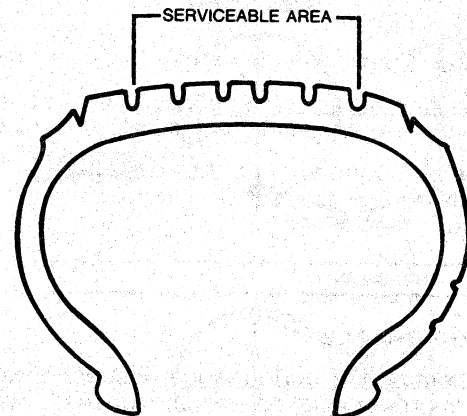
After mounting, inflate the tire so its beads are completely sealed. Install the valve core and inflate the tire to the proper pressure.

**Tire Service**

Punctured tires should be removed from the wheel and permanently serviced from the inside using a combination service plug and vulcanized patch. When servicing a puncture, always follow the manufacturer's instructions for using the service kit.

Service punctures in the tread area only. Never attempt to service punctures in the tire shoulders or sidewalls. In addition, do not service any tire that has sustained the following damage:

- Bulges or blisters.
- Ply separation.
- Broken or cracked beads.
- Fabric cracks or cuts.
- Tires worn to the fabric, or if wear indicators are visible.
- Punctures larger than 6.35mm (1/4-inch).



F2891-C

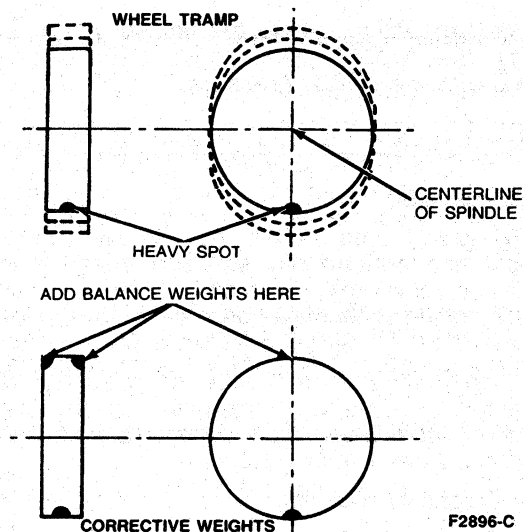
**SERVICE (Continued)**

**WARNING: TIRE SEALANTS THAT ARE INJECTED THROUGH THE VALVE STEM ARE NOT TO BE USED TO SERVICE PUNCTURED TIRES BECAUSE THEY CAN PRODUCE WHEEL RUST AND CAUSE TIRE UNBALANCE.**

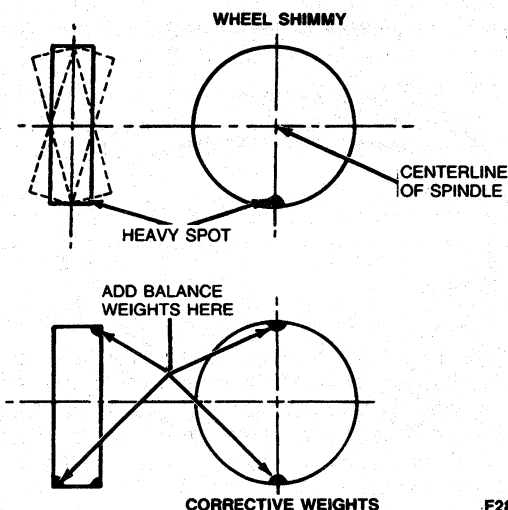
**Tire and Wheel Balance**

There are two types of wheel and tire balance: static and dynamic.

A **Static** balance is the equal distribution of weight around the wheel. Wheels that are statically unbalanced cause a bouncing action called wheel tramp.



A **Dynamic** balance is the equal distribution of weight on each side of the centerline so that when the tire spins there is no tendency for the assembly to move from side-to-side. Wheels that are dynamically unbalanced may cause wheel shimmy.



Deposits of mud must be cleaned from the inside of the rim. Stones should be removed from the tread in order to avoid operator injury during spin balancing and to obtain a good balance. The tire should be inspected for any damage, then balanced according to the equipment manufacturer's explicit instruction.

**Off-Vehicle Balancing**

When balancing wheels off the vehicle, use a balancer that pilots the wheel by its center hole. If the wheel tramp and vehicle vibration is not corrected by the off-vehicle balance, an on-vehicle balance may be needed.

When performing an off-vehicle wheel balance on vehicles equipped with aluminum wire spoke wheels, use one of the following electronic balancers to provide the proper wheel balance:

- Rotunda Off-Vehicle Wheel Balancer 036-00118 or equivalent with wheel adapter sets.
- Rotunda Off-Vehicle Wheel Balancer 078-00153 with Rotunda Wheel Adapter Set 078-00055 or equivalent.
- Rotunda Off-Vehicle Wheel Balancer 006-01699 or equivalent with Accessory Kit 006-01640 or equivalent.

1. Loosen metric wheel lug nuts of wheel(s) to be balanced. Raise up front or rear of vehicle, as required.

NOTE: Use metric (M-12) lug nuts.

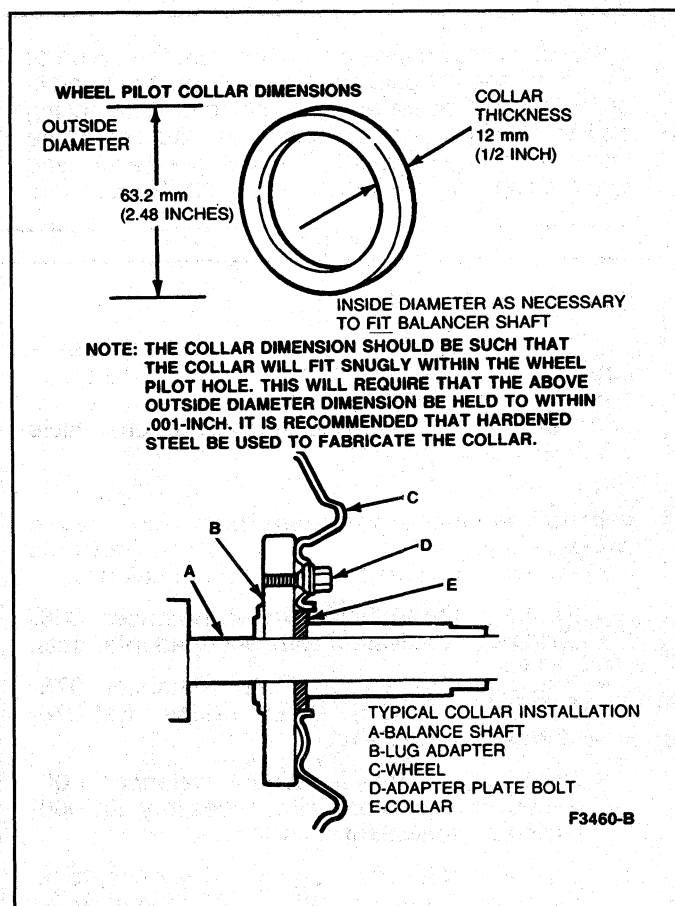
2. Remove wheel to be balanced. Remove center cap and mount wheel to balance machine. Lock hub adapter into spindle.
3. Remove any existing balance weights.

NOTE: Ensure tire is inflated to correct pressure and that no large objects or stones are wedged in tire tread.

4. Spin wheel and balance in accordance with manufacturer's instructions.
5. Remove wheel from machine and mount onto vehicle. Install center cap.
6. Lower vehicle to ground. Tighten wheel lug nuts to specification.

**Optional Lug Adapter**

For a more consistent wheel balance, optional lug adapters and wheel pilot collars should be used. This additional equipment ensures proper wheel position on the balance equipment. This equipment is available for all Rotunda off-vehicle wheel balancers.

**SERVICE (Continued)****On-Vehicle Balancing**

**CAUTION:** The suspension should not be allowed to hang free. When the constant velocity joint is run at a very high angle, extra vibrations can occur as well as damage to seals and joints.

The lower control arm should be supported as far outboard as possible.

If the above method is not used, front tires should be balanced on rear position, or on an off-vehicle balancer.

**WARNING: ON FRONT WHEEL DRIVE VEHICLES, FRONT WHEELS SHOULD BE SPUN WITH THE ENGINE. DRIVE WHEEL SPIN SHOULD BE LIMITED TO 56 KM/H (35 MPH) AS INDICATED ON THE SPEEDOMETER. THIS LIMIT IS NECESSARY BECAUSE THE SPEEDOMETER ONLY INDICATES ONE-HALF OF THE ACTUAL WHEEL SPEED WHEN ONE DRIVE WHEEL IS SPINNING AND THE OTHER DRIVE WHEEL IS STOPPED. UNLESS CARE IS TAKEN IN LIMITING DRIVE WHEEL SPIN, THE SPINNING WHEEL CAN REACH EXCESSIVE SPEEDS. THIS CAN RESULT IN POSSIBLE TIRE DISINTEGRATION OR DIFFERENTIAL FAILURE, WHICH COULD CAUSE SERIOUS PERSONAL INJURY OR EXTENSIVE VEHICLE DAMAGE.**

**Vibration**

If vehicle vibration persists after the wheels have been balanced, it may be caused by either tire or wheel runout. The vibration may also be caused by bumps or bulges in the tire tread or sidewall, bent driveshaft, engine vibration or worn engine mounts, frozen (seized) shock absorbers or unindexed tires/wheels.

**NOTE:** Do not align vehicle for vibration complaints. Vibration cannot be improved or eliminated by alignment.

**Tire and Wheel Runout**

Excessive radial and lateral runout of a wheel and tire assembly can cause roughness, vibration, wheel tramp, and steering wheel nibble (tremor).

Before checking runout and to avoid false readings caused by temporary flat spots in the tires, check runout only after the vehicle has been driven. Visually inspect the tire carcass for abnormal bulges or distortions.

Runout should be measured with a dial indicator. All measurements should be made on the vehicle with the tires inflated to recommended load inflation pressures and with the wheel bearings adjusted to specification.

For service and adjustment, refer to Section 18-01.

**CLEANING AND INSPECTION****Wheel Inspection**

Inspect the wheel lug nuts and tighten to 109-142 N·m (80-105 lb-ft). Loose lug nuts can cause shimmy and vibration, and may also destroy the stud holes in the wheels.

Ensure wheels and hubs are clean. Stones wedged between the wheel and rotor or rear drum or lumps of mud and grease can unbalance the wheel.

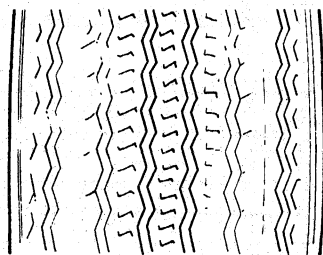
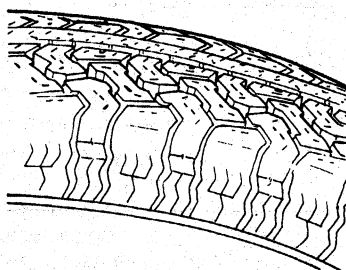
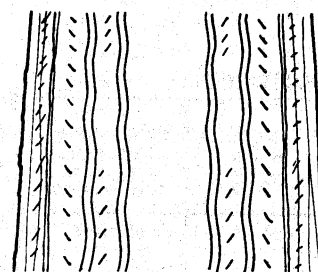
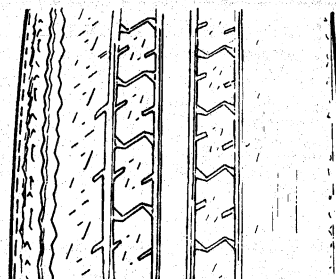
Check for wheel damage. Wobble or shimmy caused by a damaged wheel will eventually damage the bearings. Inspect the rims for dents that could leak air.

**Tire Sizes**

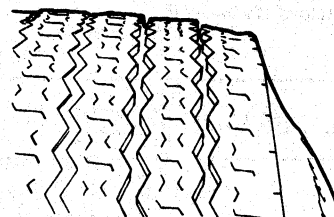
It is mandatory to use only the tire sizes recommended on the tire chart attached to the vehicle. Larger or smaller tires can damage the vehicle and affect durability and may require changing the speedometer drive gears. Ensure wheel size and offsets match those recommended for the tire in use.

**CLEANING AND INSPECTION (Continued)****Tire Inspection**

Inspect tires for wear. Abnormal or excessive wear may be caused by incorrect wheel alignment, wheel/tire unbalance, or improper tire pressure.

**UNDERINFLATION****CUPPING****OVERINFLATION****INCORRECT TOE-IN OR EXTREME CAMBER**

UNDERINFLATION AND/OR MECHANICAL IRREGULARITIES SUCH AS OUT-OF-BALANCE CONDITION OF WHEEL AND/OR TIRE, AND BENT OR DAMAGED WHEEL. POSSIBLE LOOSE OR WORN STEERING TIE-ROD OR STEERING IDLER ARM. POSSIBLE LOOSE, DAMAGED OR WORN FRONT SUSPENSION PARTS.

**FEATHERING DUE TO MISALIGNMENT**

F3050-C

**Spare Tire**

The spare tire and jack are stowed under the rear load floor in sedan, and rear quarter panel in station wagon. Refer to Section 11-02 for information on how the tire, jack and wrench are stowed.

**Temporal Spare Tire—Standard**

The temporal tire spare is lightweight and is for limited mileage, emergency use only. It should be used only until the regular tire is serviced. This tire is identified by the wording TEMPORARY USE ONLY moulded into the tire.

**SPECIFICATIONS****TORQUE SPECIFICATIONS**

Description	N·m	Lb·Ft
Wheel Lug Nuts	109-142	80-105

CF3462-A

**WHEEL SPECIFICATIONS**

Type	Color/Code	Wheel Size	No. of Belts	Bolt Diameter	Offset	Tire Usage	Size
Steel	Blue/White GA①	14 x 5.5	5	107.95	42	P195/70R14 P205/70R14	14
Steel	Blue/Yellow JA①	15 x 6.0	5	107.95	42	P205/65R15	15
Polycast Steel	Red/White AK①	14 x 5.5	5	107.95	42	P195/70R14 P205/70R14	14
Aluminum Cast	—	15 x 6.0	5	107.95	42	P205/65R15	15
Steel Mini-Spare	Red/Red SP①	14 x 4.0	5	107.95	35.6	T135/80R14	14

① Code stamped at valve stem

CF3884-A

**SPECIAL SERVICE TOOLS****ROTUNDA EQUIPMENT**

Model	Description
006-01582	On-Vehicle Wheel Balancer
006-01699	Off-Vehicle Wheel Balancer
006-01640-7	Adapter Set for 006-01699
013-00001	Locking Lug Nut Master Key Set
013-00002	Locking Wire Wheel Cover Master Key Set
036-00118	Off-Vehicle Wheel Balancer
078-00153	Off-Vehicle Wheel Balancer
078-00055, 71	Adapter Set for 078-00153
084-00001	Tire Changer

CF3806-B

# SECTION 11-02 Wheels and Tires

SUBJECT	PAGE	SUBJECT	PAGE
DESCRIPTION		REMOVAL AND INSTALLATION (Cont'd.)	
Spare Tire, Light-Weight Temporal .....	11-02-1	Wheel and Tire .....	11-02-2
REMOVAL AND INSTALLATION		SPECIAL SERVICE TOOLS .....	11-02-2
Hoisting .....	11-02-2	SPECIFICATIONS .....	11-02-2
Tire .....	11-02-2	VEHICLE APPLICATION .....	11-02-1

## VEHICLE APPLICATION

Taurus/Sable.

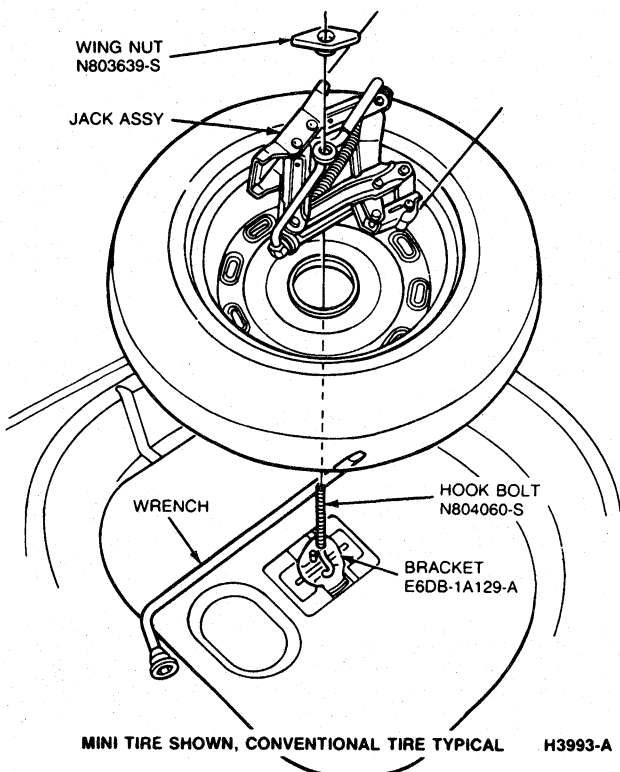
## DESCRIPTION

### Spare Tire, Light-Weight Temporal

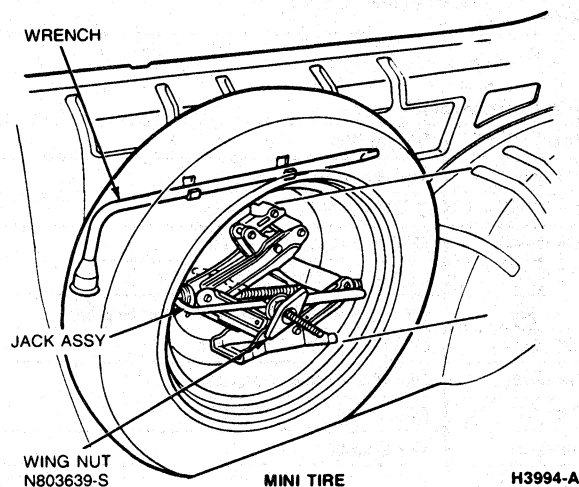
A light-weight temporal spare tire and wheel is standard equipment.

The temporal spare is designed to provide additional luggage room and a light-weight, easy-to-use spare tire. This spare is a normal-type radial ply with a reduced tread depth to provide an estimated tread life of 3218.6 km (2000 miles). It is intended for emergency use only and has a maximum speed capacity of 80 km/h (50 mph).

#### Sedan



#### Wagon



### Directions for Use

1. Spare tire is for temporary, emergency use only and not for continuous use as a road wheel. Do not exceed 80 km/h (50 mph) under any circumstances. Replace with a regular tire as soon as possible.
2. Do not use tire chains. Check cold inflation pressure monthly and when used, maintain cold inflation pressure as specified on vehicle tire pressure decal.
3. Avoid abusive use such as potholes. Carefully read Owner Guide before using this emergency spare. When tread wear indicators appear on tire, replace tire/wheel assembly. Do not reuse wheel once tire has worn out.



**DESCRIPTION (Continued)**

**WARNING: DO NOT USE AS A REGULAR TIRE. SERVICE AND REPLACE THE REGULAR TIRE AS SOON AS POSSIBLE. ANY CONTINUOUS ROAD USE OF THIS TEMPORARY, EMERGENCY TIRE MAY RESULT IN TIRE FAILURE, LOSS OF VEHICLE CONTROL, AND POSSIBLE INJURY TO VEHICLE OCCUPANTS.**

4. Do not exceed vehicle maximum load rating noted on tire decal.

**REMOVAL AND INSTALLATION****Hoisting**

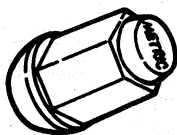
Incorrect hoisting can damage steering linkage components and front end suspension struts. Refer to Pre-Delivery manual, Section 50-04 for hoisting instructions.

**Wheel and Tire****Removal**

1. Remove wheelcover with tapered end of wheel nut wrench by inserting and twisting handle, then prying against inner wheelcover flange. Loosen, but do not remove, the lug nuts.

**NOTE:** All lug nuts are metric (M-12). Replacement lug nuts must be of the same type and thread size as original. Metric lug nuts are identified by the word METRIC stamped on the top surface of the nut.

Aluminum wheels require a special "bulge" type lug nut with enlarged chamfer to prevent distortion of the wheel lug nut seat.



F3494-B

2. Raise vehicle until tire clears floor.
3. Remove lug nuts and pull wheel off hub and drum assembly (rear) or hub assembly (front).

**NOTE:** Wheel ornaments for the aluminum wheel should be removed from the inside of the wheel with the wheel removed.

**Wheel Ornaments**

Installation of the styled road wheel ornament is made by inserting one side of the ornament into the center of the wheel opening and striking the opposite side of the ornament with the palm of the hand until the ornament is seated in the opening.

To remove the ornament, insert the tapered end of the jack handle between the ornament and wheel and use a prying or twisting motion.

**Wheel Trim Rings**

Installation or removal must be made at the clip to wheel attachment points only, to prevent damage.

**Installation**

1. Clean dirt from hub mounting surface.
2. Place wheel on hub and drum assembly or hub assembly and tighten nuts alternately.

**NOTE:** Replacement lug nuts must be metric (M-12) and same type and size as original equipment.

3. Lower vehicle and tighten hub nuts to 109-142 N·m (80-105 lb-ft). Refer to Section 11-01.
4. Align wheelcover with valve stem extension matching the hole in the wheelcover, and ensure it is snapped in place all the way around.

**Tire**

Follow instructions provided with Rotunda Tire Changer 084-00001 or equivalent.

Use appropriate equipment and adhere to prescribed safety instructions to avoid damage to the tire and possible injury.

**SPECIFICATIONS****TORQUE SPECIFICATIONS**

Description	N·m	Lb-Ft
Wheel Lug Nuts	109-142	80-105

CF3462-A

**SPECIAL SERVICE TOOLS****ROTUNDA EQUIPMENT**

Model	Description
084-00001	Tire Changer

CF3807-A



# SECTION 11-12 Wheel Hubs and Bearings—Front

SUBJECT	PAGE	SUBJECT	PAGE
<b>ADJUSTMENTS</b>		<b>REMOVAL AND INSTALLATION</b>	
Hoisting .....	11-12-1	Hub and Wheel Bearings .....	11-12-2
Wheel Bearings .....	11-12-2	<b>SPECIAL SERVICE TOOLS</b> .....	11-12-5
<b>DESCRIPTION</b>		<b>SPECIFICATIONS</b> .....	11-12-5
Wheel Assembly .....	11-12-1	<b>VEHICLE APPLICATION</b> .....	11-12-1

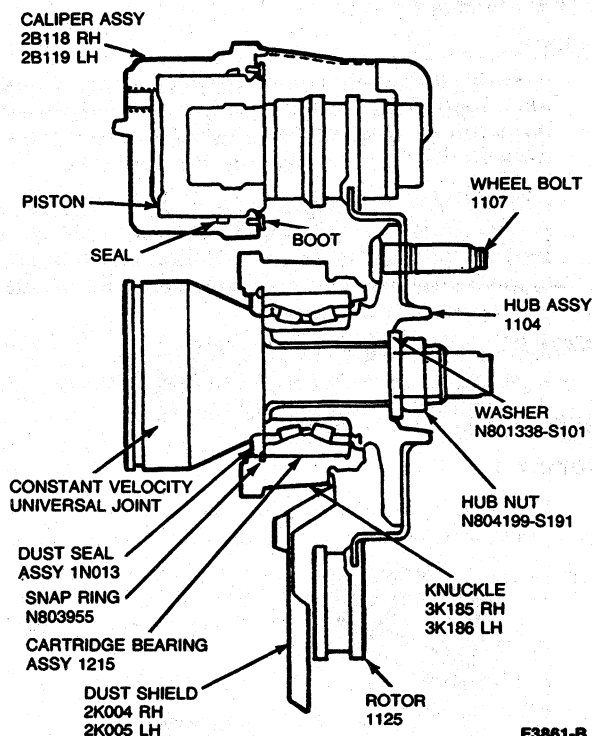
## VEHICLE APPLICATION

Taurus/Sable.

## DESCRIPTION

### Wheel Assembly

Each front wheel is bolted to a hub assembly. There are two opposed and tapered roller bearings (inner and outer) with grease retainer seals (inner and outer), encased in one single cup or cartridge. This bearing assembly is pressed into the steering knuckle bore from the inboard side until it rests against the shoulder on the outboard side. A snap ring is installed in a groove on the inboard side of the knuckle bore for added bearing retention. A bearing dust seal is installed on the constant velocity joint, inboard of the knuckle/bearing/hub assembly. The hub assembly is pressed into the bearing/knuckle assembly. The constant velocity joint splined shaft is pressed through the hub. A prevailing torque hub nut and washer attach the hub assembly to the constant velocity joint.



F3861-B

## ADJUSTMENTS

### Hoisting

Refer to Pre-Delivery manual, Section 50-04 for hoisting instructions.

## ADJUSTMENTS (Continued)

### Wheel Bearings

The front wheel bearings are of a cartridge design and are pregreased, sealed and require no scheduled maintenance. The bearings are preset and cannot be adjusted. If a bearing is disassembled for any reason, it must be replaced as a unit. No individual service seals, roller or races are available. The hub nut torque of 245-270 N·m (180-200 lb-ft) restricts bearing/hub relative movement and maintains axial position of the hub. Due to the importance of the hub nut torque/tension relationship, take the following precautions during service:

1. Since the bearing cannot be adjusted, the hub nut retainer must not be backed off after reaching the required torque of 245-270 N·m (180-200 lb-ft) during installation.
2. The hub nut must be replaced with a new nut whenever the nut is backed off or removed. Never reuse the nut.
3. Impact-type tools must not be used to tighten the hub nut or bearing damage will result.
4. The hub and constant velocity joint splines have an interference fit requiring special tools for disassembly. The hub nut retainer must not be used to accomplish assembly. Refer to Section 15-22.
5. To remove the hub nut retainer, apply sufficient torque to the nut to overcome the prevailing torque feature of the nut collar.

## REMOVAL AND INSTALLATION

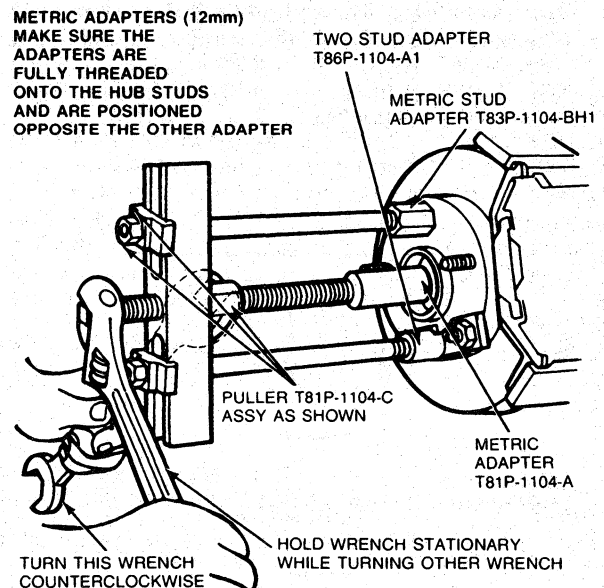
### Hub and Wheel Bearings

#### Removal

1. Remove wheelcover/hub cover from wheel and tire assembly and loosen wheel nuts.
2. Remove hub nut retainer and washer by applying sufficient torque to nut to overcome prevailing torque feature of crimp in nut collar. Do not use an impact-type tool to remove hub nut retainer. Hub nut retainer must be discarded after removal.
3. Raise vehicle and remove wheel and tire assembly.
4. Remove brake caliper by loosening caliper locating pins and rotating caliper off rotor, starting from lower end of caliper and lifting upward. Do not remove caliper pins from caliper assembly. Lift caliper off rotor and hang it free of rotor. Do not allow caliper assembly to hang from brake hose. Support caliper assembly with a length of wire.
5. Remove rotor from hub by pulling it off the hub bolts. If rotor is difficult to remove from hub, strike rotor sharply between studs with a rubber or plastic hammer.

If rotor will not pull off, apply Rust Penetrator D7AZ-19A501-A or equivalent to inboard and outboard rotor hub mating surfaces. Install 3-Jaw Puller D80L-1013-A or equivalent and remove rotor by pulling on rotor outside diameter and pushing on hub center. If excessive force is required for removal, check rotor for lateral runout prior to installation.

6. Lateral runout must be checked with nuts clamping stamped hat section of rotor.
7. Remove rotor splash shield. Refer to Section 12-20.
8. Disconnect lower control arm and tie rod from knuckle (leave strut attached).
9. Loosen two strut top mount-to-apron nuts.
10. Install Hub Remover/Installer T81P-1104-A with T81P-1104-C and Wheel Bolt Adapters T83P-1104-BH1 and Two Stud Adapter T86P-1104-A1 or equivalent and remove hub, bearing and knuckle assembly by pushing out constant velocity joint outer shaft until it is free of assembly.

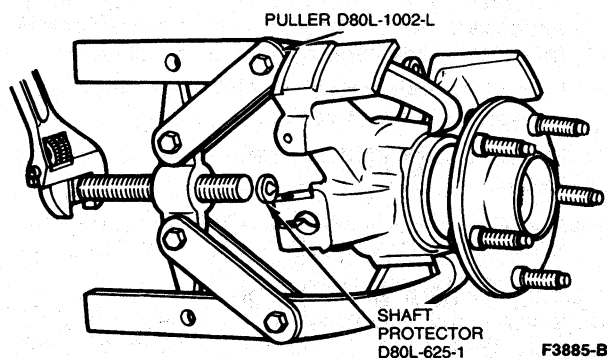


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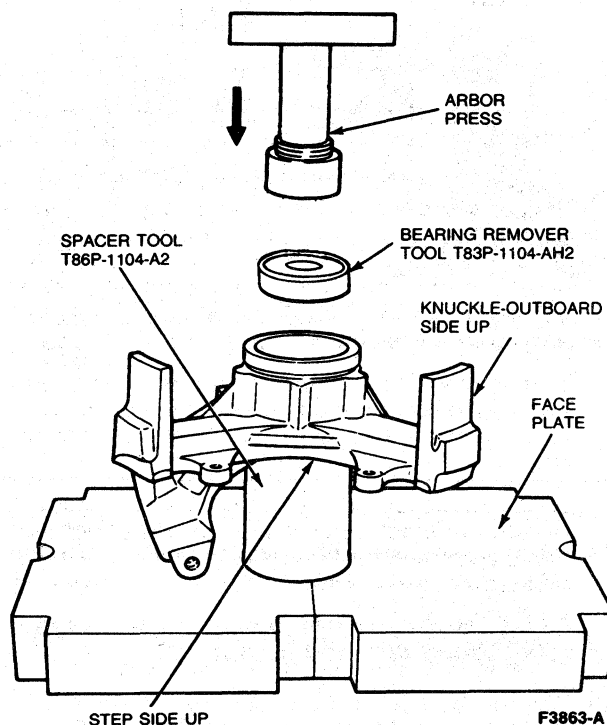
11. Support knuckle with a length of wire, remove strut bolt and slide hub/bearing/knuckle assembly off strut.
12. Carefully remove support wire and carry hub/bearing/knuckle assembly to a bench.
13. On the bench, install Front Hub Puller D80L-1002-L and Shaft Protector D80L-625-1 or equivalent, with jaws of puller on knuckle bosses and remove hub.

## REMOVAL AND INSTALLATION (Continued)

NOTE: Ensure the shaft protector is centered, clears the bearing ID, and rests on the end face of the hub journal.



14. Remove snap ring, which retains bearing in knuckle assembly, with snap ring pliers and discard.
15. Using a hydraulic press, place Front Bearing Spacer T86P-1104-A2 or equivalent step side up on press plate and position knuckle (outboard side up) on the spacer. Install Front Bearing Remover T83P-1104-AH2 or equivalent centered on the bearing inner race and press bearing out of the knuckle.
16. Discard bearing.



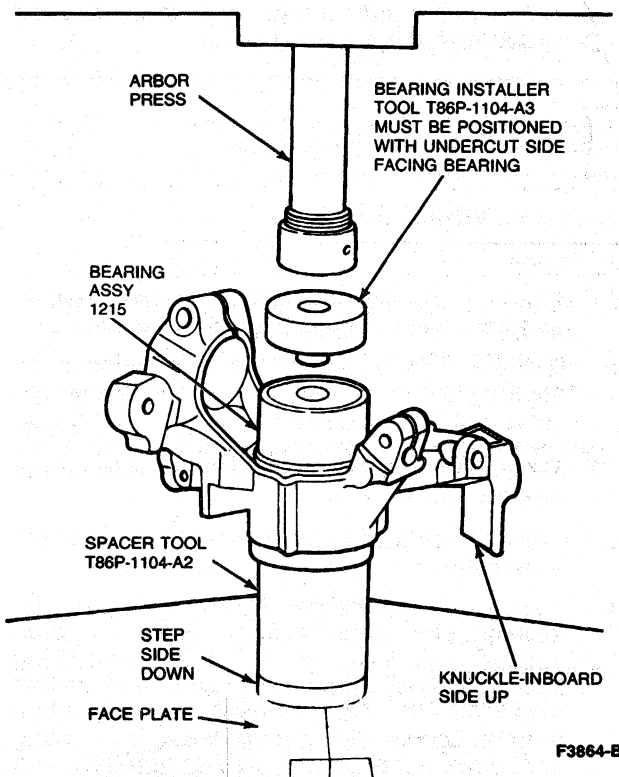
## Installation

1. On bench, remove all foreign material from knuckle bearing bore and hub bearing journal to ensure correct seating of new bearing.

NOTE: If hub bearing journal is scored or damaged, replace hub. Do not attempt to service. The front wheel bearings are of a cartridge design and are pregreased, sealed, and require no scheduled maintenance. The bearings are preset and cannot be adjusted. If a bearing is disassembled for any reason, it must be replaced as a unit. No individual service seals, roller or races are available.

2. Place Front Bearing Spacer T86P-1104-A2 or equivalent step side down on hydraulic press plate and position knuckle (outboard side down) on spacer. Position a new bearing in inboard side of knuckle. Install Bearing Installer T86P-1104-A3 or equivalent (undercut side facing bearing), on bearing outer race and press bearing into knuckle. Ensure that bearing seats completely against shoulder of knuckle bore.

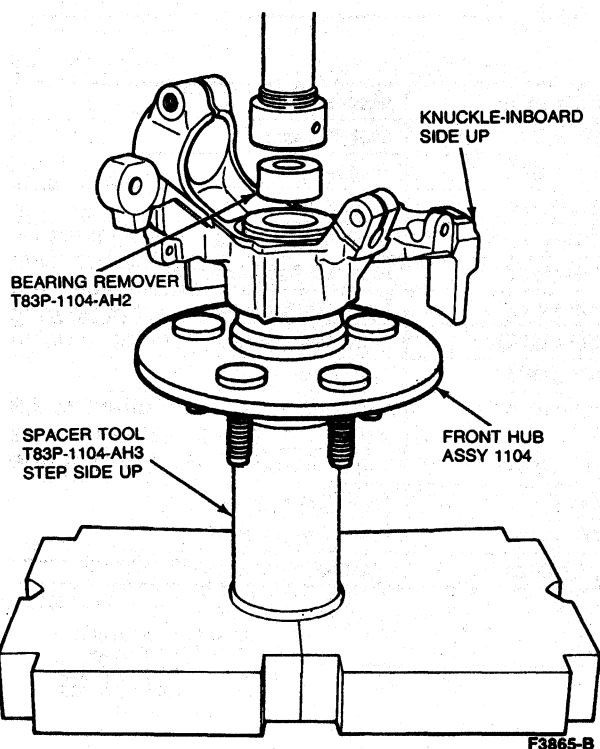
**CAUTION: Bearing Installer T86P-1104-A3 or equivalent must be positioned as indicated above to prevent bearing damage during installation.**



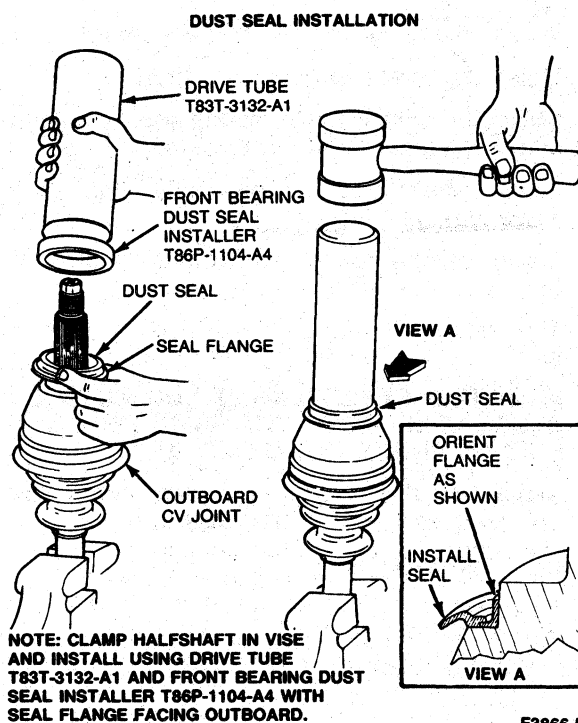
3. Install a new snap ring (part of bearing kit) in knuckle groove using snap ring pliers.

## REMOVAL AND INSTALLATION (Continued)

4. Place Front Bearing Spacer T86P-1104-A2 or equivalent on the arbor press plate and position hub on tool with lugs facing downward. Position knuckle assembly (outboard side down) on the hub barrel. Place Bearing Remover T83P-1104-AH2 or equivalent flat side down, centered on inner race of the bearing and press down on tool until bearing is fully seated onto hub. Ensure that hub rotates freely in knuckle after installation.

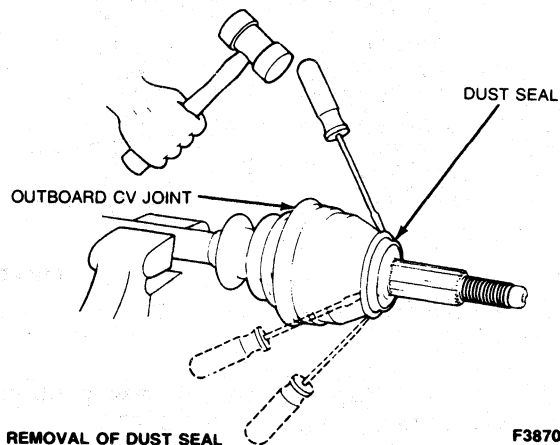


6. Install new dust seal, ensuring seal flange faces outboard toward bearing. Use Drive Tube T83T-3132-A1 and Front Bearing Dust Seal Installer T86P-1104-A4 or equivalent.



5. Prior to hub/bearing/knuckle installation, replace bearing dust seal on the outboard constant velocity joint with new seal from bearing kit.

**NOTE: TAP UNIFORMLY TO REMOVE DUST SEAL, USING LIGHT DUTY HAMMER AND SCREWDRIVER.**



7. Suspend the hub/bearing/knuckle assembly on the vehicle with wire and attach the strut loosely to the knuckle. Lubricate the constant velocity joint stub shaft splines with SAE 30 weight motor oil and insert shaft into hub splines as far as possible using hand pressure only. Check that splines are properly engaged.
8. Temporarily fasten rotor to hub with washers and two wheel lug nuts. Insert a steel rod into rotor diameter and rotate clockwise to contact knuckle.
9. Install hub nut washer and new hub nut retainer. Rotate nut clockwise to seat CV joint. Tighten nut to specification. Remove steel rod, washers and lug nuts.

**CAUTION: Do not use power or impact-type tools to tighten the hub nut.**

**REMOVAL AND INSTALLATION (Continued)**

10. Complete installation of front suspension components. Refer to Section 14-10.
11. Install rotor splash shield. Refer to Section 12-20.

**NOTE:** Apply a small amount of Disc Brake Caliper Slide Grease D7AZ-19590-A or equivalent to pilot diameter of rotor.

12. Install disc brake rotor to hub assembly.
13. Install disc brake caliper over rotor.
14. Ensure outer brake shoe spring hook is seated under upper arm of knuckle.
15. Install wheel and tire assembly, tightening wheel nuts finger-tight.
16. Lower vehicle and block wheels to prevent vehicle from rolling.
17. Tighten wheel nuts to 109-142 N·m (80-105 lb-ft).

**WARNING: REPLACEMENT LUG NUTS OR STUDS MUST BE OF THE SAME TYPE AND SIZE AS THOSE BEING REPLACED.**

18. Install wheelcover or hub cover and lower vehicle completely to the ground.
19. Remove wheel blocks.

**SPECIFICATIONS****TORQUE SPECIFICATIONS**

Description	N·m	Lb·Ft
Hub Nut	245-270	180-200
Wheel Nuts	109-142	80-105

CF3867-A

**SPECIAL SERVICE TOOLS**

Tool Number	Description
D80L-625-I	Shaft Protector
D80L-1002-L	Front Hub Puller
D80L-1013-A	3-Jaw Puller
T81P-1104-A	Metric Adapter (Used with T81P-1104-C)
T81P-1104-C	Front Hub Remover/Installer
T83P-1104-AH2	Front Bearing Remover
T83P-1104-BH	Wheel Bolt Adapters
T83T-3132-A1	Drive Tube
T86P-1104-A	Tool Set-Consists of T86P-1104-A1, A2, A3, and A4
T86P-1104-A1	Two Stud Adapter
T86-1104-A2	Front Bearing Spacer
T86-1104-A3	Front Bearing Installer
T86-1104-A4	Front Bearing Dust Seal Installer

CF3868-A

# SECTION 11-15 Wheel Hubs and Bearings—Rear

SUBJECT	PAGE	SUBJECT	PAGE
<b>ADJUSTMENTS</b>		<b>SPECIAL SERVICE TOOLS</b> .....	<b>11-15-3</b>
Hoisting .....	11-15-1	<b>SPECIFICATIONS</b> .....	<b>11-15-3</b>
Wheel Bearing Adjustment .....	11-15-2	<b>VEHICLE APPLICATION</b> .....	<b>11-15-1</b>
<b>DESCRIPTION</b>			
Wheel Assembly .....	11-15-1		
<b>REMOVAL AND INSTALLATION</b>			
Hub, Drum, Wheel Bearings and Grease			
Seal .....	11-15-2		

## VEHICLE APPLICATION

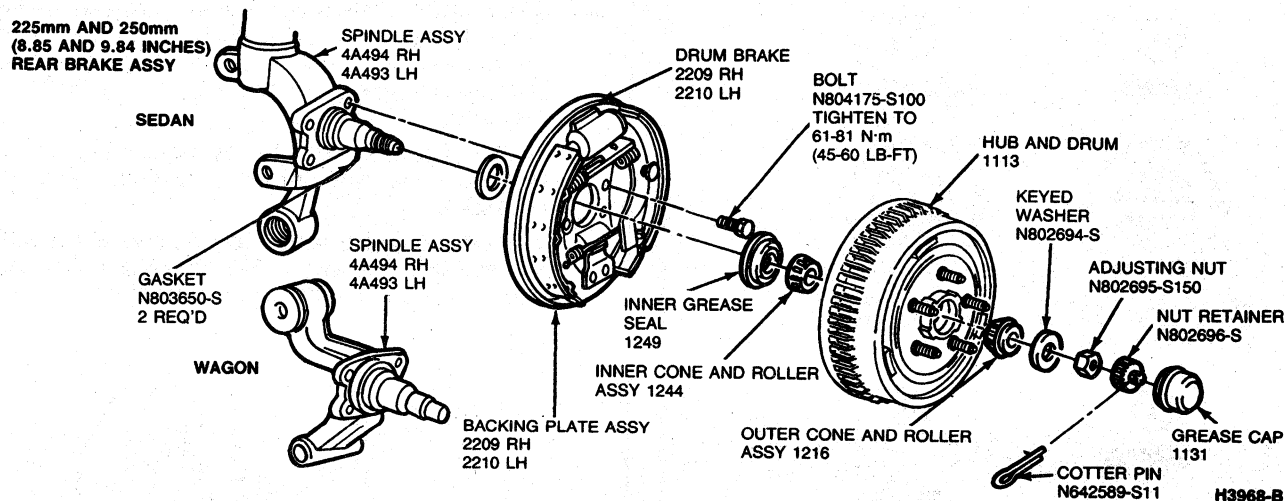
Taurus/Sable.

## DESCRIPTION

### Wheel Assembly

Each rear wheel is bolted to a hub and drum assembly. There are two opposed and tapered roller bearings and a grease retainer installed in the hub. The grease retainer seal prevents grease leakage into the drum.

A keyed washer, adjusting nut, nut retainer and cotter pin attach the assembly to the spindle.



## ADJUSTMENTS

### Hoisting

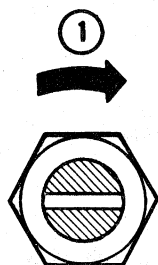
Refer to the Pre-Delivery manual, Section 50-04 for vehicle hoisting instructions.

## ADJUSTMENTS (Continued)

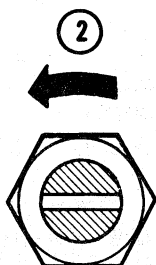
**Wheel Bearing Adjustment**

Rear bearing adjustments should be performed using the following procedures whenever the wheel is excessively loose on the spindle or does not rotate freely. It should be noted that the tapered roller bearings used on the rear hubs may have a slightly loose feel when properly adjusted. This should be considered normal.

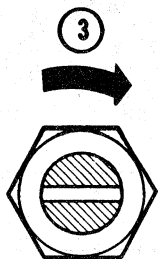
1. Raise vehicle until tire clears floor.
2. Remove wheelcover or ornament and nut covers. Remove grease cap from hub, taking care not to damage cap.  
NOTE: Styled steel wheels and aluminum wheels require removal of the wheel and tire assembly to remove the dust cover.
3. Remove cotter pin and nut retainer. Discard cotter pin.
4. Back off adjusting nut one full turn.
5. Tighten adjusting nut to 23-34 N·m (17-25 lb-ft) while rotating hub and drum assembly to seat bearings, then loosen adjusting nut one-half turn and tighten adjusting nut to 1.1-1.4 N·m (10-12 lb-in) using lb-in torque wrench.
6. Position adjusting nut retainer over adjusting nut so slots in nut retainer flange are in line with cotter pin hole in spindle.
7. Install a new cotter pin and bend ends around retainer flange.



WITH WHEEL ROTATING  
TIGHTEN ADJUSTING NUT  
TO 23-34 N·m (17-25 LB-FT)



BACK ADJUSTING  
NUT OFF 1/2 TURN



TIGHTEN ADJUSTING  
NUT TO 1.1-1.4 N·m  
(10-12 LB-IN)



INSTALL THE RETAINER  
AND A NEW COTTER PIN

F3466-B

8. Check hub rotation. If hub rotates freely, install grease cap. If not, check bearings for damage and replace as necessary.
9. Install wheel and tire assembly, wheelcover or ornaments and nut covers as required.
10. Lower vehicle.

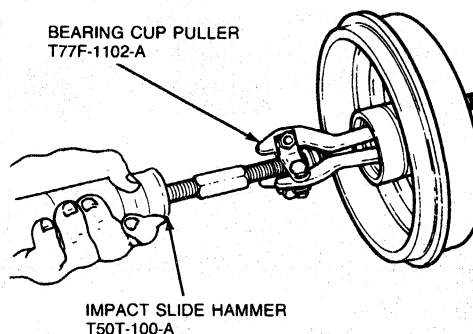
## REMOVAL AND INSTALLATION

**Hub, Drum, Wheel Bearings and Grease Seal****Removal**

1. Raise vehicle until tire clears floor. Remove wheel from hub and drum.
2. Remove grease cap from hub, taking care not to damage cap. Remove cotter pin, nut retainer, adjusting nut, and keyed flatwasher from spindle. Discard cotter pin.
3. Pull hub and drum assembly off spindle being careful not to drop outer bearing assembly.
4. Remove outer bearing assembly.
5. Using Seal Remover TOOL-1175-AC or equivalent, remove and discard grease seal. Remove inner bearing assembly from hub.
6. Wipe all lubricant from spindle and inside of hub. Cover spindle with a clean cloth, and vacuum all loose dust and dirt from brake assembly. Carefully remove cloth to prevent dirt from falling on spindle.
7. Clean both bearing assemblies and cups using solvent. Inspect bearing assemblies and cups for excessive wear, scratches, pits or other damage. Replace all worn or damaged parts as required.

NOTE: Allow solvent to dry before repacking bearings. Do not spin-dry bearings with air pressure.

8. If cups are to be replaced, remove them with Impact Slide Hammer T50T-100-A and Bearing Cup Puller T77F-1102-A or equivalent.



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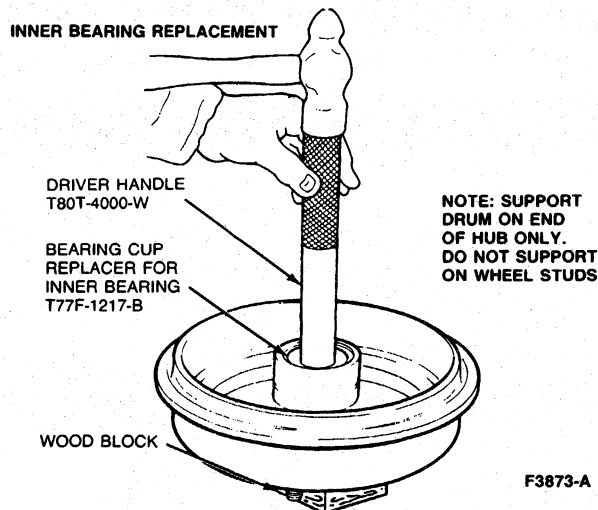
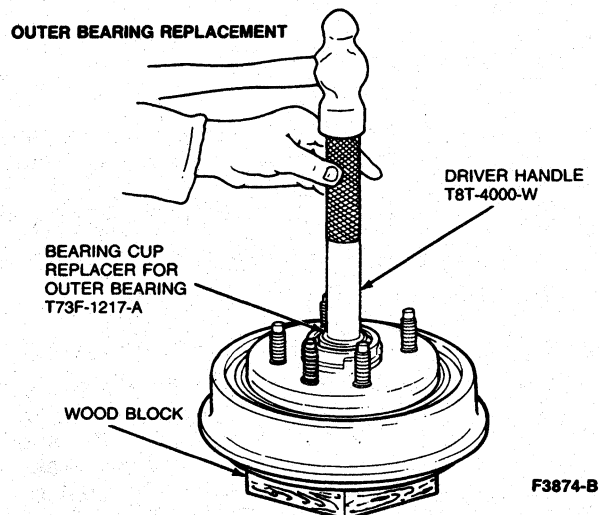
## REMOVAL AND INSTALLATION (Continued)

## Installation

1. If inner or outer bearing cups were removed, install replacement cups using Driver Handle T80T-4000-W and Bearing Cup Replacers T73F-1217-A and T77F-1217-B or equivalent.

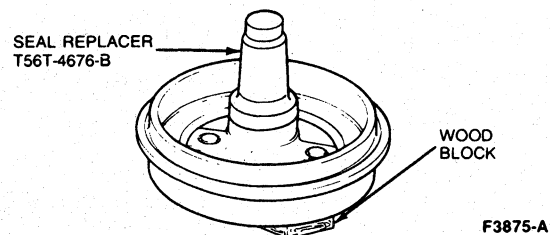
**CAUTION: Do not use cone and roller assembly to install cup as this will cause damage to bearing cup, and cone and roller assembly.**

Support drum hub on wood block to prevent damage. Ensure cups are properly seated in hub.



2. Make sure all spindle and bearing surfaces are clean.
3. Using a bearing packer, pack the bearing assemblies with Multi-Purpose Long-Life Lubricant C1AZ-19590-B or equivalent. If a packer is not available, work in as much specified grease as possible between rollers and cages. Grease cup surfaces.

4. Place inner bearing cone and roller assembly in inner cup. Apply light film of grease to lips of a new grease seal and install seal with Rear Hub Seal Replacer T56T-4676-B or equivalent. Ensure the retainer flange is seated all around.
5. Apply light film of grease on spindle shaft bearing surfaces.
6. Install hub and drum assembly on spindle. Keep hub centered on spindle to prevent damage to grease seal and spindle threads.
7. Install outer bearing assembly and keyed flatwasher on spindle. Install adjusting nut finger-tight. Adjust wheel bearings. Install a new cotter pin. Refer to Adjustments.
8. Install grease cap. Replace with new cap if corrosion is present on inside surface.
9. Place wheel and tire on drum. Install lug nuts and tighten alternately to draw wheel evenly against hub and drum.
10. Lower vehicle and tighten lug nuts to 109-142 N·m (80-105 lb-ft). Do not use power tools. Install wheelcover.



## SPECIFICATIONS

## TORQUE SPECIFICATIONS

Description	N·m	Lb·Ft
Wheel Lug Nuts	109-142	80-105

CF3462-A

## SPECIAL SERVICE TOOLS

Tool Number	Description
D79P-100-A	Slide Hammer
T77F-1102-A	Bearing Cup Puller
TOOL-1175-AC	Seal Remover
T77F-1217-B	Bearing (Inner) Cup Replacer
T73F-1217-A	Bearing (Outer) Cup Replacer
T56T-4676-B	Rear Hub Seal Replacer
T80T-4000-W	Driver Handle

CF3876-A



# BRAKES

# GROUP 12

(2000)

SECTION TITLE	PAGE	SECTION TITLE	PAGE
BRAKE BOOSTER, VACUUM—DASH MOUNTED .....	12-50-1	BRAKES, HYDRAULIC—SERVICE .....	12-01-1
BRAKES, DISC-SINGLE PISTON, SLIDING CALIPER-FRONT .....	12-20-1	PARKING BRAKE, CABLE ACTUATED—REAR WHEELS .....	12-70-1
BRAKES, DRUM—SINGLE CYLINDER, DUAL PISTON—REAR .....	12-02-1		

## SECTION 12-01 Brakes, Hydraulic—Service

SUBJECT	PAGE	SUBJECT	PAGE
<b>ADJUSTMENTS</b>		<b>DIAGNOSIS AND TESTING (Cont'd.)</b>	
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Brake Vacuum Booster Push Rod-To-Master Cylinder .....	12-01-23	Brake System Diagnosis .....	12-01-5
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Brake Booster .....	12-01-30	Diagnostic Technique No. 4 .....	12-01-6
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Disc Brakes .....	12-01-30	<b>OVERHAUL</b>	
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Hydraulic Lines .....	12-01-30	<b>REMOVAL AND INSTALLATION</b>	
Service Precautions .....	12-01-29	Brake Master Cylinder Reservoir .....	12-01-26
<b>DESCRIPTION</b>		Brake Pedal .....	12-01-27
Brake System—Dual .....	12-01-2	Brake Pressure Control Valve .....	12-01-26
Fluid Control Valve .....	12-01-5	Fluid Control Valve Assembly .....	12-01-25
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Pressure Control Valves .....	12-01-2	<b>SPECIAL SERVICE TOOLS</b> .....	12-01-31
<b>DIAGNOSIS AND TESTING</b>		<b>SPECIFICATIONS</b> .....	12-01-31
Brake Pedal Free Height Measurements .....	12-01-6	<b>VEHICLE APPLICATION</b> .....	12-01-1

### VEHICLE APPLICATION

Taurus/Sable.

## DESCRIPTION

**Brake System—Dual**

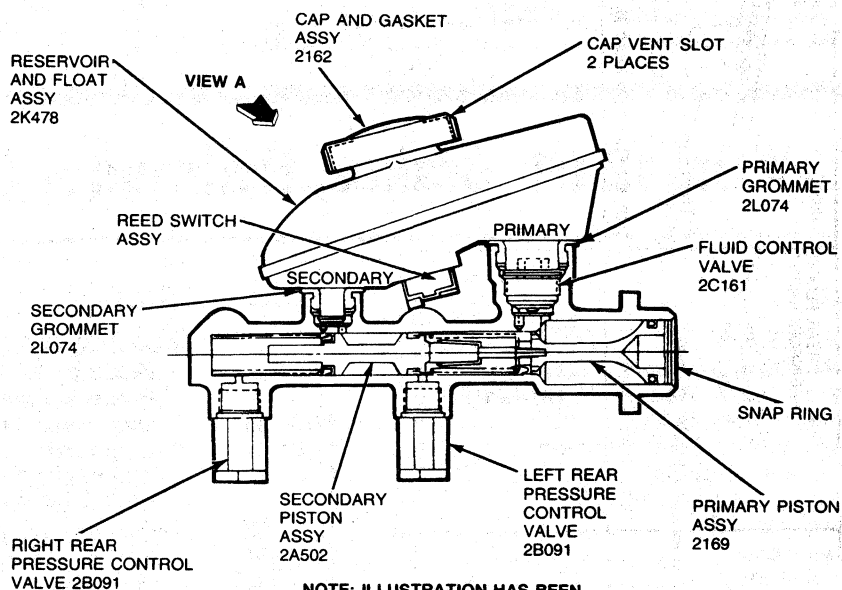
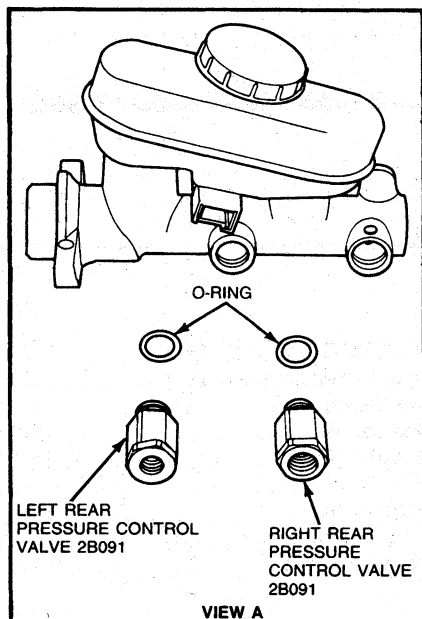
The dual hydraulic brake system is a conventional, pedal-actuated system with a master cylinder, pressure control valve, brake tubes and hoses. The hydraulic brake line routing has been diagonally split

front to rear (LH front to RH rear and RH front to LH rear). The master cylinder has a common reservoir, brake pressure control valve, and a fluid level indicator, all combined in one assembly.

**Pressure Control Valves**

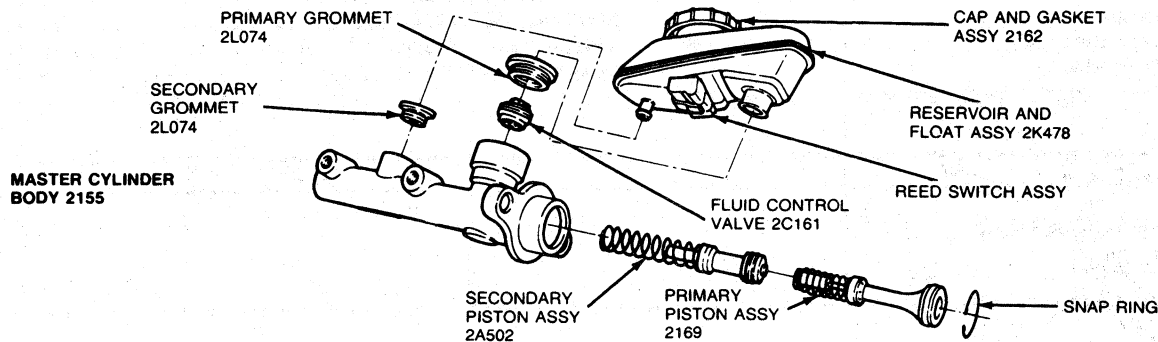
The sedan and station wagon use different types of rear brake pressure control valves. The valve for the sedan is mounted to the floorpan near the left rear wheel. It utilizes a mechanical linkage to the lower suspension arm to vary valve performance based on the rear weight of the vehicle.

The valves for the station wagon are screwed into the master cylinder. They limit the pressure level at the rear brakes to minimize rear wheel skidding during hard braking.

**Wagon**

NOTE: ILLUSTRATION HAS BEEN ROTATED 90 DEGREES FOR CLARITY.

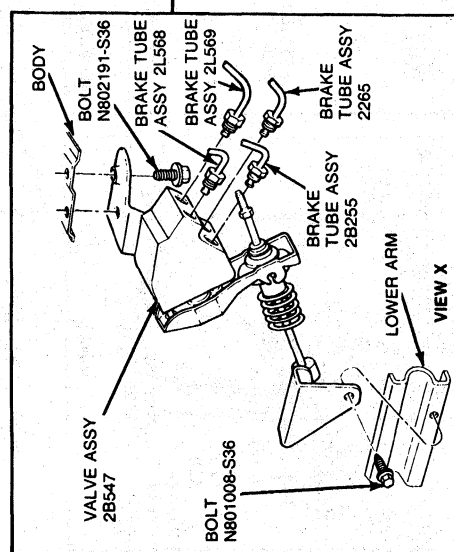
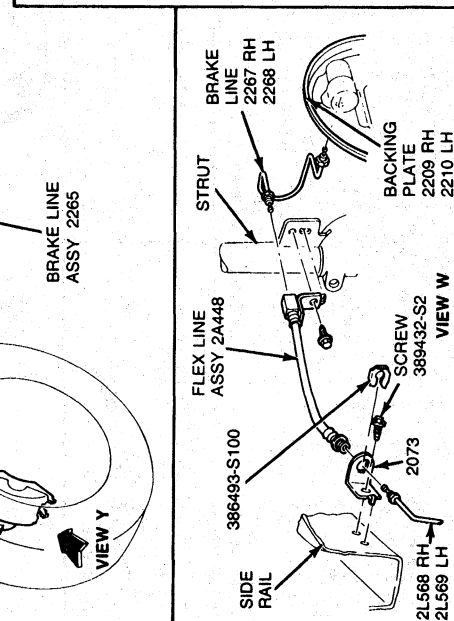
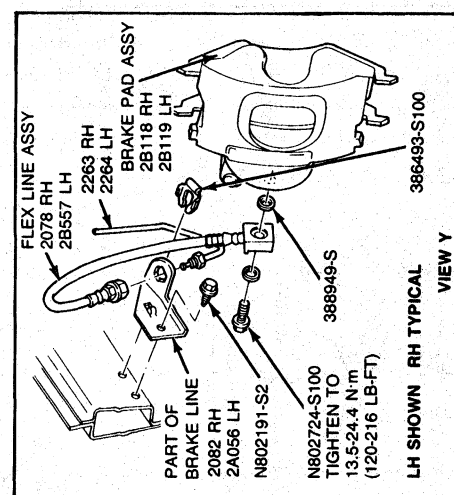
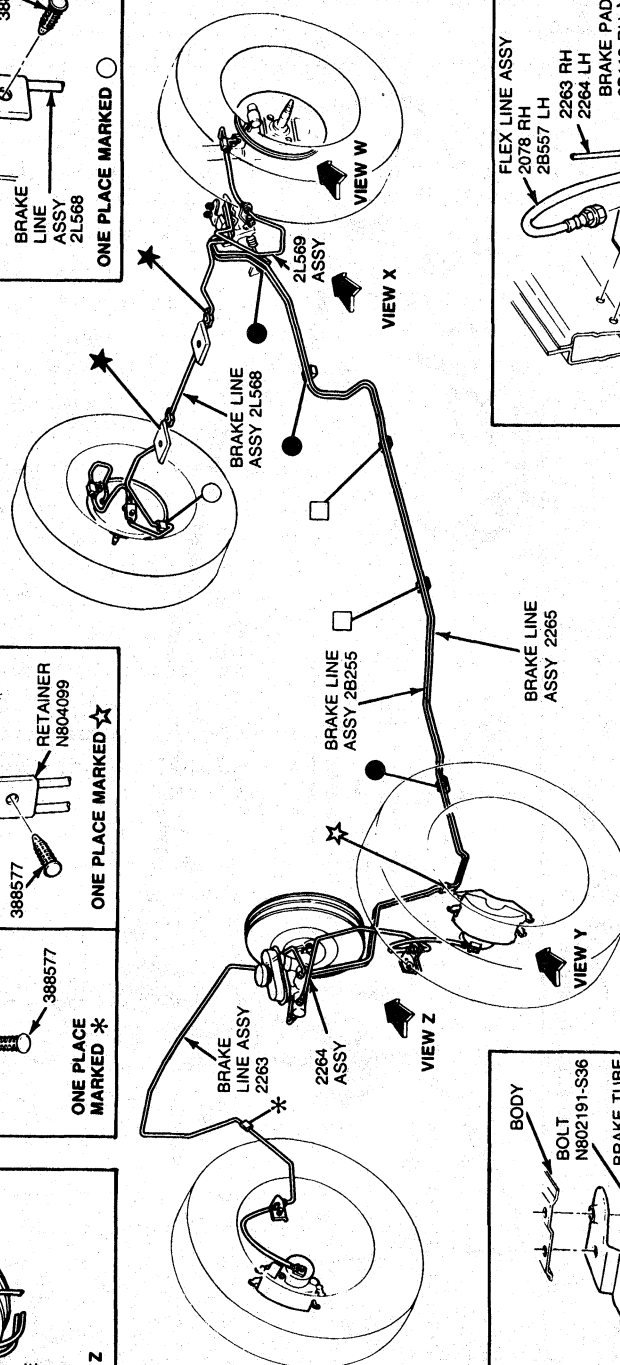
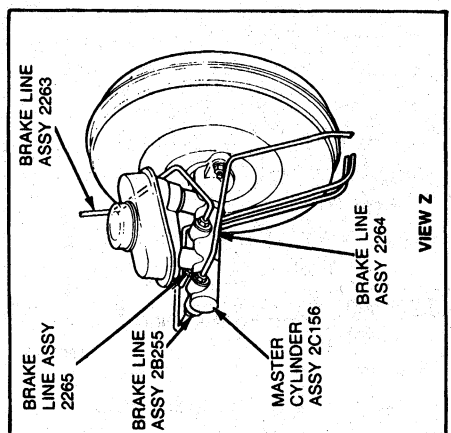
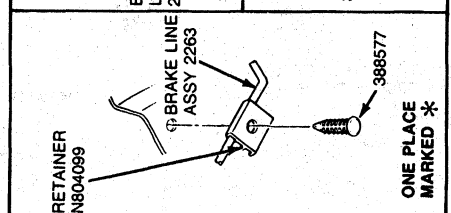
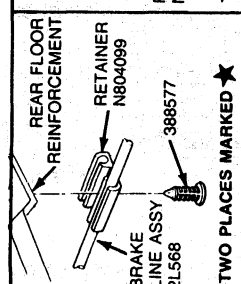
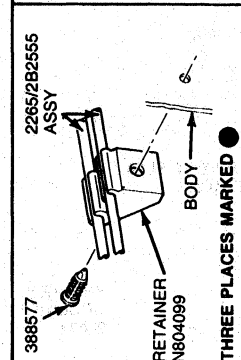
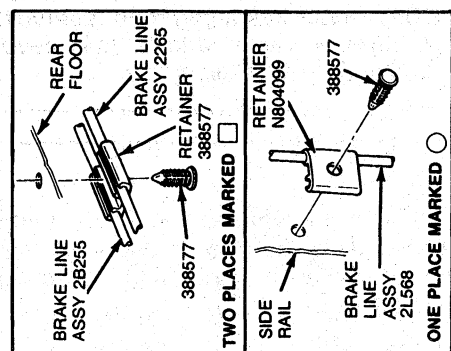
H4000-B

**Sedan**

H3999-A

**DESCRIPTION (Continued)**

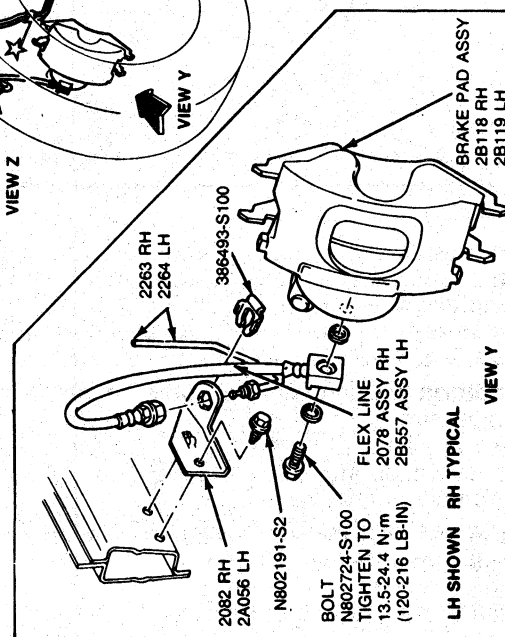
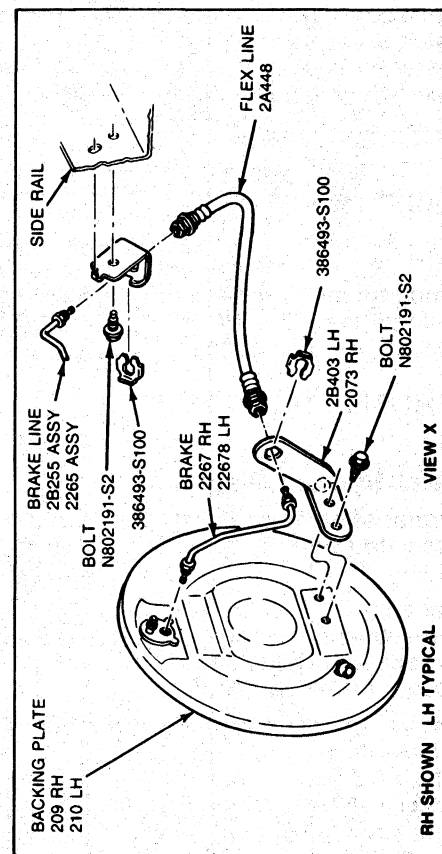
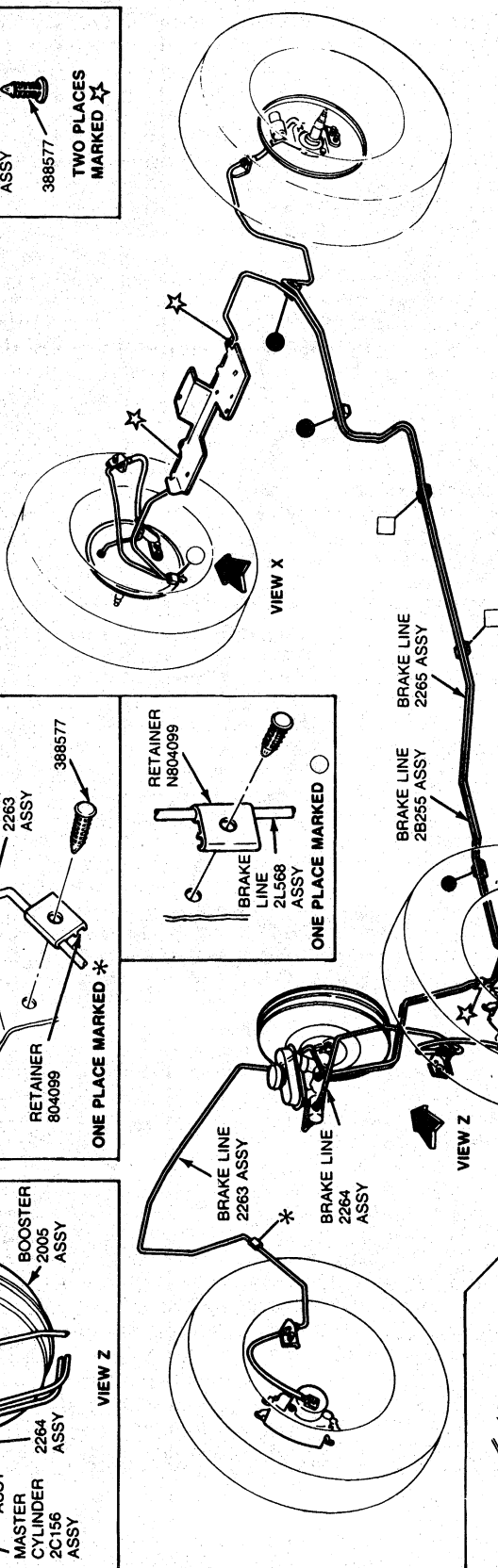
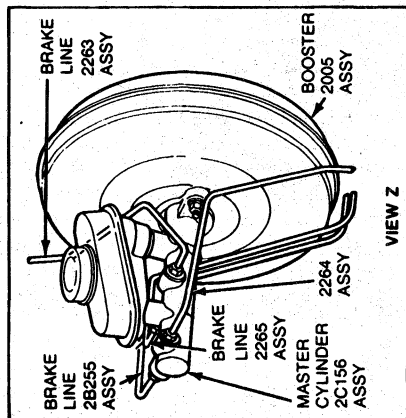
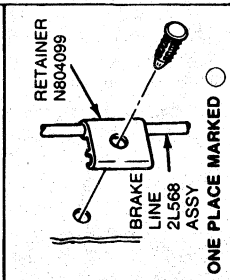
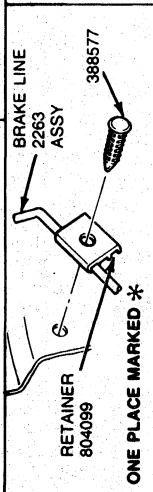
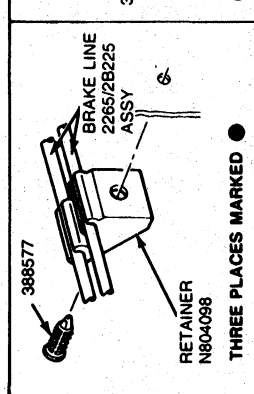
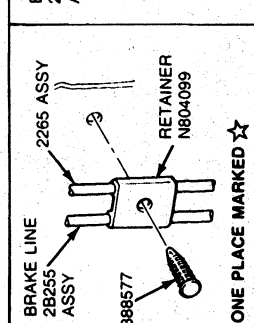
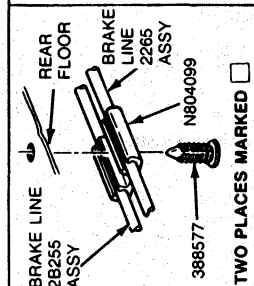
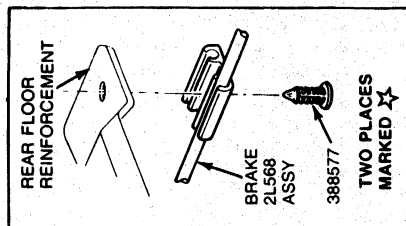
## Sedan



H3980-B

## DESCRIPTION (Continued)

## Wagon



H3979-A

**DESCRIPTION (Continued)****Fluid Level Indicator**

The fluid level indicator replaces the pressure differential valve used in the previous brake systems. It is contained inside the body of the master cylinder plastic reservoir and activates the brake warning lamp whenever fluid level is low.

**Fluid Control Valve**

The fluid control valve is located in the body of the master cylinder just below the primary reservoir compartment. This valve provides relief pressure for the large fast fill bore.

**DIAGNOSIS AND TESTING****Brake System Diagnosis**

Diagnosis of mechanical and hydraulic problems associated with the brake system is covered in this Section.

In addition to the Brake System Diagnosis charts, further specific diagnosis charts are furnished for the master cylinder, brake control valve and the vacuum brake booster.

**Always check the fluid level in the master cylinder before performing the test procedures.** If the fluid level is not at the "MAX" line on the master cylinder reservoirs, add Heavy Duty Brake Fluid (ESA-M6C25-A) C6AZ-19542-A or DOT-3 equivalent.

**If a brake is locked and the vehicle must be moved, open a bleeder screw to let out enough fluid to relieve the pressure. This bleeding operation will release the brakes but will not correct the cause of trouble.**

**Master Cylinder****Normal Conditions**

The following conditions are considered normal and are not indications that the master cylinder is in need of service:

**Condition 1:** New brake systems are not designed to produce as hard a pedal effort as in the past. Complaints of light pedal efforts should be compared to pedal efforts on another vehicle, same model and year.

**Condition 2:** During normal operation of the master cylinder, the fluid level in the reservoir will rise during brake application and fall during release. The net fluid level (i.e., after brake application and release) will remain unchanged.

**Condition 3:** A trace of brake fluid existing on the booster shell below the master cylinder mounting flange. This results from the normal lubricating action of the master cylinder bore end seal.

**Condition 4:** Fluid level will decrease with pad wear.

**Abnormal Conditions**

Changes in brake pedal feel or travel are indicators that something could be wrong in the brake system. The following conditions use brake pedal feel and the warning lamp along with reservoir fluid level, as indicators in diagnosing brake system complaints.

**Condition 1:** Pedal goes down fast. This could be caused by an external leak or internal leak.

**Condition 2:** Pedal eases down slowly. This could be caused by an external leak or internal leak.

**Condition 3:** Pedal is low and/or feels spongy. This condition may be caused by: no fluid in the reservoir, reservoir cap vent holes clogged, rear brakes out of adjustment, or air in the hydraulic system.

**Condition 4:** Pedal effort excessive. This may be caused by a bind or obstruction in pedal/linkage, insufficient booster vacuum, or clogged fluid control valve.

**Condition 5:** Rear brake lockup during light pedal force. This may be caused by wrong tire pressure, grease or fluid on linings/damaged linings, improperly adjusted parking brakes, or damaged/contaminated pressure control valve(s).

**Condition 6:** Erratic pedal effort. This condition could be caused by brake booster malfunction, damaged fluid control valve, or extreme caliper piston knock back.

**Condition 7:** Brake warning lamp on. This may be caused by low fluid level, ignition wire routing too close to fluid level indicator assembly, or float assembly damage.

**Condition 8:** Right front brake drag. This may be caused by a damaged fluid control valve.

**NOTE:** Prior to performing any diagnosis, ensure that the brake system warning lamp is functional.

The diagnosis techniques and service procedures are referenced in the Brake Master Cylinder Diagnosis charts. Refer to these charts for proper use of diagnosis techniques in diagnosing brake hydraulic system problems.

**Diagnostic Technique No. 1****External Fluid Leaks—Check**

It is possible that all evidence of fluid leakage may have washed off, if the vehicle has been operated in rain or snow, as brake fluid is water soluble. Refill system, bleed, and apply the brakes several times. Examine the system to verify that the reservoir fluid level is actually dropping. Locate and correct the external leak. If fluid level drops and no external leak can be found, check for a master cylinder bore end seal leak.

**DIAGNOSIS AND TESTING (Continued)****Diagnostic Technique No. 2****Master Cylinder Bypass Condition Check**

1. Check fluid in master cylinder. Fill reservoir if low or empty.
2. Observe fluid level in reservoir. If after several brake applications the fluid level remains the same, measure wheel turning torque required to rotate wheels with brakes applied as follows:
  - Place transmission in NEUTRAL and raise front wheels off the ground.
  - Apply brakes with a minimum of 445N (100 lbs) and hold for approximately 15 seconds. With brakes still applied, exert torque on front wheels to 101 N·m (75 lb-ft). If either wheel rotates, check internals of master cylinder and replace damaged parts.

**Diagnostic Technique No. 3****Reservoir Sealing Points—Check**

An empty reservoir condition may be caused by two types of non-pressure external leaks.

**Type 1:** An external leak may occur at the master cylinder reservoir cap because of improper positioning of the gasket and cap. Reposition cap and gasket.

**Type 2:** An external leak may occur at the reservoir mounting grommets. Service such a leak by installing new grommets.

**Diagnostic Technique No. 4****Brake Pedal Reserve—Check**

Where a low pedal or the feel of a bottomed out condition exists, check for brake pedal reserve.

1. Operate engine at idle with the transmission in either PARK or NEUTRAL position.
2. Depress brake pedal lightly three to four times.
3. Allow 15 seconds for vacuum to replenish booster.
4. Apply brake pedal until it stops moving downward or an increased resistance to the pedal travel occurs.

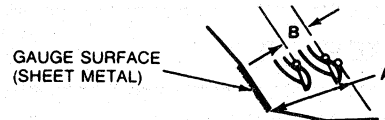
NOTE: This increased resistance may feel like something has bottomed out.

5. Hold pedal in applied position and raise the engine speed to approximately 2,000 rpm.
6. Release accelerator pedal and observe that brake pedal moves downward as engine returns to idle speed.

NOTE: The additional movement of the brake pedal is the result of the increased engine manifold vacuum which exerts more force on the brake booster during engine rundown. This means that additional stroke is available in the master cylinder, and the brake system is not bottoming out as a customer may believe.

**Brake Pedal Free Height Measurements**

1. Insert a slender, sharp-pointed prod through carpet and sound deadener to dash panel metal. Measure distance to center on top of brake pedal pad.
2. If the position of pedal is not within specification, check brake pedal for missing, worn, or damaged bushings, or loose attaching bolts, and replace, as required.
3. If pedal free height is still out of specification, check brake pedal, booster or master cylinder to ensure correct components are installed. Replace components as necessary.



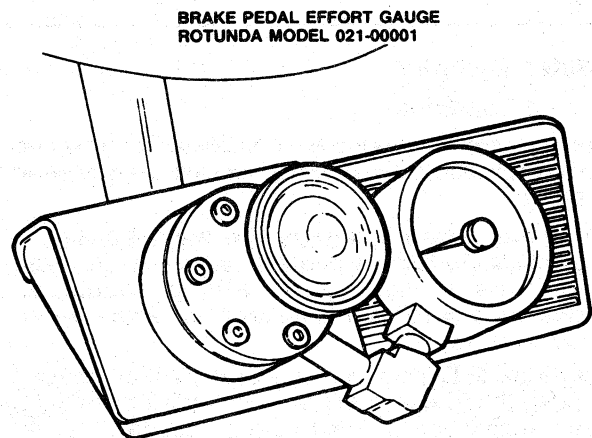
VEHICLE	TYPE	PEDAL FREE HEIGHT "A" (INCHES)		MAXIMUM PEDAL TRAVEL (INCHES) "B"
		MAX.	MIN.	
TAURUS/SABLE	POWER DISC	180mm (7.09 INCH)	161mm (6.34 INCH)	59.5mm (2.34 MAX.)

NOTE: VEHICLES CLOSE TO MAXIMUM PEDAL TRAVEL SPECIFICATIONS MAY BE IMPROVED BY BLEEDING THE BRAKE SYSTEM.

H4001-A

**Brake Pedal Travel Measurement**

1. With engine running and transmission in PARK or NEUTRAL, block wheels and release parking brake.
2. Install Rotunda Brake Pedal Effort Gauge 021-00001 or equivalent on the brake pedal pad.



H3669-C

3. Hook a steel measuring tape to the brake pedal. Measure and record the distance from the brake pedal free height position to the reference point, which is at the six o'clock position on the steering wheel rim.

**DIAGNOSIS AND TESTING (Continued)**

4. With steel tape still hooked to brake pedal, depress brake pedal by pressing downward on brake pedal effort gauge. Apply a 111N (25 lb) load to center of pedal. Maintain the pedal load, and measure the distance from brake pedal to the fixed reference point on steering wheel rim parallel to centerline of steering column.
5. If pedal travel is more than the maximum specification on vehicles with self-adjusting/drum brakes, make several reverse stops with a forward stop before each. Move vehicle in reverse and forward for approximately ten feet. Then, apply brakes and hold brake pedal down until vehicle is completely stopped. This will actuate brake self-adjusters. If these stops do not bring brake pedal travel within specification, make several additional forward and reverse stops as outlined above.
6. On self-adjusting rear drum brakes, if the second series of stops does not bring brake pedal travel within specification, remove brake drums, and check brake adjusters to ensure they are functioning. Check brake lining for wear or damage. Service or replace all worn or damaged components. Adjust brake. Refer to Section 12-02.
7. If all drum brake adjusters, brake drums and brake shoe linings are functional, and brake travel is not within specifications, check pedal assembly for missing or loose attachments.
8. If above Steps do not bring brake travel within specification, bleed brake system.

**Power Brake Functional Test****Vacuum Booster**

Inspect all hoses and connections. All unused vacuum connectors should be capped. Hoses and their connections should be properly secured and in good condition with no holes or collapsed areas. Inspect check valve on power unit for damage.

**Booster Operation Check**

1. Check hydraulic brake system for leaks or insufficient fluid.
2. With transmission in NEUTRAL, stop engine and apply parking brake. Depress brake pedal several times to exhaust all vacuum in the system.
3. Depress pedal and hold it in the applied position. Start engine. If vacuum system is operating, pedal will tend to move downward under constant foot pressure. If no motion is felt, the vacuum booster system is not functioning.
4. Remove vacuum hose from brake booster check valve connection. Manifold vacuum should be available at the check valve end of the hose with engine at idle speed and transmission in NEUTRAL. If manifold vacuum is available to the booster, connect vacuum hose to booster and repeat Step 3. If no downward movement of brake pedal is felt, replace brake booster.
5. Operate engine a minimum of 10 seconds at fast idle. Stop engine, and let vehicle stand for 10 minutes. Then, depress brake pedal with approximately 89N (20 lbs) of force. Pedal feel should be the same as that noted with engine operating. If pedal feels hard (no power assist), replace check valve and retest.

If brake pedal feels spongy, bleed hydraulic system to remove air. Refer to Hydraulic System Bleeding.



**DIAGNOSIS AND TESTING (Continued)**

Refer to Vacuum Brake Diagnosis chart to assist in vacuum booster diagnosis.

**GENERAL BRAKE SYSTEM DIAGNOSIS**

<b>CONDITION</b>	<b>POSSIBLE SOURCE</b>	<b>ACTION</b>
<ul style="list-style-type: none"> <li>• Brakes do not apply.</li> </ul>	<ul style="list-style-type: none"> <li>• Insufficient brake fluid.</li> <li>• Binding or damaged brake pedal linkage.</li> <li>• Binding or damaged brake booster linkage.</li> </ul>	<ul style="list-style-type: none"> <li>• Add fluid, bleed system, check for leaks.</li> <li>• Service as required.</li> <li>• Service as required.</li> </ul>
<ul style="list-style-type: none"> <li>• Excessive pedal travel or pedal goes to floor.</li> </ul>	<ul style="list-style-type: none"> <li>• Air in system.</li> <li>• Loose brake tube fittings.</li> <li>• Malfunctioning master cylinder.</li> <li>• Drum brakes — improperly adjusted.</li> <li>• Loose-missing pedal bushings or fasteners.</li> <li>• Outer shoe retainer buttons not properly seated in caliper holes.</li> <li>• Loose rear wheel bearings.</li> </ul>	<ul style="list-style-type: none"> <li>• Bleed system.</li> <li>• Tighten to specification.</li> <li>• Refer to Master Cylinder Diagnosis Chart.</li> <li>• Check adjustment. Inspect brakes. Service as required.</li> <li>• Replace/tighten as required.</li> <li>• Check and service.</li> <li>• Check bearing adjustment.</li> </ul>
<ul style="list-style-type: none"> <li>• Excessive pedal effort to stop vehicle.</li> </ul>	<ul style="list-style-type: none"> <li>• Binding or damaged pedal linkage.</li> <li>• Engine vacuum loss.</li> <li>• Booster inoperative.</li> <li>• Malfunctioning master cylinder.</li> <li>• Worn or contaminated linings.</li> <li>• Brake system.</li> </ul>	<ul style="list-style-type: none"> <li>• Inspect. Service as required.</li> <li>• Check engine vacuum, and vacuum at check valve to booster. Service as required.</li> <li>• Perform power brake function test.</li> <li>• Refer to Master Cylinder Diagnosis Chart.</li> <li>• Inspect. Replace if necessary.</li> <li>• Inspect wheel cylinders or caliper pistons, restricted lines or hoses, contaminated brake fluid, improper operation of proportioning valve. Service as necessary.</li> </ul>
<ul style="list-style-type: none"> <li>• Spongy pedal.</li> </ul>	<ul style="list-style-type: none"> <li>• Air in system.</li> <li>• Loose or improper brake pedal, pedal support, booster, master cylinder attachment.</li> <li>• Malfunctioning master cylinder.</li> <li>• Brake system.</li> <li>• Inoperative brake adjusters.</li> </ul>	<ul style="list-style-type: none"> <li>• Bleed system.</li> <li>• Service as required.</li> <li>• Refer to Master Cylinder Diagnosis Chart.</li> <li>• Inspect for damaged or distorted parts in brake caliper assemblies, cracked brake drums, mis-machined knuckle anchor plates.</li> <li>• Service as required.</li> </ul>
<ul style="list-style-type: none"> <li>• Brakes drag, slow or incomplete release.</li> </ul>	<ul style="list-style-type: none"> <li>• Parking brake cable out of adjustment or binding.</li> <li>• Blocked master cylinder compensator ports.</li> <li>• Brake adjustment (rear).</li> <li>• Restriction in hydraulic system.</li> <li>• Wheel cylinders or caliper piston seizure.</li> </ul>	<ul style="list-style-type: none"> <li>• Check cables for correct adjustment or bind.</li> <li>• Refer to Master Cylinder Diagnosis Chart.</li> <li>• Check and adjust.</li> <li>• Check and service.</li> <li>• Check and service.</li> </ul>



## DIAGNOSIS AND TESTING (Continued)

## GENERAL BRAKE SYSTEM DIAGNOSIS — Continued

CONDITION	POSSIBLE SOURCE	ACTION
<ul style="list-style-type: none"> <li>Noise at wheels when brakes are applied — snap or clicks.</li> </ul>	<ul style="list-style-type: none"> <li>On drum brakes — brake shoes binding at backing plate ledges.</li> <li>On drum brakes — backing plate ledges worn.</li> <li>Loose or missing disc brake caliper attaching bolts.</li> <li>On disc brakes — loose or missing inner anti-rattle clip.</li> <li>Loose caliper retaining spring.</li> <li>Spiral grooves on rotor braking surface.</li> <li>Disc brake shoe end clearance in excess of 0.66mm (0.026 inch)</li> </ul>	<ul style="list-style-type: none"> <li>Lubricate.</li> <li>Replace backing plate and lubricate ledges.</li> <li>Replace missing bolts, tighten to specification.</li> <li>Replace.</li> <li>Inspect. Service or replace.</li> <li>Hand sand rotor to remove grooves.</li> <li>Peen ends of shoes with hammer and anvil to lengthen shoe end and reinstall. Minimum clearance 0.13mm (0.005 inch).</li> </ul>
<ul style="list-style-type: none"> <li>Noise at wheels when brakes are applied — scrape or grind.</li> </ul>	<ul style="list-style-type: none"> <li>Worn brake linings.</li> <li>Brake shoe interference with back of drum. Binding at backing plate guide ledges.</li> <li>Caliper to wheel or rotor interference.</li> <li>Other brake system components: Warped or bent brake backing plate or splash shield, cracked drums or rotors.</li> <li>Tires rubbing against chassis or body.</li> </ul>	<ul style="list-style-type: none"> <li>Replace. Refinish drums or rotors if heavily scored.</li> <li>Inspect. Replace as necessary. Lubricate.</li> <li>Inspect and replace as required.</li> <li>Inspect and service.</li> <li>Inspect and service.</li> </ul>
<ul style="list-style-type: none"> <li>Noise at wheels when brakes are applied — squeaks, squeals, or chatter.</li> </ul> <p>NOTE: Brake friction materials inherently generate noise and heat in order to dissipate energy. As a result, occasional squeal is normal, and is aggravated by severe environmental conditions such as cold, heat, wetness, snow, salt, mud, etc. This occasional squeal is not a functional problem and does not indicate any loss of brake effectiveness.</p>	<ul style="list-style-type: none"> <li>Brake drums and linings, rotors and pads worn or scored.</li> <li>On disc brakes — missing or damaged brake pad insulators.</li> <li>On disc brakes — burred or rusted calipers or knuckles.</li> <li>Dirty, greased or glazed linings.</li> <li>Improper lining parts.</li> <li>On drum brakes — loose lining rivets, weak, damaged or incorrect shoe retracting springs, loose or damaged shoe retaining pins, springs and clips, and grooved backing plate ledges.</li> </ul>	<ul style="list-style-type: none"> <li>Inspect, service or replace. Lightly sand rotors. Do not machine unless heavily scored.</li> <li>Replace.</li> <li>Clean or deburr.</li> <li>Sand or replace dirty or glazed linings and lightly sand rotor braking surfaces, replace pads if contaminated.</li> <li>Inspect for correct usage. Replace.</li> <li>Inspect, service or replace.</li> </ul>

## DIAGNOSIS AND TESTING (Continued)

## GENERAL BRAKE SYSTEM DIAGNOSIS — Continued

CONDITION	POSSIBLE SOURCE	ACTION
<ul style="list-style-type: none"> <li>Noise at wheels, brakes not applied — squeak or squeal.</li> </ul>	<ul style="list-style-type: none"> <li>Wheel cover attachment.</li> <li>Loose wheel attaching lug nuts.</li> <li>Bent or warped backing plate causing interference with drum or rotor.</li> <li>Improper machining of drum, causing interference with backing plate or shoe.</li> <li>Other brake system components:               <ul style="list-style-type: none"> <li>Loose or extra parts in brakes.</li> <li>Drum brake adjustment too tight causing lining to glaze.</li> <li>Worn, damaged, or insufficiently lubricated wheel bearings.</li> <li>On drum brakes — weak, damaged or incorrect shoe retracting springs.</li> <li>On drum brakes — grooved backing plate ledges.</li> <li>Improper positioning of shoe in caliper.</li> <li>Outside diameter of rotor rubbing caliper housing.</li> <li>Improper installation of front disc brake caliper retaining spring.</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>Seat covers with a rubber mallet. Service flanges or replace cover.</li> <li>Tighten to correct torque. Replace wheel if stud holes are damaged.</li> <li>Service or replace.</li> <li>Replace drum.</li> <li>Inspect, service, replace as required.</li> </ul>
<ul style="list-style-type: none"> <li>Noise at wheels, brakes not applied — growling, click or rattle.</li> </ul>	<ul style="list-style-type: none"> <li>Stones or foreign material trapped inside wheel covers.</li> <li>Loose grease cap. (Rear only).</li> <li>Loose wheel lug nuts.</li> <li>Disc brake caliper — loose or missing anti-rattle clips.</li> <li>Drum brakes — loose parts.</li> <li>Worn, damaged or dry wheel bearings.</li> </ul>	<ul style="list-style-type: none"> <li>Service or replace.</li> <li>Service or replace.</li> <li>Tighten to specification. Replace if stud holes are elongated.</li> <li>Inspect, service or replace.</li> <li>Inspect, service or replace.</li> <li>Inspect, lubricate or replace.</li> </ul>

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## DIAGNOSIS AND TESTING (Continued)

## GENERAL BRAKE SYSTEM DIAGNOSIS — Continued

CONDITION	POSSIBLE SOURCE	ACTION
<ul style="list-style-type: none"> <li>Brakes pull to one side.</li> </ul>	<ul style="list-style-type: none"> <li>Unequal air pressure in tires.</li> <li>Grease or fluid on linings.</li> <li>Loose or missing disc brake caliper attaching pins.</li> <li>Improper size or type lining on one wheel.</li> <li>Seized wheel cylinders or calipers.</li> <li>Restricted brake lines or hoses.</li> <li>Loose suspension components.</li> <li>Other brake system components:               <ul style="list-style-type: none"> <li>Improper adjustment of drum.</li> <li>Improper positioning of disc brake shoe and lining in the caliper.</li> <li>Improperly adjusted, damaged or worn rear wheel bearings.</li> <li>Distorted drum brake linings.</li> <li>Missing, broken or stretched retracting or retaining springs and clips in drum brakes.</li> </ul> </li> <li>Malfunctioning master cylinder.</li> </ul>	<ul style="list-style-type: none"> <li>Inflate tires to correct pressure.</li> <li>Replace.</li> <li>Replace missing bolts. Tighten to specification.</li> <li>Replace with correct brake lining in axle sets.</li> <li>Service or replace.</li> <li>Service or replace.</li> <li>Tighten as necessary.</li> <li>Inspect, service or replace as required.</li> <li>Refer to Master Cylinder Diagnosis chart.</li> </ul>
<ul style="list-style-type: none"> <li>Brakes grab or lock-up when applied.</li> </ul>	<ul style="list-style-type: none"> <li>Tires worn or incorrect pressure.</li> <li>Grease or fluid on linings — damaged linings.</li> <li>Improper size or type of linings.</li> <li>Other brake system components:               <ul style="list-style-type: none"> <li>Bolts for caliper attachment loose or missing.</li> <li>Worn, damaged or dry wheel bearings.</li> <li>Improperly adjusted parking brake.</li> <li>Contaminated fluid control valve.</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>Inflate tires to correct pressure. Replace tires with worn tread.</li> <li>Inspect and replace as necessary.</li> <li>Replace with correct brake in axle sets.</li> <li>Inspect, service or replace as required.</li> <li>Refer to Master Cylinder Diagnosis chart.</li> </ul>
<ul style="list-style-type: none"> <li>Brake warning lamp on.</li> </ul>	<ul style="list-style-type: none"> <li>Hydraulic system.</li> <li>Shorted lamp circuit.</li> <li>Parking brake not returned.</li> <li>Brake warning switch.</li> </ul>	<ul style="list-style-type: none"> <li>Refer to Master Cylinder Diagnosis chart.</li> <li>Correct short in warning circuit.</li> <li>Refer to Parking brake will not release or fully return.</li> <li>Replace.</li> </ul>
<ul style="list-style-type: none"> <li>Intermittent increase in pedal travel.</li> </ul>	<ul style="list-style-type: none"> <li>Loose front hub nut.</li> <li>Master Cylinder.</li> </ul>	<ul style="list-style-type: none"> <li>If hub nut is loose install new nut and tighten to 244-271 N·m (180-200 lb-ft) and stake.</li> <li>Perform Master Cylinder Diagnosis.</li> </ul>

## DIAGNOSIS AND TESTING (Continued)

## GENERAL BRAKE SYSTEM DIAGNOSIS — Continued

CONDITION	POSSIBLE SOURCE	ACTION
<ul style="list-style-type: none"><li>● Rough engine idle or stall, brakes applied — power brakes only.</li></ul>	<ul style="list-style-type: none"><li>● Vacuum leak in neutral switch.</li><li>● Vacuum booster.</li></ul>	<ul style="list-style-type: none"><li>● Check lines for leaks. Service or replace as required.</li><li>● Check vacuum booster for internal leaks. Replace if required.</li></ul>
<ul style="list-style-type: none"><li>● Parking brake will not release or fully return (manual release).</li></ul>	<ul style="list-style-type: none"><li>● Cable disconnected.</li><li>● Control assembly binding.</li><li>● Parking brake lining binding.</li><li>● Rear brakes.</li></ul>	<ul style="list-style-type: none"><li>● Connect or replace cable.</li><li>● Service or replace.</li><li>● Service or replace.</li><li>● Check rear brakes shoe retracting springs and parking brake levers.</li></ul>

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## DIAGNOSIS AND TESTING (Continued)

MASTER CYLINDER DIAGNOSIS  
PEDAL GOES DOWN FAST

TEST STEP		RESULT	ACTION TO TAKE
<b>A0</b>	<b>VERIFY CONDITION</b>		
	<ul style="list-style-type: none"> <li>Road test vehicle and depress brake pedal.</li> </ul>	(OK) → (X) →	Vehicle OK. GO to A1.
<b>A1</b>	<b>BRAKE FLUID LEVEL</b>		
	<ul style="list-style-type: none"> <li>Check master cylinder brake fluid reservoir level.</li> </ul>	(OK) → (X) →	GO to A2. CHECK reservoir sealing points (use Diagnostic Technique No. 3), ADD fluid and BLEED system. REPEAT Test A0.
<b>A2</b>	<b>PRESSURIZE SYSTEM</b>		
	<ul style="list-style-type: none"> <li>Pump brake pedal rapidly (five times).</li> </ul>	Pedal height builds up, then sinks. → Pedal height builds up and holds. →	GO to A3. CHECK rear brake adjustment and ADJUST if necessary. If condition still exists, BLEED system for air. REPEAT Test A0.
<b>A3</b>	<b>BRAKE SYSTEM LEAKS</b>		
	<ul style="list-style-type: none"> <li>Check for external brake system leaks (use Diagnostic Technique No. 1).</li> </ul>	(OK) → (X) →	GO to A4. SERVICE as necessary, ADD fluid and BLEED system. REPEAT Test A0.
<b>A4</b>	<b>MASTER CYLINDER BY-PASS TEST</b>		
	<ul style="list-style-type: none"> <li>Test for master cylinder by-pass (use Diagnostic Technique No. 2).</li> </ul>	(OK) → (X) →	System OK. REPLACE damaged parts, ADD fluid and BLEED system. REPEAT Test A0.

## DIAGNOSIS AND TESTING (Continued)

**MASTER CYLINDER DIAGNOSIS — Continued**  
**PEDAL EASES DOWN SLOWLY**

TEST STEP		RESULT	ACTION TO TAKE
<b>B0</b>	<b>VERIFY CONDITION</b>		
<ul style="list-style-type: none"> <li>Check if condition occurs during actual stopping application by depressing the brake pedal while the vehicle is moving.</li> </ul>		Condition occurs only when vehicle is stationary.  No action required. (SEE Normal Condition No. 1.)	
		Condition occurs while vehicle is moving and braking performance is affected.  GO to B1.	
<b>B1</b>	<b>BRAKE SYSTEM LEAKS</b>		
<ul style="list-style-type: none"> <li>Check for external brake system leaks. (Refer to Diagnostic Technique No. 1.)</li> </ul>		(OK)  GO to B2.	
		(X)  SERVICE as necessary, ADD fluid and BLEED system. REPEAT Test B0.	
<b>B2</b>	<b>MASTER CYLINDER BY-PASS TEST</b>		
<ul style="list-style-type: none"> <li>Test for master cylinder by-pass. (Refer to Diagnostic Technique No. 2.)</li> </ul>		(OK)  System OK.	
		(X)  REPLACE damaged parts, ADD fluid and BLEED system. REPEAT Test B0.	

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## DIAGNOSIS AND TESTING (Continued)









**MASTER CYLINDER DIAGNOSIS  
PEDAL IS LOW AND/OR FEELS SPONGY**

TEST STEP		RESULT	ACTION TO TAKE
<b>C0</b>	<b>VERIFY CONDITION</b>		
	<ul style="list-style-type: none"> <li>Road test vehicle and apply brake pedal.</li> </ul>	<p align="center">OK ►</p> <p align="center"><del>OK</del> ►</p>	<p>Vehicle OK.</p> <p>GO to C1.</p>
<b>C1</b>	<b>BRAKE FLUID LEVEL CHECK</b>		
	<ul style="list-style-type: none"> <li>Check master cylinder brake fluid reservoir level.</li> </ul>	<p align="center">OK ►</p> <p align="center"><del>OK</del> ►</p>	<p>GO to C2.</p> <p>CHECK reservoir sealing points. (USE Diagnostic Technique No. 3), ADD fluid and BLEED system.</p>
<b>C2</b>	<b>FILLER CAP VENT CHECK</b>		
	<ul style="list-style-type: none"> <li>Check if filler cap vent holes are clogged or dirty.</li> </ul>	<p align="center">OK ►</p> <p align="center"><del>OK</del> ►</p>	<p>GO to C3.</p> <p>CLEAN as necessary. REPEAT Test C0.</p>
<b>C3</b>	<b>BLEED BRAKE SYSTEM</b>		
	<ul style="list-style-type: none"> <li>Bleed brake system as described in this section.</li> </ul>	<p>Condition corrected ►</p> <p>Condition persists ►</p>	<p>Vehicle OK.</p> <p>GO to C4.</p>
<b>C4</b>	<b>FRONT HUB NUT CHECK</b>		
	<ul style="list-style-type: none"> <li>Check front wheel hub nut for looseness (Refer to Section 11-12)</li> </ul>	<p align="center">OK ►</p> <p align="center"><del>OK</del> ►</p>	<p>CHECK rear brake adjustment and ADJUST if necessary. REPEAT Test C0.</p> <p>REPLACE with new nut and stake. Do not reuse the nut. REPEAT Test C0.</p>

CH4003-A

## DIAGNOSIS AND TESTING (Continued)

**MASTER CYLINDER DIAGNOSIS — Continued**  
**PEDAL EFFORT EXCESSIVE**










TEST STEP		RESULT	ACTION TO TAKE
<b>D0</b>	<b>VERIFY CONDITION</b>		
	<ul style="list-style-type: none"> <li>Depress brake pedal fully several times.</li> </ul>	Pedal has short stroke and requires excessive effort.  GO to <b>D1</b> .  Pedal has long stroke and requires excessive effort.  GO to <b>D2</b> .	
<b>D1</b>	<b>FLUID CONTROL VALVE CHECK</b>		
	<ul style="list-style-type: none"> <li>Check fluid control valve for contamination. (Refer to Fluid Control Valve Assembly procedure in this section.)</li> </ul>	  GO to <b>D2</b> .    REPLACE valve. FILL reservoir. REPEAT Test <b>D0</b> .	
<b>D2</b>	<b>BRAKE PEDAL LINKAGE TEST</b>		
	<ul style="list-style-type: none"> <li>Detach booster push rod from pedal pin and depress brake pedal fully.</li> </ul>	Pedal moves freely.  CHECK booster vacuum availability as described under Vacuum Booster Diagnosis in this Section.  Condition persists.  SERVICE or REPLACE brake pedal linkage. REPEAT Test <b>D0</b> .	

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## DIAGNOSIS AND TESTING (Continued)

**MASTER CYLINDER DIAGNOSIS — Continued**  
**REAR BRAKE LOCK-UP DURING LIGHT BRAKE PEDAL FORCE**

TEST STEP		RESULT	ACTION TO TAKE
<b>E0</b>	<b>VERIFY CONDITION</b>		
	<ul style="list-style-type: none"> <li>Road test vehicle and apply brakes lightly.</li> </ul>	<p align="center"> → Vehicle OK.</p> <p>Sedan: Right rear or left rear lockup.  → REPLACE valve.</p> <p>Sedan: Both rear lockup.  → GO to E3.</p> <p>Wagon: Right rear lockup. → GO to E4.</p> <p>Wagon: Left rear lockup. → GO to E5.</p> <p>Wagon: Both lockup → PERFORM Tests E4 and E5.</p>	
<b>E1</b>	<b>TIRE INSPECTION</b>		
	<ul style="list-style-type: none"> <li>Check for excessive tire wear or improper tire pressures.</li> </ul>	<p align="center"> → GO to E2.</p> <p align="center"> → SUBSTITUTE known good tires if worn. INFLATE to proper pressure. REPEAT Test E0.</p>	
<b>E2</b>	<b>BRAKE SHOE INSPECTION</b>		
	<ul style="list-style-type: none"> <li>Inspect rear brake shoe linings for grease or fluid on linings and/or wear problems.</li> </ul>	<p align="center"> → GO to E3.</p> <p align="center"> → REPLACE if necessary. REPEAT Test E0.</p>	
<b>E3</b>	<b>PRESSURE CONTROL VALVE TEST</b>		
	<ul style="list-style-type: none"> <li>Install pressure gauges in left front and right rear bleeder screws. Apply 6895 kPa (1000 psi) in the front brake system, with car at curb height, and one person in drivers seat to apply brake. The rear brake pressure must be between 3447-3964 kPa (500-575 psi).</li> </ul>	<p align="center"> → INSPECT parking brake and ADJUST as required.</p> <p align="center"> → ADJUST valve by loosening set screw and move piston on operating rod. 1 mm up will lower rear pressure 413 kPa (60 psi), 1 mm down will increase pressure 413 kPa (60 psi). TIGHTEN set screw in correct position.</p>	

## DIAGNOSIS AND TESTING (Continued)

**MASTER CYLINDER DIAGNOSIS — Continued**  
**REAR BRAKE LOCK-UP DURING LIGHT BRAKE PEDAL FORCE**

TEST STEP		RESULT	ACTION TO TAKE
<b>E4</b>	<b>PRESSURE CONTROL VALVE TEST — RIGHT REAR</b>		
	<ul style="list-style-type: none"> <li>Install pressure gauges in left front and right rear bleeder screws. Apply 6895 kPa (1000 psi) in front brake system. The rear brake pressure must be between 3964-4343 kPa (575-630 psi).</li> </ul>	<p align="center">   </p> <p align="center">   </p>	<p>INSPECT parking brake and ADJUST as required.</p> <p>REPLACE right rear valve.</p>
<b>E5</b>	<b>PRESSURE CONTROL VALVE TEST — LEFT REAR</b>		
	<ul style="list-style-type: none"> <li>Install pressure gauges in right front and left rear bleeder screws. Apply 6895 kPa (1000 psi) in front brake system. The rear brake pressure must be between 3964-4343 kPa (575-630 psi).</li> </ul>	<p align="center">   </p> <p align="center">   </p>	<p>INSPECT parking brake and ADJUST as required.</p> <p>REPLACE left rear valve.</p>

CH4005-A

## DIAGNOSIS AND TESTING (Continued)

**MASTER CYLINDER DIAGNOSIS — Continued**  
**EXCESSIVE AND/OR ERRATIC PEDAL TRAVEL**

TEST STEP		RESULT	ACTION TO TAKE
<b>F0</b>	<b>VERIFY CONDITION</b>		
	<ul style="list-style-type: none"> <li>Road test vehicle and apply brakes slowly.</li> </ul>	<p align="center">OK ►</p> <p align="center">✗ OK ►</p>	<p>GO to F2.</p> <p>GO to F1.</p>
<b>F1</b>	<b>FLUID CONTROL VALVE CHECK</b>		
	<ul style="list-style-type: none"> <li>Inspect fluid control valve for contamination. (Refer to fluid control valve removal procedure in this section.)</li> </ul>	<p align="center">OK ►</p> <p align="center">✗ OK ►</p>	<p>GO to F2.</p> <p>REPLACE valve if necessary. REPEAT Test F0.</p>
<b>F2</b>	<b>ROUGH ROAD TEST</b>		
	<ul style="list-style-type: none"> <li>Road test vehicle under rough road conditions. Apply brakes slowly.</li> </ul>	<p align="center">OK ►</p> <p align="center">✗ OK ►</p>	<p>Vehicle OK.</p> <p>GO to F3.</p>
<b>F3</b>	<b>WHEEL BEARING CHECK</b>		
	<ul style="list-style-type: none"> <li>Check for loose wheel bearings.</li> </ul>	<p align="center">OK ►</p> <p align="center">✗ OK ►</p>	<p>CHECK rotor for thickness variances. (REFER to Section 12-20 for front disc overhaul procedures.)</p> <p>REPLACE wheel bearing if damaged. TIGHTEN wheel bearing assembly to specification. REPEAT Test F0.</p>

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## DIAGNOSIS AND TESTING (Continued)

**MASTER CYLINDER DIAGNOSIS — Continued**  
**BRAKE WARNING LAMP ON**

TEST STEP		RESULT	ACTION TO TAKE
<b>G0</b>	<b>BRAKE FLUID LEVEL</b>		
	<ul style="list-style-type: none"> <li>Check master cylinder brake fluid reservoir level.</li> </ul>	(OK) → GO to G2. (X) → GO to G1.	
<b>G1</b>	<b>BRAKE SYSTEM LEAKAGE</b>		
	<ul style="list-style-type: none"> <li>Check reservoir sealing points and external brake system for leakage. (Refer to Diagnostic Techniques No. 1 and 3.)</li> </ul>	(OK) → FILL reservoir. GO to G2. (X) → SERVICE as necessary, ADD fluid and BLEED system.	
<b>G2</b>	<b>IGNITION WIRING CHECK</b>		
	<ul style="list-style-type: none"> <li>Check that ignition wiring is not within a 50.8 mm (2-inches) radius of the reed switch (FLI) assembly.</li> </ul>	(OK) → GO to G3. (X) → REROUTE wiring as necessary.	
<b>G3</b>	<b>FLOAT ASSEMBLY CHECK</b>		
	<ul style="list-style-type: none"> <li>Check if float is stuck or if magnet is dislodged from float.</li> </ul>	(OK) → CHECK if ignition prove out circuit is working properly. (X) → REPLACE reservoir assembly.	

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**MASTER CYLINDER DIAGNOSIS — Continued**  
**RIGHT FRONT BRAKE DRAGS**

TEST STEP		RESULT	ACTION TO TAKE
<b>H0</b>	<b>VERIFY CONDITION</b>		
	<ul style="list-style-type: none"> <li>Road test vehicle and apply brakes.</li> </ul>	(OK) → Vehicle OK. (X) → INSPECT fluid control valve for contamination. (REFER to Fluid Control Valve Assembly procedure in this section.) REPEAT H0.	

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## DIAGNOSIS AND TESTING (Continued)

**VACUUM BRAKE BOOSTER DIAGNOSIS  
EXCESSIVE BRAKE PEDAL EFFORT OR VACUUM LEAKS**

TEST STEP		RESULT	ACTION TO TAKE
<b>J0</b>	<b>VERIFY CONDITION</b>		
	<ul style="list-style-type: none"> <li>With engine OFF, depress and release brake pedal five times to deplete all vacuum from booster. Depress pedal, hold with light pressure. Start engine.</li> </ul>	Pedal falls slightly, then holds (OK)  GO to J1.  (X)  GO to J3.	
<b>J1</b>	<b>VACUUM BOOSTER LEAK TEST</b>		
	<ul style="list-style-type: none"> <li>Run engine to medium speed, release accelerator and turn engine OFF. Wait 90 seconds and apply brakes. Two or more applications should be power assisted.</li> </ul>	(OK)  Vehicle OK.  (X)  GO to J2.	
<b>J2</b>	<b>POWER SECTION CHECK VALVE TEST</b>		
	<ul style="list-style-type: none"> <li>Disconnect vacuum hose for booster check valve at manifold. Blow into hose attached to check valve.</li> </ul>	Air passes through check valve (X)  INSTALL new check valve and REPEAT Test Step J1.  (OK)  REPLACE booster. REPEAT Test Step J0.	
<b>J3</b>	<b>POWER SECTION TEST</b>		
	<ul style="list-style-type: none"> <li>Disconnect vacuum hose from vacuum booster check valve. Run engine at idle. Check vacuum supply with a vacuum gauge.</li> </ul>	Above 405 kPa (12 inches Hg) and booster does not operate  REPLACE booster. REPEAT Test Step J0.  Below 405 kPa (12 inches Hg)  REPLACE or SERVICE vacuum hose and vacuum fittings. Also TUNE or SERVICE engine as required. REPEAT Test Step J0.	

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## DIAGNOSIS AND TESTING (Continued)

**VACUUM BRAKE BOOSTER DIAGNOSIS — Continued**  
**SLOW OR INCOMPLETE BRAKE PEDAL RETURN**

TEST STEP		RESULT	ACTION TO TAKE
<b>K0</b>	<b>VERIFY CONDITION</b>		
<ul style="list-style-type: none"> <li>Run engine at fast idle. Pull brake pedal rearward with approximately 10 pounds force. Release the pedal and measure the distance to the toe board. Make a heavy brake application. Release the brake pedal and measure the pedal to toe distance. The pedal should return to its original position.</li> </ul>		ⓄK ➤	Vehicle OK.
		ⓄK ➤	GO to K1.
<b>K1</b>	<b>BRAKE PEDAL BINDING</b>		
<ul style="list-style-type: none"> <li>Check pedal to be sure it is operating freely.</li> </ul>		ⓄK ➤	REPLACE booster, REPEAT Test K0.
		ⓄK ➤	CORRECT any sticking or binding. REPEAT Test K0.

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**VACUUM BRAKE BOOSTER DIAGNOSIS — Continued**  
**VACUUM BRAKE BOOSTER NOISE**

TEST STEP		RESULT	ACTION TO TAKE
<b>L0</b>	<b>VERIFY CONDITION</b>		
<ul style="list-style-type: none"> <li>Run engine at fast idle for 10 seconds or longer. Depress brake pedal and listen for noise. Compare results with known good system.</li> </ul>		ⓄK ➤	Bleed brakes.
		Noise ➤	CHECK and ADJUST booster push rod as described in this section.

CH4840-A

## ADJUSTMENTS

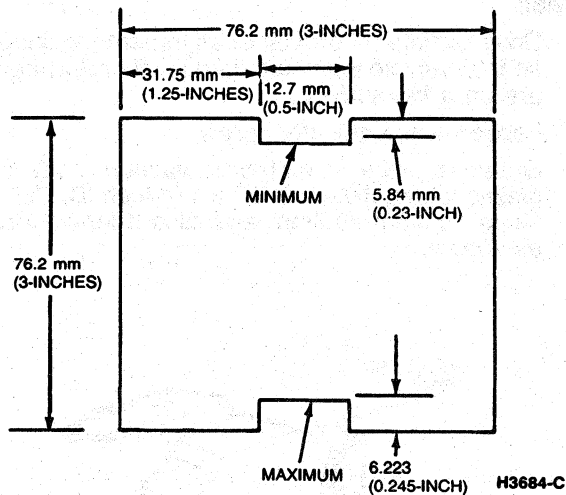
### Brake Vacuum Booster Push Rod-To-Master Cylinder

The vacuum booster has an adjustable push rod (output rod).

A booster that is suspected of having an improper push rod length will indicate either of the following:

1. A push rod which is too long will prevent master cylinder piston from completely releasing hydraulic pressure and cause brakes to drag.
2. A push rod which is too short will increase brake pedal travel and cause a groaning noise from booster.

If necessary, a booster push rod length can be checked with a push rod gauge using the following procedure:



1. Without disconnecting brake tubes, disconnect master cylinder and set it away from booster power unit. Master cylinder must be supported to prevent damaging brake tubes.
2. With engine running, check and adjust push rod length, as shown in the following illustration. A force of approximately 22N (5 lbs) applied to the push rod with the gauge will ensure that push rod is seated with power unit.

BOOSTER CHECK VALVE

ADJUST PUSH ROD SCREW TO PROVIDE A SLIGHT PRESSURE APPROXIMATELY 22N (5 LBS) AGAINST THE GAUGE

POWER UNIT

H3693-C

3. Install master cylinder on power unit. Gradually alternate tightening of the retaining nuts to 18-33 N·m (13-25 lb-ft).
4. With engine idling and master cylinder reservoir removed, observe fluid surface in reservoirs when brake pedal is applied rapidly. Some fluid movement should occur in forward reservoir. If fluid surface movement did not occur, push rod is adjusted too long and procedure must be repeated to prevent eventual brake drag.

### Hydraulic System Bleeding

When any part of the hydraulic system has been disconnected for service, air may enter system and cause spongy pedal action. Bleed the hydraulic system after it has been opened to ensure that all air is expelled.

1. Clean all dirt from master cylinder filler cap.
2. If master cylinder is known or suspected to have air in bore, it must be bled before any of the wheel cylinders or calipers. To bleed master cylinder, loosen upper secondary LH front outlet fitting approximately three-quarter turn.
3. Have assistant push brake pedal down slowly through full travel. Close outlet fitting, then return pedal slowly to full-released position. **Wait five seconds**, then repeat operation until air bubbles cease to appear.
4. Loosen upper primary right front outlet fitting approximately three-quarter turn.
5. Repeat Step 3.

## ADJUSTMENTS (Continued)

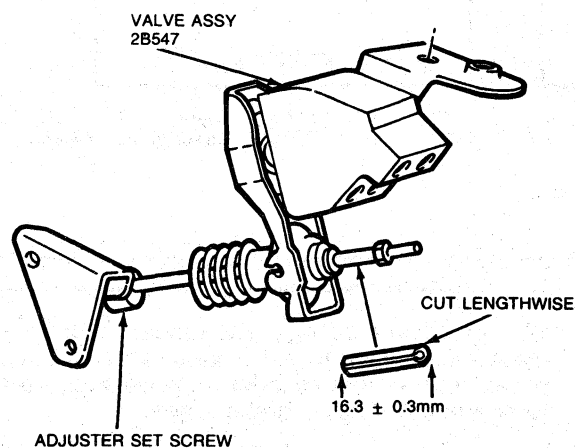
6. To continue to bleed brake system, remove rubber dust cap from wheel cylinder bleeder fitting or caliper fitting. Check to ensure bleeder fitting is positioned at upper half of front caliper. If not, caliper is located on wrong side. Place suitable box wrench on bleeder fitting and attach rubber drain tube to fitting. **The end of tube should fit snugly around bleeder fitting.**
7. Submerge free end of tube in container partially filled with clean brake fluid and loosen bleeder fitting approximately three-quarter turn.
8. Have assistant push brake pedal down slowly through full travel. Close bleeder fitting, then return pedal to full release position. **Wait five seconds**, then repeat this operation until air bubbles cease to appear at submerged end of bleeder tube.
9. When fluid is completely free of air bubbles, secure bleeder fitting and remove bleeder tube. Install rubber dust cap on bleeder fitting.
10. Repeat this process on opposite diagonal system. Refill master cylinder reservoir after each wheel cylinder or caliper is bled, and install master cylinder cover and gasket. When bleeding operation is completed, fluid level should be filled to maximum fill level indicated on reservoir.
11. Always ensure disc brake pistons are returned to their normal positions by depressing brake pedal several times until normal pedal travel is established.
12. Check pedal feel. If pedal feels "spongy" repeat bleed procedure.

5. Submerge free end of tube in container partially filled with clean brake fluid, and loosen bleeder fitting.
6. When air bubbles cease to appear in fluid at submerged end of bleeder tube, close bleeder fitting and remove tube. Replace rubber dust cap on bleeder screw.
7. Repeat Steps 4 through 7 at LH front wheel caliper.
8. Next, repeat Steps 4 through 7, starting at LH wheel cylinder and ending at RH front wheel caliper.
9. When bleeding operation is completed, close bleeder tank valve and remove tank hose from adapter fitting.

## Brake Pressure Control Valve

## Sedan

1. Drive vehicle on a hoist or alignment machine, so that vehicle is at curb load level and wheels are on a flat surface.
2. Loosen valve adjuster screw.
3. Obtain a piece of rubber or vacuum hose or plastic tubing 3/8-inch OD x 1/4-inch ID. Cut a piece 16.3mm  $\pm$  0.3mm and slice it lengthwise as shown.



## Pressure Bleeding

For pressure bleeding, use a bleeder-type tank only, such as Rotunda Brake Bleeder 104-00064 or equivalent.

Bleed longest line first on the system being bled. The bleeder tank should contain enough new brake fluid to complete bleeding operation. Use Heavy Duty Brake Fluid C6AZ-19542-A or DOT 3 equivalent for all brake applications. Never reuse brake fluid that has been drained from the hydraulic system. Pressure bleeder tank should be charged with approximately 69-207N (10-30 psi) of air pressure. **Never exceed 345N (50 psi) pressure.**

1. Clean all dirt from master cylinder reservoir cover.
2. Remove master cylinder filler cap and rubber gasket, and fill master cylinder reservoir with specified brake fluid. Install pressure bleeder adapter tool to master cylinder, and attach bleeder tank hose to fitting on adapter. Follow manufacturer's instructions when installing adapter.
3. If all wheel cylinders are to be bled, start with RH rear brake wheel cylinder and attach bleeder tube **snugly around bleeder fitting.**
4. Open valve on bleeder tank to admit pressurized brake fluid to master cylinder reservoir.

4. Place this length of hose or tubing on valve operating rod. Refer to illustration under Step 3.
5. Ensure the adjuster is resting on the lower mounting bracket. Tighten setscrew to specification. The dimension will position the valve for normal operation. Remove hose or tub.

NOTE: Do not change position of the upper nut on valve operating rod.



**ADJUSTMENTS (Continued)**

If further adjustment is necessary refer to the following procedures:

**Decrease Pressure at Rear Brakes**

1. Ensure suspension is at curb height.
2. Loosen setscrew.
3. Move piston up operating rod 1mm for each 413 kPa (60 psi) pressure decrease.
4. Tighten setscrew in desired position.

**Increase Pressure at Rear Brakes**

1. Ensure suspension is at curb height position.
2. Loosen setscrew.
3. Move piston down operating rod 1mm for each 413 kPa (60 psi) pressure increase.
4. Tighten setscrew in desired position.

**REMOVAL AND INSTALLATION****Master Cylinder****Removal**

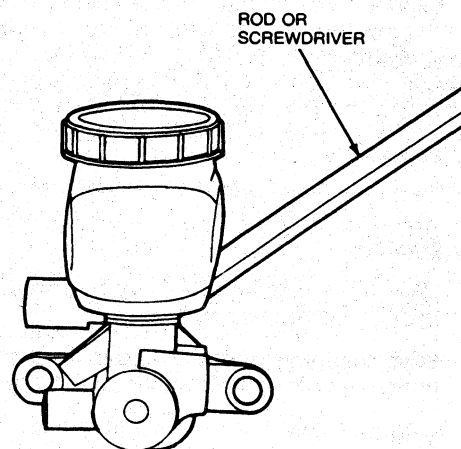
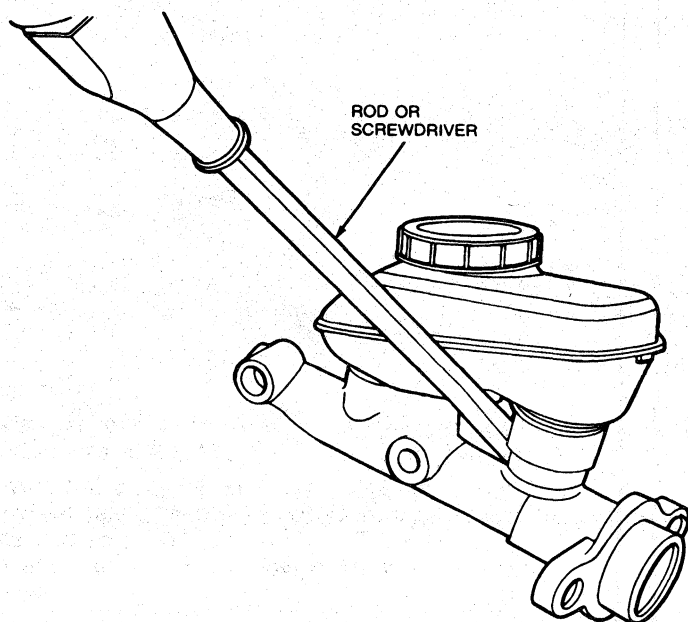
1. Remove brake tubes from primary and secondary outlet ports of master cylinder and pressure control valves.
2. Disconnect brake warning lamp connector.
3. Remove two nuts attaching master cylinder to brake booster assembly.
4. Slide master cylinder forward and upward from vehicle.

**Installation**

1. Position master cylinder over booster push rod and onto two studs on booster assembly.
2. Install brake tubes to master cylinder and pressure control valve outlet ports.
3. Install nuts and tighten to specification.
4. Connect brake warning lamp connector.
5. Fill master cylinder with Heavy Duty Brake Fluid C6AZ-19542-A or DOT 3 equivalent to MAX line on side of reservoir.
6. Bleed brake system, as outlined.
7. Operate brakes several times, then check for external hydraulic leaks.

**Fluid Control Valve Assembly****Removal**

1. Remove brake fluid from reservoir.
2. Remove reservoir primary port (only) with a rod or long screwdriver.



H4006-A

**REMOVAL AND INSTALLATION (Continued)**

3. Rotate reservoir out of way and remove sealing grommet from casting.
4. With a 12mm socket, remove fluid control valve. Inspect for contamination under seal or in center orifice.

**NOTE:** The fluid control valve assembly is serviced as an assembly only. Do not attempt to service this unit.

**CAUTION:** Do not operate brake until reservoir is installed and filled, or primary brake system will have to be bled.

**Installation**

1. Install a new fluid control valve. Tighten to 11-13 N·m (97-115 lb-in).
2. Lubricate new grommet with brake fluid and install it in primary port.
3. Install reservoir in new grommet.
4. Refill reservoir.

**Brake Master Cylinder Reservoir****Removal**

**NOTE:** Whenever the small (secondary) reservoir port is removed from the master cylinder, the reservoir assembly must be replaced and new grommets must be installed.

1. Disconnect fluid level indicator switch.
2. Remove cap from reservoir.
3. Using needlenose pliers, remove float from reservoir.
4. Remove brake fluid from reservoir.
5. Remove primary reservoir port from master cylinder by prying upward with rod or long screwdriver, as shown in the previous illustration.
6. Remove secondary reservoir port in same manner and discard complete reservoir assembly.
7. Remove grommets from master cylinder.

**Installation**

1. Wet new grommet in clean brake fluid and press into master cylinder.
2. Wet reservoir ports in clean brake fluid and press new reservoir assembly into grommets.
3. Connect fluid level indicator switch.

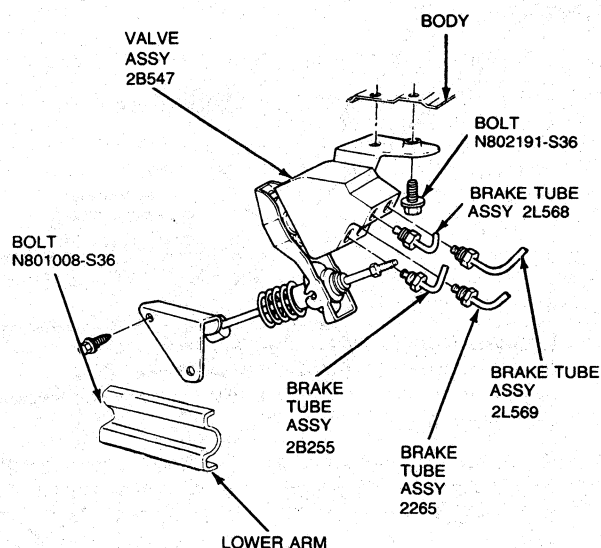
**Brake Pressure Control Valve****Sedan****Removal**

1. Raise vehicle on hoist.
2. Disconnect four brake tubes from valve assembly and note position.
3. Remove screw retaining valve bracket to lower suspension arm.
4. Remove two screws retaining valve bracket to underbody and remove assembly.

**NOTE:** The service replacement valve will have a red plastic gauge clip on the valve and must not be removed until installed on the vehicle.

**Installation**

1. Ensure rear suspension is in full rebound.
2. Ensure the red plastic gauge clip is in position on the valve and the operating rod lower adjustment screw is loose.
3. Position valve assembly to underbody and install two retaining screws.
4. Position valve lower mounting bracket to lower suspension arm. Install one retaining screw. Ensure the valve adjuster is resting on lower bracket and tighten setscrew to specification.
5. Connect four brake tubes in the same position as removed.
6. Bleed rear brakes.
7. Remove red plastic gauge clip and lower vehicle.



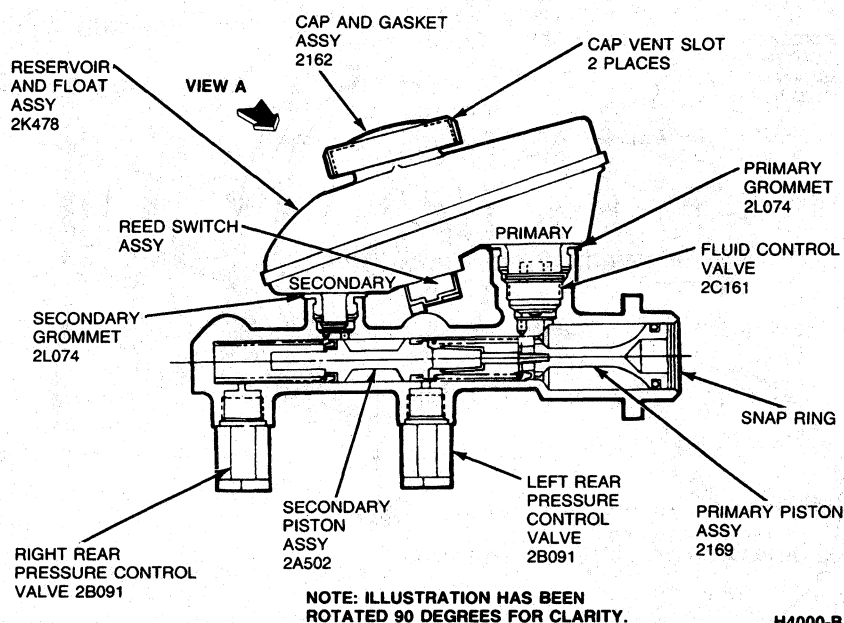
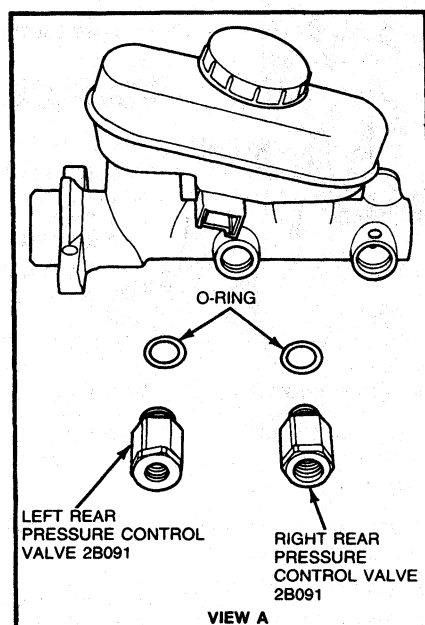
H4007-B

## REMOVAL AND INSTALLATION (Continued)

## Station Wagon

## Removal

1. Disconnect primary or secondary brake tube as necessary.
2. Loosen and remove pressure control valve from the master cylinder housing.



H4000-B

## Installation

1. Install pressure control valve in master cylinder housing port and tighten to specification.
2. Install the brake tube and tighten to specification.
3. Fill and bleed brake system as outlined.

## Brake Pedal

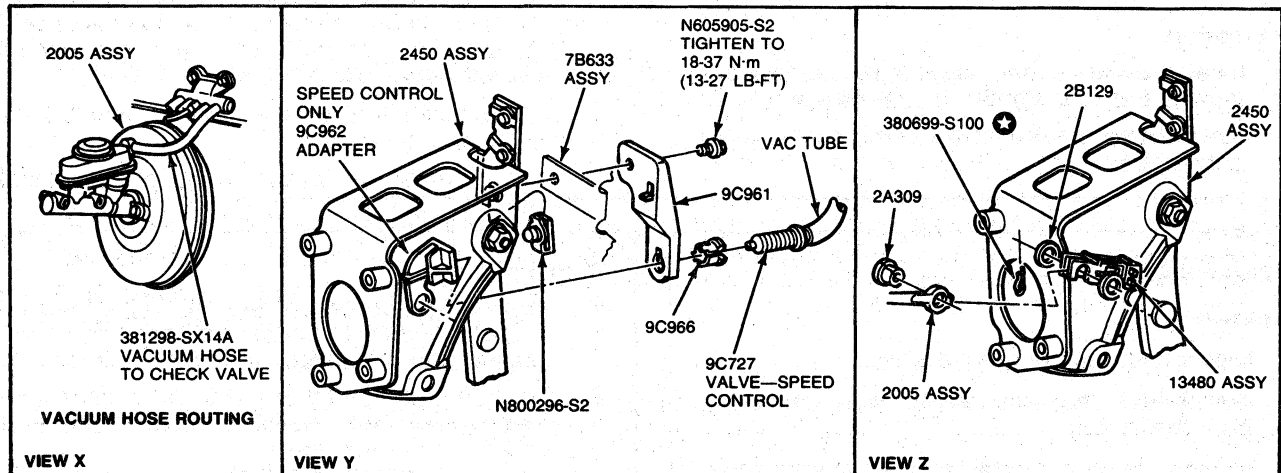
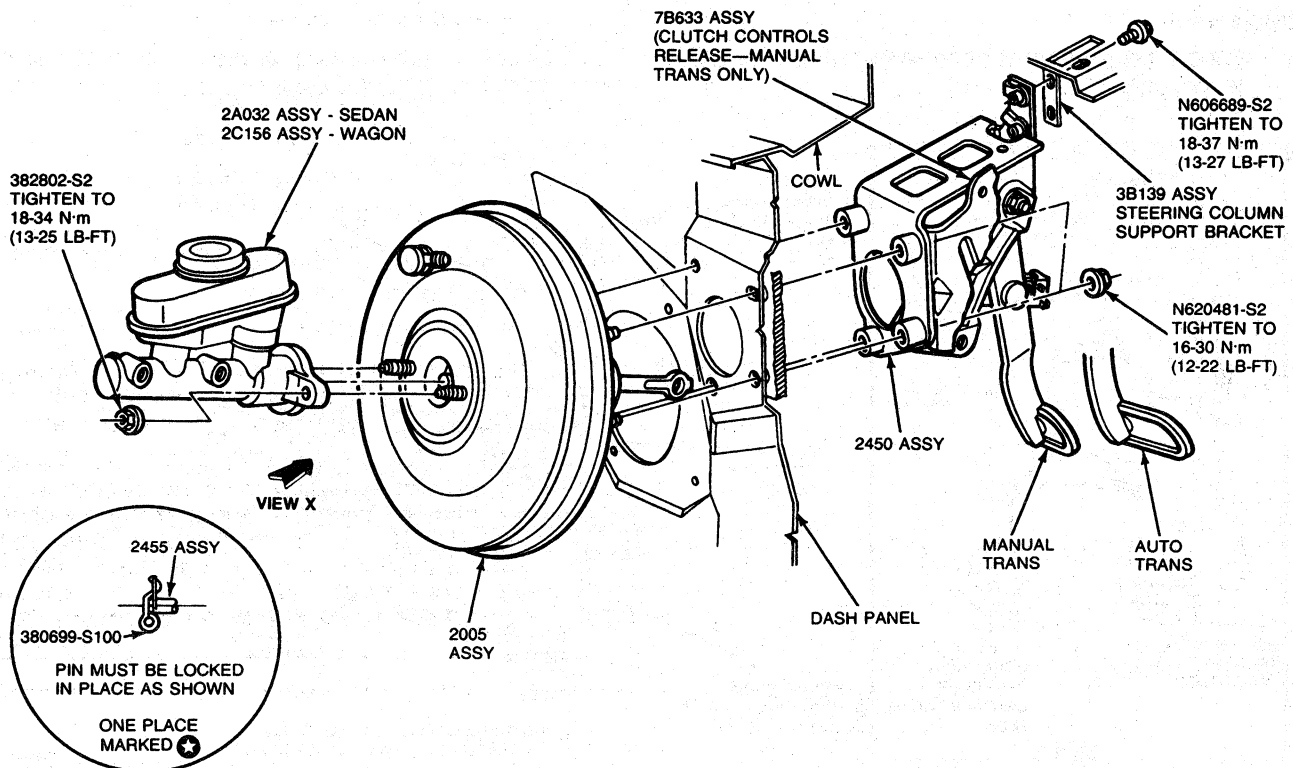
## Removal

1. Disconnect battery ground cable.
2. Disconnect stoplamp switch wire connector from the switch.
3. Remove push rod retainer and nylon washer. Slide stoplamp switch outboard along brake pedal pin just far enough for outer hole of switch frame to clear pin. Remove switch by sliding it upward. Remove black stoplamp switch bushing from push rod.
4. Loosen four power brake booster nuts at the pedal support and slide the push rod and inner nylon washer, on vehicle without speed control, off pedal pin.
5. Remove locknut and then remove pivot bolt, brake pedal, pivot spacer and bushings from the pedal support. Remove speed control adapter, if so equipped, by unlatching the locking tab.

## Installation

1. Apply a light coating of SAE 10W40 engine oil to clean bushings. Locate bushings and pivot spacer in brake pedal hub.
2. Position brake pedal in the pedal support and install pivot bolt. Install locknut. Tighten to 14-27 N·m (10-20 lb-ft).
3. Install the inner nylon washer or speed control adapter, if so equipped, the master cylinder push rod, and the black stoplamp switch bushing on the brake pedal pin. Do not oil stoplamp switch. Position the stoplamp switch so that it straddles the push rod with the slot on the pedal pin and the switch outer frame hole just clearing the pin. Slide the switch down onto the pin and push rod. Slide assembly inboard toward brake pedal arm. Install outer nylon washer and push rod retainer. Lock retainer securely.
4. Tighten master cylinder attaching nuts or booster attaching nuts to 16-30 N·m (12-22 lb-ft).
5. Connect stoplamp switch wire to the switch.
6. Connect battery ground cable.

## REMOVAL AND INSTALLATION (Continued)

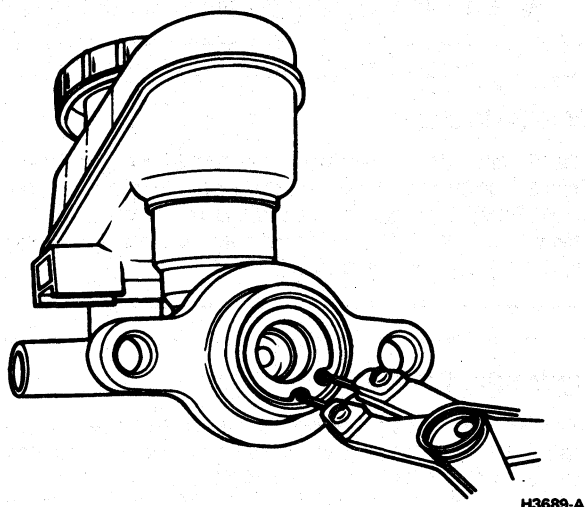


H3981-B

## OVERHAUL

**Master Cylinder****Disassembly**

1. Clean the outside of the master cylinder thoroughly. Remove cap. Drain all brake fluid from cylinder. Always discard used brake fluid.
2. Depress primary piston and remove snap ring from retaining groove at the open end of the bore.



NOTE: If master cylinder is to be put into vise to aid in disassembly, mount into vise by flange only to avoid damage to bore or reservoir areas.

3. Remove primary and secondary piston assemblies from master cylinder. Tap open end of cylinder on bench to remove pistons. If secondary piston does not readily come out, apply air pressure to secondary outlet port to assist removal.
4. Remove the reservoir and fluid control valve as outlined.

The components which must be replaced are:

- Fluid control valve.
  - Front brake caliper seals.
  - Rubber front brake hoses.
  - Rear wheel cylinder seals.
  - Rubber rear brake hoses.
  - Pressure control valves.
  - Primary and secondary piston assemblies.
  - Reservoir grommets.
  - Cap assemblies.
3. Inspect master cylinder bore for pitting, corrosion or heavy wear. Heavy wear is characterized by scoring or galling of metal.

NOTE: The aluminum body of the master cylinder is anodized. Some signs of bore wear, as evidenced by lighter areas of the anodized surface, are normal and not detrimental. **Honing of the bore on aluminum master cylinders is not permitted as the anodic coating and hardness could be removed.**

**Assembly**

1. Dip replacement piston assemblies in clean Heavy Duty Brake Fluid C6AZ-19542-A or DOT 3 equivalent for lubrication prior to assembly into cylinder.
2. Install secondary (smaller) piston assembly into bore, spring end first.
3. Install primary piston assembly, spring end first.
4. Depress primary piston and install snap ring.
5. Install the fluid control valve as outlined.
6. Fill and bleed master cylinder. Refer to Hydraulic System Bleeding procedure.
7. Install cap on master cylinder reservoir and secure.

**Inspection**

1. Wash master cylinder body, especially bore, along with primary and secondary piston assemblies in clean brake fluid, or denatured or isopropyl alcohol.
2. Inspect seals on primary and secondary piston assemblies for cuts, nicks, scratches or signs of wear and for presence of any blistering or swelling.

NOTE: Blistering or swelling indicates contamination of brake fluid by a petroleum-based solvent or oil. In that case, all rubber components in the brake hydraulic system must be inspected and replaced and the entire system must be flushed with clean brake fluid to prevent recontamination.

**CLEANING AND INSPECTION****Service Precautions**

1. Grease or any other foreign material must be kept off lining surfaces and braking surfaces of rotor, and external surfaces of hub during service operation. In handling the rotor and caliper assemblies, avoid deformation of brake rotor and nicking or scratching of brake linings.
2. If a caliper piston is removed for any reason, piston seal must be replaced. Exercise care not to damage plastic piston by protecting it from contact with any metal or sharp objects.

NOTE: Do not pry on plastic piston with a screwdriver or other tools, as this will cause chipping.

**CLEANING AND INSPECTION (Continued)**

3. During removal and installation of a wheel assembly, exercise care not to interfere with and damage rotor splash shield or caliper bleeder screw fitting.
4. Ensure vehicle is centered on the hoist before servicing any front end components to avoid bending or damaging rotor splash shield on full right or left wheel turns.
5. Do not attempt to clean or restore oil or grease-soaked brake linings. When contaminated linings are found, brake linings must be replaced in complete axle sets and the rotor braking surfaces wiped clean.
6. Calipers must be installed with bleed screws in upward position for proper bleeding of air from brake system.

4. Check condition of brake shoes, retracting spring, hold-down springs, and drum for signs of overheating. If shoes have a slight blue coloring, indicating overheating, retracting and hold-down springs should be replaced. **Overheated springs lose their pull and could cause new lining to wear prematurely, if not replaced. If brake drums are heat spotted, indicating an overheated condition, they should be replaced.**
5. Refer to Section 11-15 for hub and drum installation and bearing adjustment procedure.

**Disc Brakes**

1. Remove wheel and tire from hub and rotor.
2. Inspect brake shoes and lining for wear. If the lining is worn to within 3mm (1/8-inch) of the shoe, replace all four shoe and lining assemblies (complete axle set) on front or rear wheels as required.
3. Visually check caliper. If caliper housing is leaking, it should be replaced. If a seal is leaking, caliper must be disassembled and new seals installed. If a piston is seized in bore, a new caliper housing is required. Care should be taken not to dent, scratch or chip the plastic piston.

Refer to Section 12-20 for disc brake rotor service procedure.

**Brake Booster**

Check booster operation as noted under Power Brake Functional Test. If brake booster is damaged or inoperative, replace it with a new booster. The brake booster is serviced only as an assembly, including the check valve.

**Hydraulic Lines**

Double wall steel tubing is used throughout the brake system with the exception of the flexible hoses at the front and rear wheels.

**Brake Tubing**

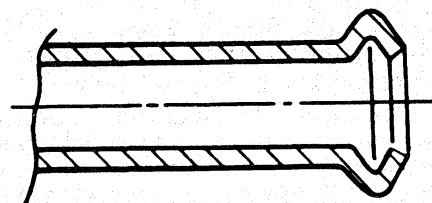
Copper tubing should not be used in a hydraulic system.

If a brake tube replacement is required from the brake master cylinder to the LH or RH front brake hose, the following procedure must be used:

1. Obtain the recommended bulk 3/16-inch steel tubing and the correct standard 3/8-24 3/16-inch tube nut.

NOTE: The M10-M12 metric nut(s) will be reused.

2. Cut tubing to the length required. Clean burrs after cutting. The correct length may be obtained by measuring the removed tube using a string and adding 1.2mm (1/8-inch) for each flare.
3. ISO flare one end of tube using Brake Line Flaring Tool D81L-2269-A or equivalent.



ISO FLARE

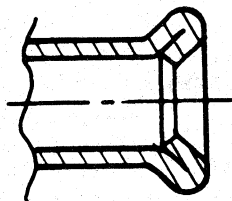
H3989-A

**Drum Brakes**

1. Remove wheel and tire assembly from spindle.
2. Remove drum assembly from spindle. Use an industrial vacuum cleaner to remove all dust from backing plates and interior of the brake drums.
3. Inspect brake shoes for excessive lining wear or shoe damage. If lining is damaged or worn within 0.794mm (1/32-inch) of the rivet heads on riveted linings or within 1.524mm (0.060-inch) of the shoe on bonded linings, they must be replaced. Replace any lining that has been contaminated with oil, grease or brake fluid. Replace lining in axle sets. Prior to replacement of lining, drum diameter should be checked to determine that brake drum braking surface diameter is within specification. If braking surface diameter exceeds specification, drum must be replaced.

## CLEANING AND INSPECTION (Continued)

4. Place the removed metric tube nut on the tube.
5. On the opposite end of the replacement tube, install a standard 3/8-24 3/16-inch tube nut and double flare the tube end.



DOUBLE FLARE

H3990-A

**NOTE:** Follow flaring instructions included in Tool Kit D81L-2269-A or equivalent.

6. Bend the replacement brake tube to match the removed tube using a tubing bender. When the replacement brake tube is installed, maintain adequate clearance to all moving or vibrating parts.

**Always bleed applicable primary or secondary brake system after hose or line replacement.**

All brake tubing should be flared properly to provide good leakproof connections. Clean brake tubing by flushing with clean brake fluid before installation.

When connecting a tube to a hose, tube connector, or brake cylinder, tighten the tube fitting nut to specification with Lb-In Torque Wrench D81L-600-A or equivalent.

**Brake Hose**

A flexible brake hose should be replaced if it shows signs of softening, cracking or other damage.

When installing a new front brake hose, two new sealing washers should be used. Positioning of the front hose is controlled by a self-indexing brass block. When attaching block to caliper, tighten bolt to 41-54 N·m (30-40 lb-ft). Attach intermediate bracket to shock strut and tighten screw. Engage the opposite end of hose to bracket on the body. Install the horseshoe-type retaining clip and connect tube to hose with tube nut. Inspect position of installed hose for clearance to other chassis components.

Positioning of rear brake hose is controlled by self-indexing end fittings.

Engage either end of hose to the bracket on the body. Install the horseshoe-type retaining clip and connect tube to hose with the tube fitting nut. Engage opposite end of hose to bracket on rear spindle. Install the horseshoe-type retaining clip and connect tube to hose with tube fitting nut.

Inspect position of installed hose for contact with other chassis parts.

## SPECIFICATIONS

## TORQUE SPECIFICATIONS

Description	N·m	Lb-Ft
Master Cylinder Mounting Nuts	18-33	13-25
Booster to Dash Panel	16-30	12-22
Wheel Cylinder Bleeder Screw	10-20	7.5-15
Caliper Bleeder Screw	8-20	6-15
Brake Hose Connection to Caliper	40-54	30-40
Brake Line to Rear Hose Attaching Brackets	10-18	7-13
Hydraulic Tube Connections — All*	14-24	10-18
Pressure Control Valves to Master Cylinder	13-24	10-18
Fluid Control Valve	11-13	8-9.6
Brake Pedal Pivot Shaft Nut	14-27	10-20

\*All hydraulic lines must be tightened to the specific torque value and be free of fluid leakage.

CH4009-A

## BRAKE BOOSTER APPLICATIONS

Vehicle	Booster Type and Size
Taurus/Sable	Vacuum — 270mm Diameter Single Diaphragm

CH4010-A

## SPECIAL SERVICE TOOLS

Tool Number	Description
D81L-600-A	Lb-In Torque Wrench
T71P-1102-A	Disc Rotor Surface Gauge
D81L-1103-A	Brake Adjusting Gauge
T81P-1125-A	Rotor Thickness Gauge
D81L-2269-A	ISO Flare Tool Kit
Rotunda 010-00010	Drum Brake Micrometer
Rotunda 104-00064	Brake Bleeder (With 10-0372)
Rotunda 010-00372	Fill Head Adapter
Rotunda 021-00001	Brake Pedal Effort Gauge
Rotunda 021-00014	Vacuum Tester
Rotunda 054-00021	Disc Brake Lathe
Rotunda 065-00016	Brake Parts Washer

CH3722-C

## SECTION 12-02 Brakes, Drum—Single Cylinder, Dual Piston—Rear

SUBJECT	PAGE	SUBJECT	PAGE
<b>ADJUSTMENTS</b>		<b>REMOVAL AND INSTALLATION</b>	
Brake Drum Removal Adjustment .....	12-02-3	Brake Backing Plate .....	12-02-7
Brake Shoes .....	12-02-3	Brake Shoes .....	12-02-4
<b>CLEANING AND INSPECTION</b> .....	12-02-7	Wheel, Tire, Hub and Drum .....	12-02-3
<b>DESCRIPTION</b>		Wheel Cylinder .....	12-02-7
Brake System, Drum .....	12-02-1	<b>SPECIAL SERVICE TOOLS</b> .....	12-02-9
<b>OVERHAUL</b>		<b>SPECIFICATIONS</b> .....	12-02-9
Brake Drum Refinishing .....	12-02-8	<b>VEHICLE APPLICATION</b> .....	12-02-1
Brake Shoe Relining .....	12-02-8		
Wheel Cylinders .....	12-02-7		

### VEHICLE APPLICATION

Taurus/Sable.

### DESCRIPTION

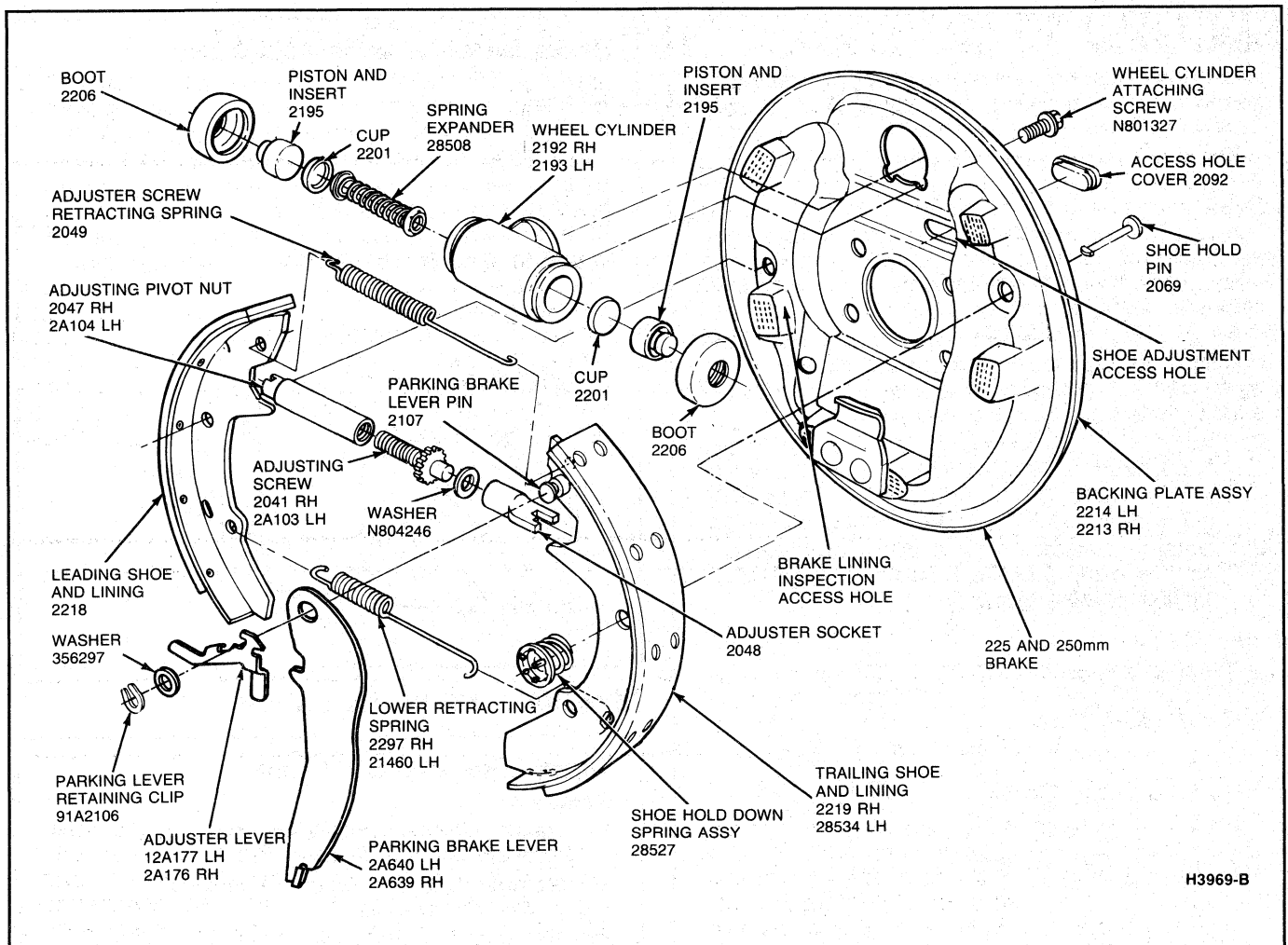
#### Brake System, Drum

Rear drum brakes are non-servo, leading-trailing shoe design in place of the duo-servo design used on other U.S. built Ford products. The leading shoe does the majority of work, stopping forward motion. The trailing shoe works in the same way for rearward motion. Two different rear brake assemblies are used, each having different internal components. Taurus/Sable sedan models use a 225mm (8.85-inch) diameter brake assembly.

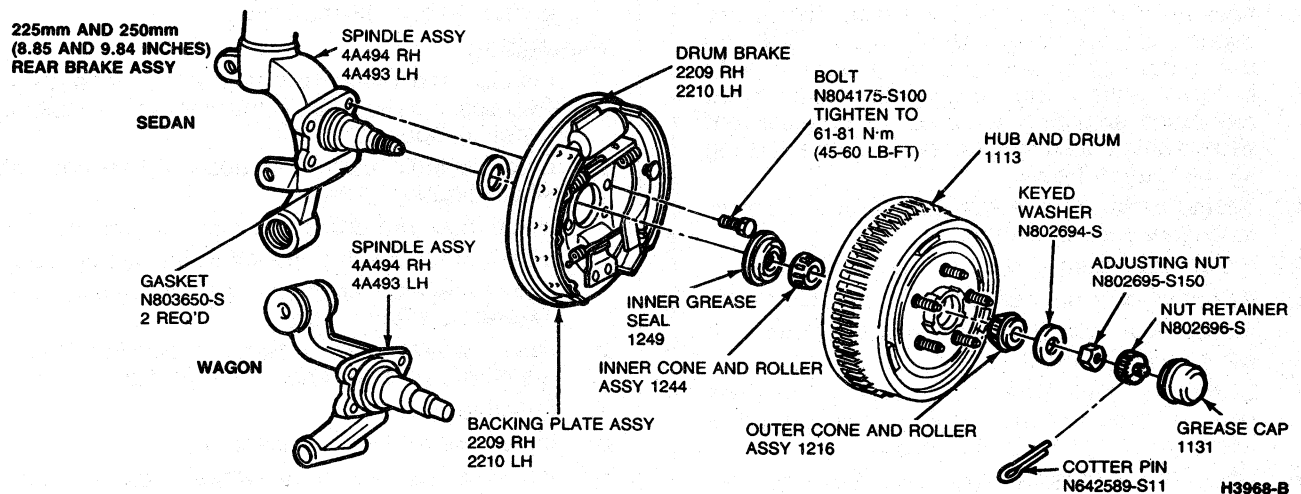
Taurus/Sable wagon models use a 250mm (9.84-inch) diameter brake assembly. The automatic adjustment of the 250mm and 225mm (9.84 and 8.85-inch) drum assemblies use an incremental adjuster that adjusts during braking whenever a wear gap appears sufficient to actuate the adjuster wheel. Brake adjustment occurs in forward and rearward braking.



## DESCRIPTION (Continued)



The rear brake drums incorporate a hub and drum assembly. The drums are attached to the rear axle spindle by a wheel bearing nut requiring adjustment. Wheel studs are located in the hub/drum for attaching the rear wheels. The wheel studs and nuts are metric (12mm).



## ADJUSTMENTS

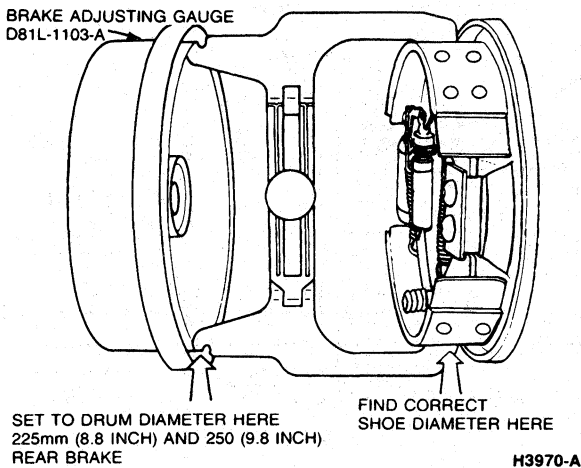
### Brake Shoes

**After any brake service work, obtain a firm brake pedal before moving the vehicle. Adjusted brakes must not drag; wheel must turn freely.**

The hydraulic rear drum brakes are self-adjusting and require a manual adjustment only after the brake shoes have been relined, replaced, or when the length of the adjusting screw has been changed while performing some other service operation. The manual adjustment is performed with the hub/drum removed. Refer to Section 11-15.

When adjusting the rear brake shoes, check the parking brake cables for proper adjustment. Make sure that the equalizer operates freely with the shoes centered on the backing plate.

1. Apply a small quantity of Disc Brake Caliper Slide Grease D7AZ-19590-A or equivalent to points where the shoes contact the backing plate, taking care not to get lubricant on linings.
2. Determine inside diameter of the drum braking surface using a Brake Adjusting Gauge D81L-1103-A or equivalent.

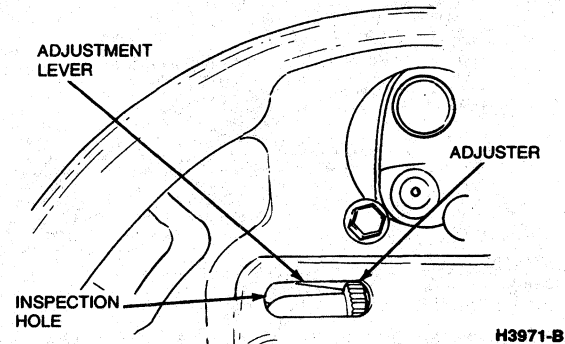


3. Adjust the brake shoe diameter to fit the gauge. Line the brake shoes up vertically so that the flats on the bottom of the brake shoes are aligned approximately 1.5mm (0.05-inch) above the bottom of the brake shoe abutment plate before setting the gauge diameter. Hold automatic adjusting lever out of engagement while rotating adjusting screw. Ensure adjusting screw rotates freely.
4. Rotate brake shoe gauge around brake shoes to ensure proper setting.
5. Install hub/drum and wheel assembly.
6. Adjust wheel bearings. Refer to Section 11-15.
7. Install the wheelcover/ornament and nut covers as required.
8. Complete adjustment by applying brakes several times. Brakes should be applied with a minimum of 111N (25 lbs) pressure.
9. After brake shoes have been properly adjusted, check operation of brakes by making several stops from varying forward speeds.

### Brake Drum Removal Adjustment

**NOTE:** If the hub/drum assembly will not come off for brake service, pry rubber plug from backing plate inspection hole and use the following procedure:

On 225mm and 250mm (8.85 and 9.84-inch) brakes, remove the brake line-to-axle retention bracket. This will allow sufficient room for insertion of a screwdriver and brake tools to disengage adjusting lever and back off the adjusting screw.



## REMOVAL AND INSTALLATION

### Wheel, Tire, Hub and Drum

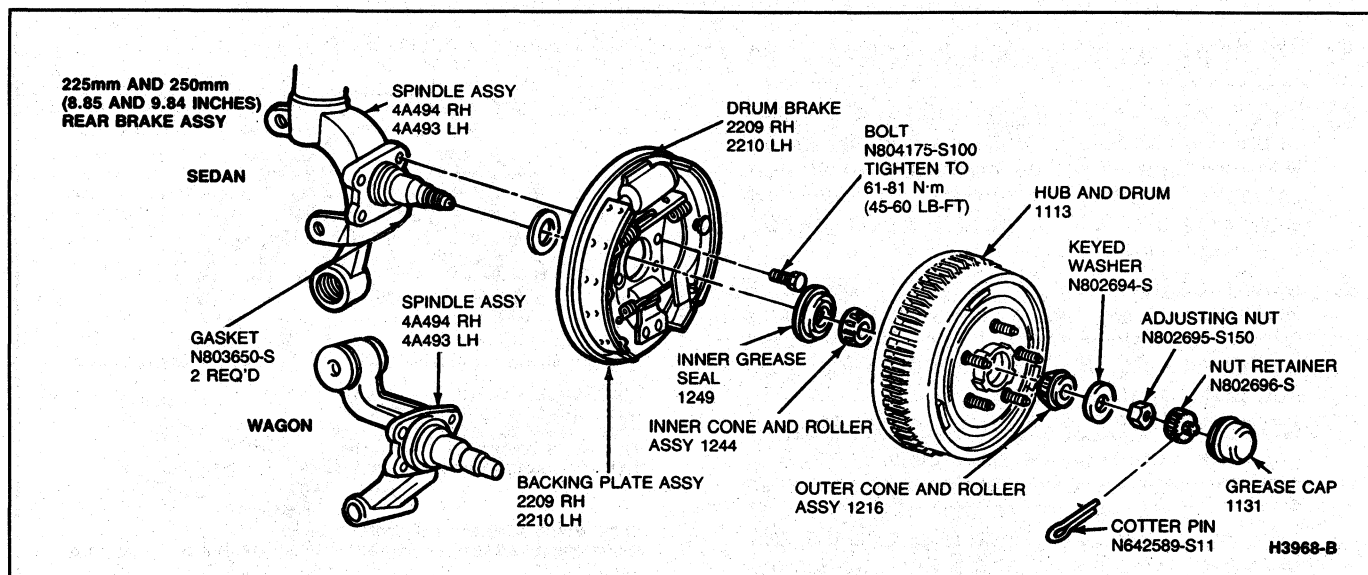
#### Removal

1. Raise vehicle on a hoist. Refer to the Pre-Delivery manual, Section 50-04.
2. Remove wheel ornament (wheelcover) and nut covers as required.
3. Remove tire and wheel assembly. Refer to Section 11-01.
4. Remove grease cap from hub. Remove cotter pin, nut lock, adjusting nut and keyed flatwasher from spindle. Remove outer bearing. Discard cotter pin.
5. Remove hub and drum assembly as a unit. Be careful not to damage grease seal and inner bearing during removal. Care must be taken not to drag seal across spindle threads during assembly and disassembly.

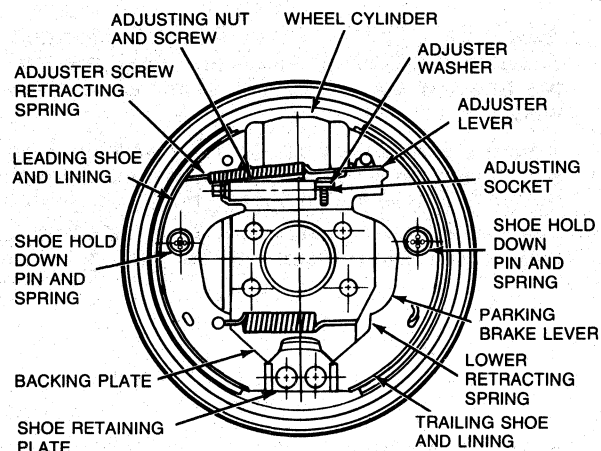
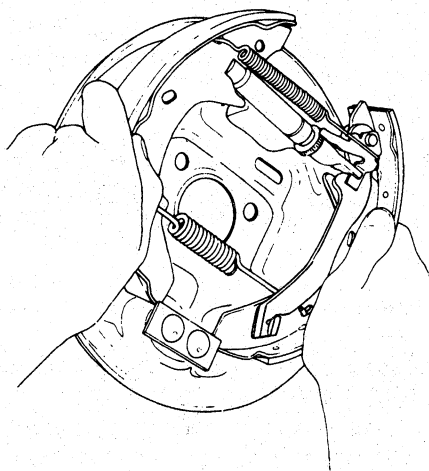
#### Installation

1. Inspect and lubricate bearings as necessary. Replace grease seal if any damage is visible. Refer to Section 11-15.
2. Clean spindle stem and apply a thin coat of wheel bearing grease.
3. Install hub and drum assembly on spindle.
4. Install outer bearing. Install in hub on spindle.
5. Install keyed flatwasher and adjusting nut. Tighten nut finger-tight.
6. Adjust wheel bearing. Refer to Section 11-15. Install nut retainer and new cotter pin.
7. Install grease cap.
8. Install tire and wheel assembly.
9. Install wheel ornament (wheelcover) and nut covers as required.
10. Lower vehicle.

## REMOVAL AND INSTALLATION (Continued)

**Brake Shoes****225mm and 250mm (8.85 and 9.84-inch)****Removal**

1. Raise vehicle on a hoist. Refer to Pre-Delivery manual, Section 50-04.
2. Remove wheel, tire, hub and drum assembly. Refer to Section 11-15.
3. Remove two shoe hold-down springs and pins.
4. Lift brake shoes, springs, and adjuster assembly off backing plate and wheel cylinder assembly. Be careful not to bend adjusting lever during assembly removal.



7. Remove horseshoe retaining clip and spring washer and slide lever off parking brake lever pin on trailing shoe.

**Installation**

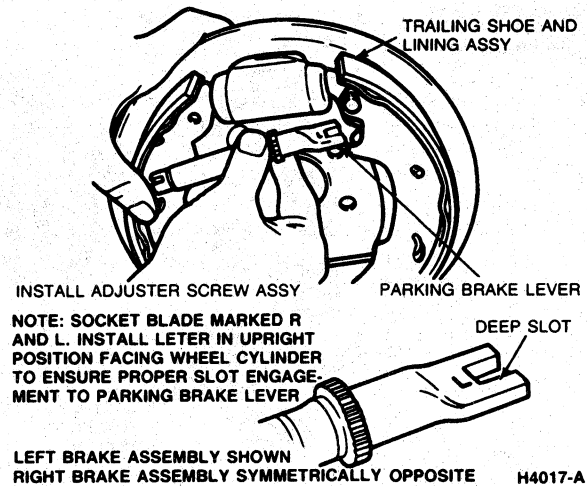
1. Apply a light coating of Disc Brake Caliper Slide Grease D7AZ-19590-A or equivalent at points where brake shoes contact backing plate.
2. Apply a thin uniform coat of Multi-Purpose Long-Life Lubricant C1AZ-19590-B or equivalent lubricant to adjuster screw threads and socket end of the adjusting screw. Install stainless steel washer over socket end of adjusting screw and install socket. Turn adjusting screw into adjusting pivot nut to the limit of threads and then back off one-half turn.
3. Assemble parking brake lever to trailing shoe and lining assembly by installing spring washer and a new horseshoe retaining clip. Crimp the clip until it retains lever to the shoe securely.

5. Remove parking brake cable from parking brake lever.
6. Remove retracting springs from lower brake shoe attachments and upper shoe-to-adjuster lever attachment points. This will separate brake shoes and disengage adjuster mechanism.

**REMOVAL AND INSTALLATION (Continued)**

4. Attach parking brake cable to parking brake lever.
5. Attach lower shoe retracting spring to leading and trailing shoe assemblies and install to the backing plate. It will be necessary to stretch retracting spring as shoes are installed downward over anchor plate to inside of shoe retaining plate.
6. Install adjuster screw assembly between leading shoe slot and the slot in the trailing shoe and parking brake lever. The adjuster socket end slot must fit into the trailing shoe and parking brake lever.

**NOTE:** The adjuster socket blade is marked R or L for RH or LH brake assemblies. The R or L adjuster blade must be installed with the letter R or L in the upright position (facing wheel cylinder) on the correct side to ensure that the deeper of two slots in the adjuster sockets fits into the parking brake lever.

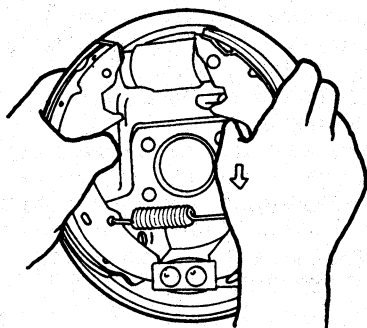


7. Assemble adjuster lever in the groove located in the parking brake lever pin and into the slot of the adjuster socket that fits into trailing shoe web.
8. Attach upper retracting spring to leading shoe slot. Using an appropriate spring tool, stretch the other end of the spring into the notch on the adjuster lever. If adjuster lever does not contact star wheel after installing the spring, it is

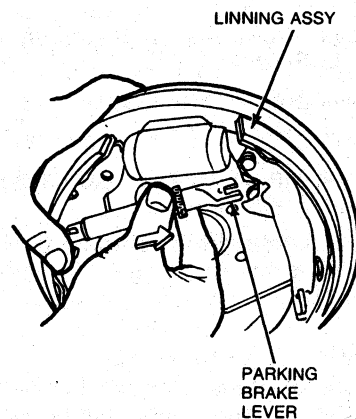
possible that the adjuster socket is installed incorrectly.

9. Install brake hub and drum assembly and wheel/tire assembly as outlined.
10. Install hub/drum and wheel/tire assemblies and adjust wheel bearings. Refer to Section 11-15.
11. Lower vehicle.

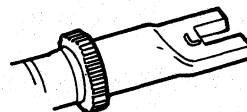
## REMOVAL AND INSTALLATION (Continued)

**STEP 1**

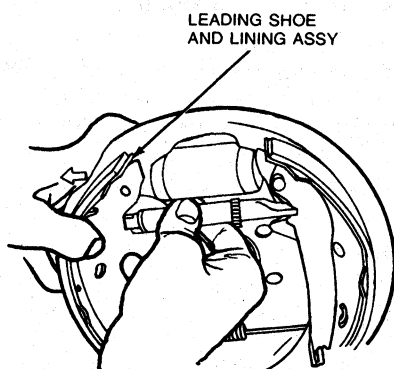
- A. ASSEMBLE PARKING BRAKE CABLE TO TRAILING SHOE AND PARKING BRAKE LEVER.
- B. INSTALL LOWER RETRACTING SPRING TO LEADING-TRAINING SHOES.
- C. INSTALL THIS ASSY TO BACKING PLATE.

**STEP 2**

INSTALL ADJUSTER SCREW ASSY.

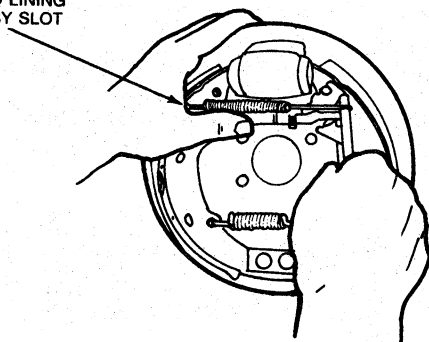


**NOTE:** SOCKET BLADE MARKED R AND L. INSTALL LETTER IN UPRIGHT POSITION TO INSURE PROPER SLOT ENGAGEMENT TO PARKING BRAKE LEVER.

**STEP 3**

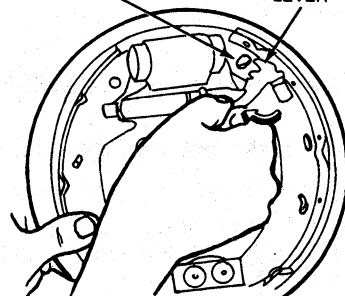
INSTALL ADJUSTER SCREW TO LEADING SHOE AND LINING ASSY.

LEADING SHOE  
AND LINING  
ASSY SLOT



PARKING BRAKE  
LEVER PIN

ADJUSTER  
LEVER

**STEP 4**

INSTALL THE ADJUSTER LEVER IN GROOVE OF PARKING BRAKE LEVER PIN.

**STEP 5**

- A. INSTALL SHOE HOLDDOWN SPRINGS AND PINS.
- B. INSTALL UPPER RETRACTING SPRING TO LEADING SHOE SLOT. STRETCH SPRING TO INSTALL TO TRAILING SHOE. IF ADJUSTER LEVER DOES NOT CONTACT STAR WHEEL AFTER SPRING INSTALLATION CHECK ADJUSTER SOCKET INSTALLATION.

**REMOVAL AND INSTALLATION (Continued)****Wheel Cylinder****Removal**

1. Remove wheel/tire and hub/drum assemblies. Refer to Section 11-15.
2. Remove brake shoe assembly as outlined.
3. Disconnect brake tube from wheel cylinder.
4. Remove wheel cylinder attaching bolts and remove wheel cylinder.

NOTE: Use caution to prevent brake fluid from contacting brake linings or they must be replaced.

**Installation**

Wipe the end(s) of the hydraulic line to remove any foreign matter before making connections.

1. Position wheel cylinder on backing plate and finger-tighten brake tube to cylinder.
2. Secure cylinder to backing plate by installing attaching bolts. Tighten bolts to 10-14 N·m (7.5-10 lb-ft).
3. Tighten tube nut fitting to specification (using a tube nut wrench).
4. Install and adjust brakes as outlined.
5. Install hub/drum and wheel assembly. Refer to Section 11-15.
6. Bleed brake system before driving vehicle.

**CLEANING AND INSPECTION**

1. Use an industrial vacuum cleaner to remove all dust from backing plates and interior of brake drums.
2. Inspect brake shoes for excessive lining wear or shoe damage. If lining is damaged or worn within 0.79mm (1/32-inch) of the rivet heads on riveted linings, it must be replaced. Replace any lining that has been contaminated with oil, grease, or brake fluid. Replace lining in axle sets only. Never replace just one shoe of a brake assembly. Replace both leading and trailing shoes. Prior to replacement of lining, drum diameter should be checked to determine that brake drum diameter is within specification. If braking surface diameter exceeds specification, drum must be replaced.
3. Check condition of brake shoes, retracting spring, hold-down springs, and drum for signs of overheating. If shoes have a slight blue coloring, indicating overheating, retracting and hold-down springs should be replaced. Overheated springs lose their tension and could allow new lining to drag and wear prematurely, if not replaced.
4. Inspect all other brake parts and replace any that are worn or damaged.
5. Inspect brake drum and, if necessary, refinish. The maximum inside diameter is shown on each brake drum. If maximum inside diameter is exceeded either by wear or refinishing, drum must be replaced.

**Brake Backing Plate****Removal**

1. Remove wheel/tire assembly. Refer to Section 11-15.
2. Remove brake hub and drum as outlined.
3. Disconnect brake line from brake cylinder.
4. Remove brake shoes, adjuster assemblies, wheel cylinder, and parking brake cable from backing plate.
5. Remove bolts retaining backing plate to spindle. Discard bolts.
6. Remove backing plate and foam gasket.

**Installation**

1. Install new foam gasket on spindle.
2. Install backing plate with new adhesive coated attaching bolts. Tighten bolts to specification.
3. Install wheel cylinder, and connect brake line as outlined.
4. Install brake shoes and adjuster assemblies. Insert parking brake cable through backing plate. Prongs must be securely locked in place. Connect parking brake cable to lever.
5. Adjust brake shoes and install brake drum and wheels. Bleed brake system. Refer to Section 12-01.

**OVERHAUL****Wheel Cylinders**

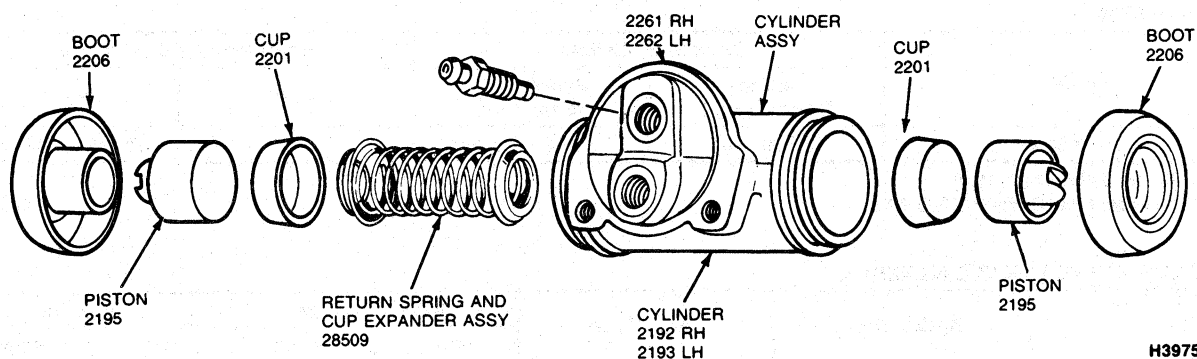
Wheel cylinders should not be disassembled unless they are leaking. Carefully pull lower edges of wheel cylinder boots away from cylinder, and note whether interior is wet with brake fluid. Excessive fluid at this point indicates leakage past piston cups and a need for wheel cylinder overhaul.

NOTE: A slight amount of fluid is nearly always present and acts as a lubricant for the piston. It is not necessary to remove the brake cylinder from the backing plate to disassemble, inspect, hone, and overhaul the cylinder. Removal is necessary only if the cylinder is damaged or scored beyond service.

**Disassembly**

1. Remove brake shoe assembly as outlined.
2. Disengage wheel cylinder boots from retaining grooves in wheel cylinder casting. Remove each boot and piston from wheel cylinder as an assembly.
3. Remove wheel cylinder rubber cups and spring and expander assemblies from wheel cylinder bore.

## OVERHAUL (Continued)



4. Discard all rubber parts.
5. Remove bleeder screw from cylinder.
6. Wash all parts in clean denatured alcohol.
7. Inspect pistons for scratches, scoring, or other visible damage. Replace if necessary. Always replace rubber cups and dust boots.
8. Inspect cylinder bore for score marks or rust. If either condition is present, cylinder bore must be honed. However cylinder should not be honed more than 0.08mm (0.003-inch) beyond its original diameter.
9. Wash cylinder with clean denatured alcohol after honing. Dry it with compressed air.
10. Ensure that bleeder hole is open.

**Assembly****Use all parts in the wheel cylinder service kit.**

1. Apply light coating of heavy duty brake fluid to all internal parts.
2. Thread bleeder screw into cylinder and tighten to specification.
3. Insert return spring and cup expander assembly, and pistons into their respective positions in cylinder bore. Place a boot over each end of cylinder.
4. Install brake shoe assemblies as outlined.
5. Install hub/drum assembly and wheel assembly.
6. Bleed brake system. Refer to Section 12-01.

NOTE: Ensure that brake line is installed in lower wheel cylinder hole and bleed screw in upper hole. Always bleed brakes before driving vehicle.

Check inside diameter of brake drum with Brake Adjusting Gauge D81L-1103-A, Rotunda Brake Drum Micrometer 010-00010 or equivalent.

After a drum is refinished, wipe refinished surface with a cloth soaked in clean denatured alcohol. If one drum is refinished, the opposite drum on the same axle should also be refinished to the same diameter.

**Brake Drum Refinishing**

Minor scores on a brake drum can be removed with sandpaper. Do not refinish drums to remove score marks. A drum surface which is highly polished can cause brake lockup or noise. This polished condition should be removed with sandpaper. A drum that is out of round sufficient to cause vehicle vibration or roughness when braking should be refinished. Remove only enough stock to true up the drum. When brake drum maximum inside diameter shown on the drum is exceeded either through wear or refinishing, the drum must be replaced.

**Brake Shoe Relining**

Brake linings on 225mm and 250mm (8.85 and 9.84-inch) brakes must be replaced if they are worn within 0.79mm (1/32-inch) of a rivet head or have been contaminated with brake fluid, grease or oil.

Failure to replace worn linings will result in a scored drum. **When it is necessary to replace linings, they must also be replaced on the wheel on the opposite side of the vehicle. Inspect brake shoes for distortion, cracks, or looseness. If this condition exists, the shoe must be discarded. Do not attempt to service a damaged brake shoe. Never change only one brake shoe and lining in a brake assembly.**

1. Wash brake shoes thoroughly in clean solvent. Dry thoroughly. Remove all burrs or rough spots from shoes.
2. Position new lining on shoe. Starting in center, insert and secure rivets, working alternately towards each end. **Replacement linings are ground, and no further grinding is required.**
3. Check clearance between shoe and lining. The lining must seat tightly against shoe with not more than 0.20mm (0.008-inch) clearance between any two rivets.

## SPECIFICATIONS

## BORE DIAMETERS

Vehicle	Brake Drum Diameter		Wheel Cylinder Bore Diameter	
	Inside Diameter (mm)	Boring Limit (Max. mm)*	Front**	Rear**
Taurus/Sable	225 and 250	1.5 on the diameter	—	25.4mm (1.00 inch)

\*— Max. Runout .127mm (.005 inch)

\*\*— Max. Allowable Hone 0.076mm (.003 inch)

CH3976-A

## REAR DRUM BRAKE LINING DIMENSIONS

Vehicle	Brake Shoe	Color Code	Brake Diameter		Lining Size	
			mm	Inches	mm	Inches
Sedan	Leading	None	225	8.85	38	1.49
	Trailing	None	225	8.85	38	1.49
Wagon	Leading	None	250	9.84	45	1.77
	Trailing	None	250	9.84	45	1.77

CH3977-A

## TORQUE SPECIFICATIONS

Description	N-m	Lb-Ft
Wheel Cylinder to Backing Plate Screws	12-18	9-13
Rear Brake Backing Plate to Spindle	60-80	45-60
Wheel Cylinder Bleeder Screw	10-20	7.5-15.0
Wheel to Hub and Drum	109-142	80-105

CH3713-A

## SPECIAL SERVICE TOOLS

Tool Number	Description
D81L-600-A	Inch-Pound Torque Wrench
D81L-1103-A	Brake Adjusting Gauge
D81L-1103-B	Brake Adjusting Tool
D81L-1103-C	Brake Cylinder Clamp
TOOL-7000-DE	Air Nozzle Assembly
Rotunda 010-00010	Brake Drum Micrometer
Rotunda 065-00016	Brake Parts Washer

CH3712-C



# SECTION 12-20 Brakes, Disc—Single Piston, Sliding Caliper—Front

SUBJECT	PAGE	SUBJECT	PAGE
DESCRIPTION .....	12-20-1	REMOVAL AND INSTALLATION (Cont'd.)	
DIAGNOSIS .....	12-20-9	Caliper Assembly .....	12-20-3
OVERHAUL		Rotor Splash Shield .....	12-20-5
Phenolic Piston and Three-Finger Inner		Shoe Lining .....	12-20-4
Shoe Clip .....	12-20-5	SPECIAL SERVICE TOOLS .....	12-20-11
Rotor Refinishing .....	12-20-7	SPECIFICATIONS .....	12-20-11
Rotor Service .....	12-20-7	VEHICLE APPLICATION .....	12-20-1
REMOVAL AND INSTALLATION			
Brake Rotor .....	12-20-4		

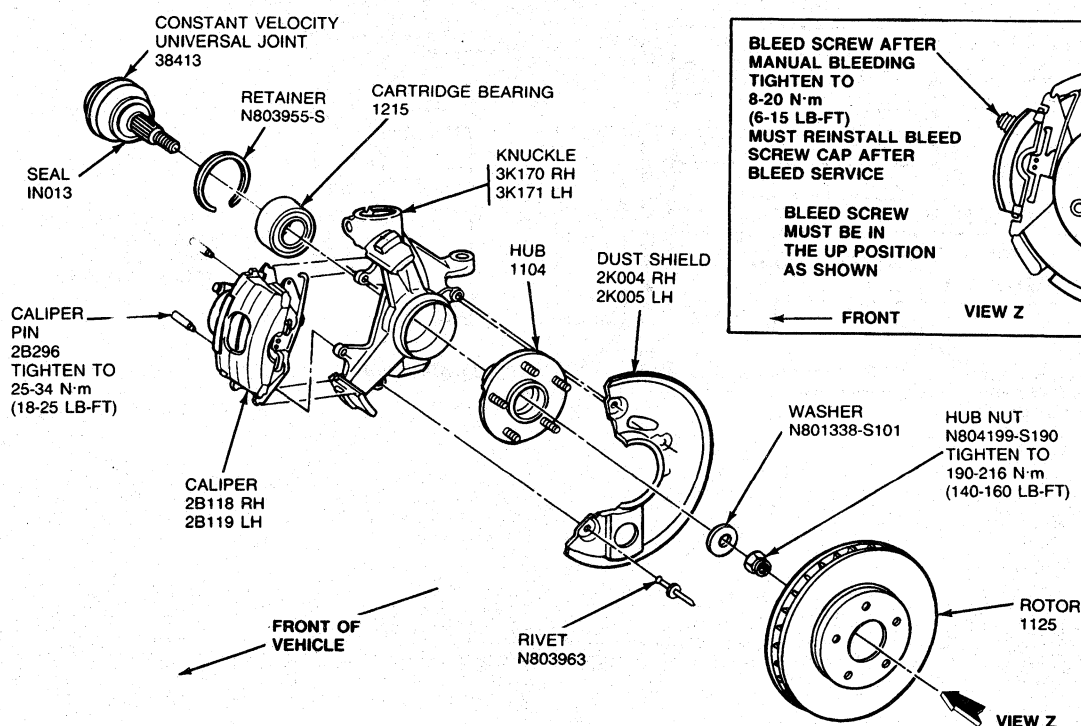
## VEHICLE APPLICATION

Taurus/Sable.

## DESCRIPTION

Front disc brakes use pin slider-type caliper assemblies with a 258mm (10.2 inch) composite rotor. The caliper has a plastic piston with a piston seal and a press-in type dust boot. The caliper is attached to the front suspension knuckle with two Torx-head locating pins. Rubber insulators isolate the stainless steel locating pins from direct contact with the caliper.

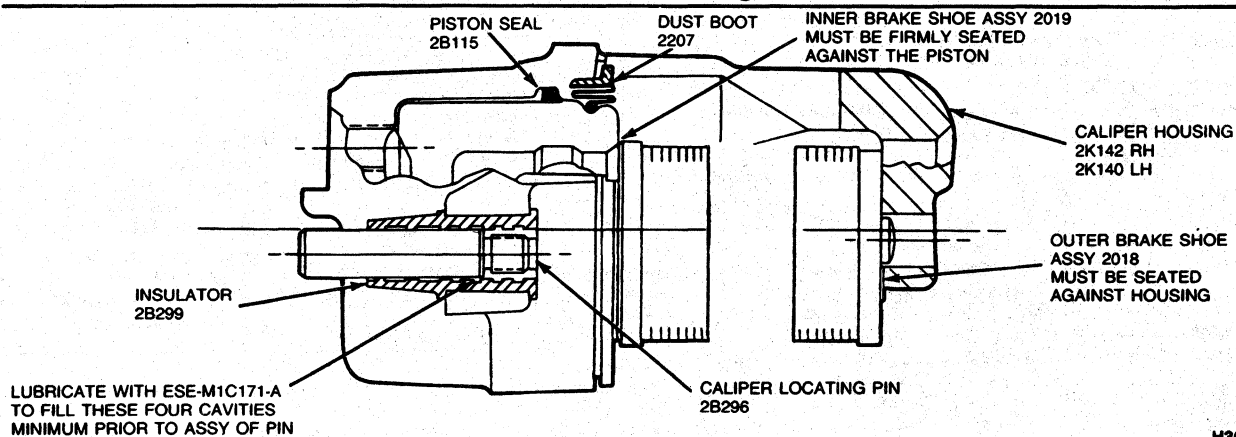
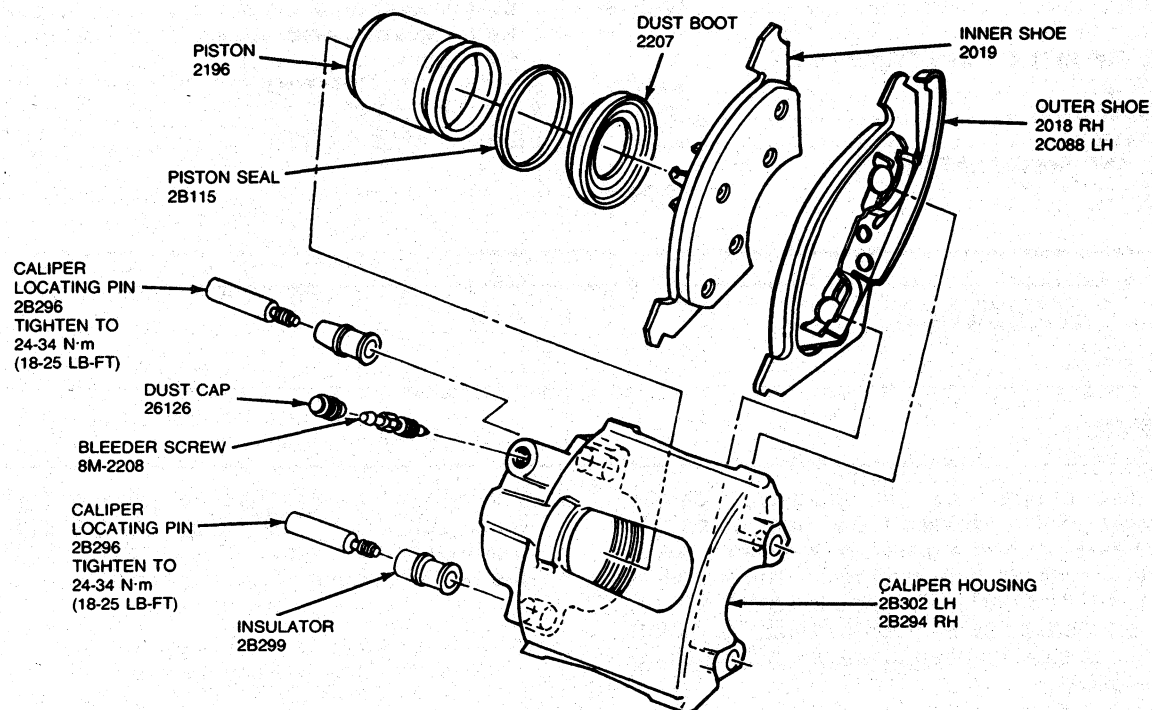
The vehicles are equipped with galvanized steel disc brake splash shields. The shields are attached to the front knuckle with three peel rivets per side and are not interchangeable side-to-side.



H3873-A

## DESCRIPTION (Continued)

The inner shoes are interchangeable left to right and use a three-finger clip that fits inside the caliper piston. The outer shoes are not interchangeable and use a dual-purpose clip which holds the brake shoes on the caliper housing and also prevents caliper rattle. The flanges on both inner and outer shoe assemblies slide on machined surfaces of the knuckle assembly.



H3653-D

## REMOVAL AND INSTALLATION

### Service Precautions

1. Grease or any other foreign material must be kept off lining surfaces and braking surfaces of rotor, and external surfaces of hub during service operation. In handling rotor and caliper assemblies, avoid deformation, nicking or scratching of brake linings and rotor.
2. If a caliper piston is removed for any reason, piston seal and dust boot must be replaced. Exercise care not to damage plastic piston by protecting it from contact with any metal or sharp edged objects.
3. During removal and installation of a wheel assembly, exercise care not to interfere with or damage caliper splash shield, if so equipped, or the bleeder screw fitting.
4. Be sure vehicle is centered on hoist before servicing any front end components to avoid bending or damaging rotor splash shield, if so equipped, on full right or left wheel turns.
5. Do not attempt to clean or restore oil or grease-soaked brake lining. When contaminated linings are found, brake linings must be replaced in complete axle sets and rotor braking surfaces wiped clean.
6. The LH and RH calipers must be installed on the correct side of the vehicle to be sure bleed is in the topmost position for proper purging of air from the front brake system during bleeding.

### Caliper Assembly

#### Removal

1. Remove wheel and tire assembly from rotor mounting face. Use care to avoid damage or interference with bleeder screw fitting during removal.
2. Mark caliper assembly to ensure it is installed on correct knuckle during installation.
3. Disconnect flexible brake hose from caliper. Remove hollow retaining bolt that connects hose fitting to caliper. Remove hose assembly from caliper and plug hose.
4. Remove caliper locating pins using Torx Drive Bit D79P-2100-T40 or equivalent.
5. Lift caliper off rotor and integral knuckle and anchor plate using rotating motion.

**CAUTION:** Do not pry directly against plastic piston, or damage to piston will occur.

### Installation

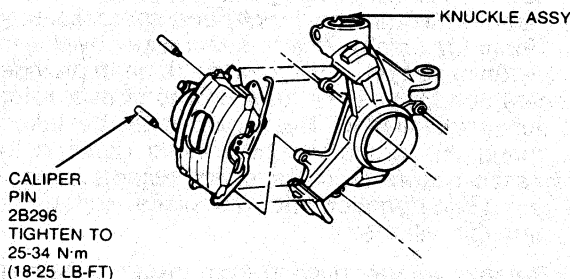
1. Retract piston fully in piston bore. Position caliper assembly above rotor with anti-rattle spring under upper arm of knuckle. Install caliper over rotor with rotating motion. Be sure inner shoe is properly positioned.

Be sure correct caliper assembly, as marked during removal, is installed on correct knuckle. The caliper bleed screw should be positioned on top of caliper when assembled on vehicle.

2. Lubricate locating pins and inside of insulators with Silicone Grease D7AZ-19A331-A or equivalent. Install locating pins through caliper insulators and into knuckle attaching holes.

NOTE: The caliper locating pins must be inserted and threads started by hand.

3. Using Torx Drive Bit D79P-2100-T40 or equivalent, tighten caliper locating pins to 24-34 N·m (18-25 lb-ft).
4. Remove plug and install brake hose on caliper with new copper washer on each side of fitting outlet. Insert attaching bolt through washers and fittings. Tighten bolts to 40-60 N·m (30-45 lb-ft).
5. Bleed brake system. Refer to Section 12-01. Always replace rubber bleed screw cap after bleeding.
6. Fill master cylinder as required.
7. Install wheel and tire assembly. Tighten wheel nuts to 109-142 N·m (80-105 lb-ft).
8. Pump brake pedal prior to moving vehicle to position brake linings.
9. Road test vehicle.



H4012-A

**REMOVAL AND INSTALLATION (Continued)****Shoe Lining****Removal**

Refer to the illustration under Caliper Assembly Installation Step 9.

1. Remove master cylinder cap and check fluid level in reservoir. Remove brake fluid until reservoir is half-full. Discard removed fluid.
2. Remove wheel and tire assembly from rotor mounting face. Use care to avoid damage or interference with caliper splash shield or bleeder screw fitting.
3. Remove caliper locating pins using Torx Drive Bit D79P-2100-T40 or equivalent. Refer to illustration under Caliper Assembly Installation, Step 9.  
  
NOTE: It is not necessary to disconnect hydraulic connections.
4. Lift caliper assembly from integral knuckle and anchor plate and rotor using rotating motion. Do not pry directly against plastic piston or damage will occur.
5. Remove outer shoe and lining assembly from caliper assembly. Refer to second illustration under Description.
6. Remove inner shoe and lining assembly.
7. Inspect both rotor braking surfaces. Minor scoring or buildup of lining material does not require machining or replacement of rotor. Hand-sand glaze from both rotor braking surfaces using garnet paper 100A (medium-grit) or aluminum oxide 150-J (medium).
8. Suspend caliper inside fender housing with wire. Use care not to damage caliper or stretch brake hose.

**Installation**

1. Use a 4-inch C-clamp and wood block 70mm x 25mm (2-3/4 inch x 1-inch) and approximately 19mm (3/4-inch) thick to seat caliper hydraulic piston in its bore. This must be done to provide clearance for caliper assembly to fit over rotor during installation. Extra care must be taken during this procedure to prevent damage to plastic piston. Metal or sharp objects cannot come into direct contact with piston surface or damage will result.
2. Remove all rust buildup from inside of caliper legs (outer shoe contact area).
3. Install inner shoe and lining assembly in caliper piston(s). Do not bend shoe clips during installation in piston or distortion and rattles can occur. Refer to the second illustration under Description.
4. Install correct outer shoe and lining assembly. Ensure clips are properly seated.

5. Install caliper over rotor. Refer to Caliper Installation.
6. Install wheel and tire assembly. Tighten wheel nuts to 109-142 N·m (80-105 lb-ft).
7. Pump brake pedal prior to moving vehicle to position brake linings.
8. Road test vehicle.

**Brake Rotor****Removal**

1. Remove wheel and tire assembly from rotor mounting face. Be careful to avoid damage or interference with caliper bleeder screw fitting and rotor splash shield.
2. Remove caliper assembly from rotor as outlined. If caliper does not require servicing, it is not necessary to disconnect brake hose or remove caliper from vehicle. Position caliper out of the way and support it with a length of wire to avoid damaging the caliper and hose.

**CAUTION: Handle rotor and caliper assembly in such a way as to prevent deformation of rotor, and nicking, scratching or contamination of brake linings/rotor surfaces.**

3. Remove rotor from hub assembly by pulling it off the hub studs.

If additional force is required to remove rotor, apply Rust Penetrator D7AZ-19A501-A or equivalent on front and rear rotor/hub mating surfaces. First, strike rotor between studs with a plastic hammer. If this does not work then attach 3-Jaw Puller D80L-1013-A or equivalent and remove rotor.

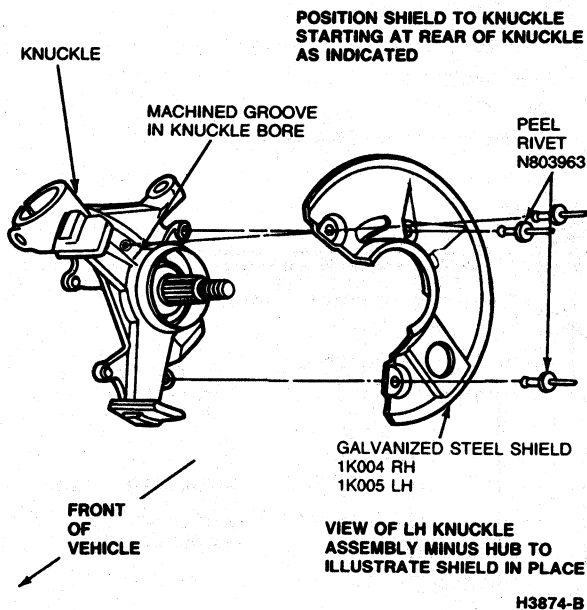
NOTE: If excessive force must be used during rotor removal, the rotor should be checked for lateral runout prior to installation.

**Installation**

1. If rotor is being replaced, remove protective coating from new rotor with carburetor degreaser. If original rotor is being installed, make sure rotor braking and mounting surfaces are clean. Apply a small amount of Silicone Grease D7AZ-19A331-A to pilot diameter of rotor.
2. Install rotor on hub assembly.
3. Install caliper assembly on rotor as outlined.
4. Install wheel and tire assembly to rotor mounting face. Tighten wheel nuts to 109-142 N·m (80-105 lb-ft).
5. Pump brake pedal prior to moving vehicle to position brake linings.
6. Road test vehicle.

**REMOVAL AND INSTALLATION (Continued)****Rotor Splash Shield****Removal**

1. Remove wheel and tire assembly, caliper and rotor, as outlined. It is not necessary to disconnect hydraulic connections.
2. Remove three rivets that attach splash shield to knuckle.
3. Remove rivets by punching out the mandrel located in the center of the rivet. With a chisel, cut off rivet at knuckle and punch out rivet remaining in hole.
4. Remove splash shield by pulling it outboard.

**Installation**

1. Locate shield until shield attachment surfaces contact knuckle mounting bosses and holes in knuckle bosses are aligned with mounting holes in shield.
2. Install new rivets using Heavy-Duty Riveter D80L-23200-A or equivalent (three per shield) through attaching holes in shield and knuckle. The rivet body head should clamp shield attachments securely to knuckle bosses.
3. Install brake rotor, caliper assembly and wheel and tire assembly as outlined.
4. Make certain splash shield does not contact rotor. Rotate wheel to visually inspect for contact.
5. Pump brake pedal prior to moving the vehicle to position brake linings.
6. Road test vehicle.

**OVERHAUL**

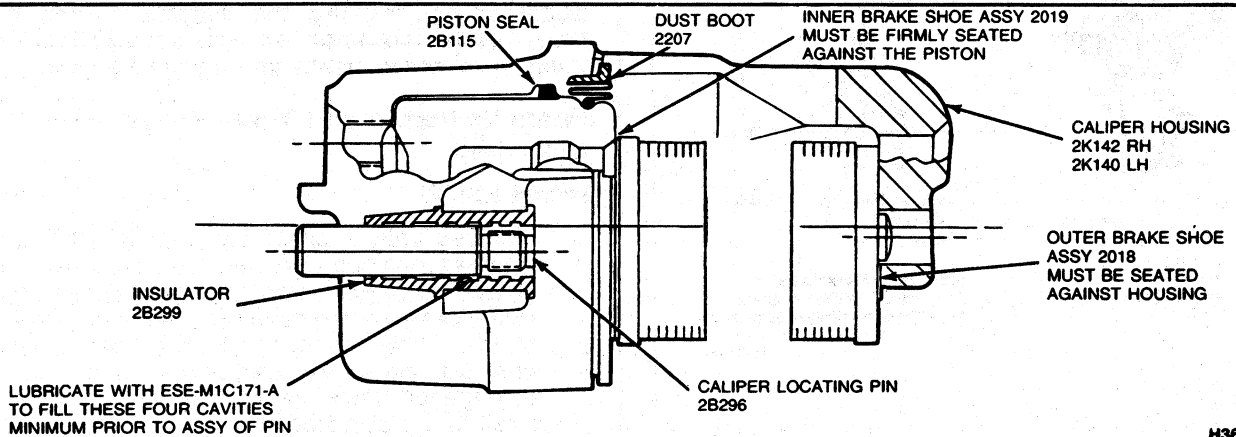
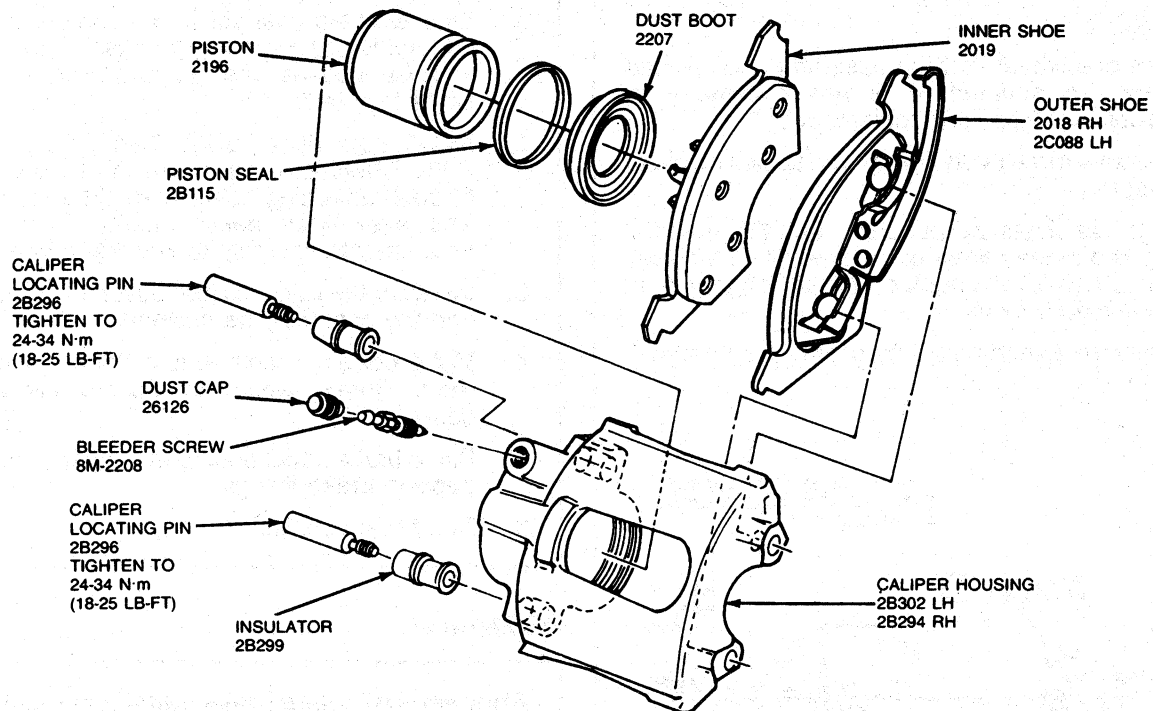
After service, pump brake pedal and have a firm pedal before moving the vehicle. Riding the brake pedal (common on left-foot application) must be avoided when driving the vehicle.

**Phenolic Piston and Three-Finger Inner Shoe Clip****Disassembly**

1. Remove caliper assembly from knuckle and rotor as outlined. Do not use screwdriver or similar tool to pry piston back into cylinder bore. Use a C-clamp. Remove outer shoe by pushing shoe to move "buttons" from caliper housing and slipping down caliper leg until clip is disengaged. Remove inner shoe by pulling it straight out of piston.

NOTE: Inner shoe removal force may be as high as 45-90N (10-20 lbs).

## OVERHAUL (Continued)



H3653-D

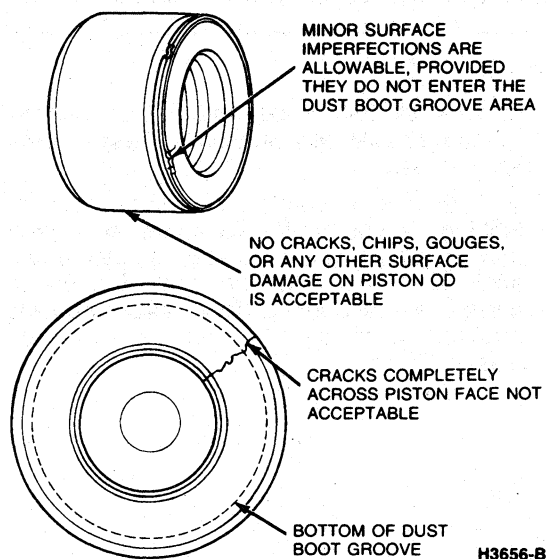
- If further disassembly is required to service piston, disconnect caliper from hydraulic system, and blow piston out using air pressure.  
**CAUTION: Do not use a screwdriver or any similar tool to pry piston out of bore. It will**

**result in damage to piston. Cushion piston's impact against caliper when blowing it out of bore by placing shop towels or rags between piston and caliper bridge.**

## OVERHAUL (Continued)

## Assembly

1. When assembling caliper, examine piston for surface irregularities or small chips and cracks. Replace piston if damaged. Be sure to clean foreign material from piston surfaces and lubricate with brake fluid before inserting into caliper. Always install new seal and dust boot.



2. When installing piston back into bore, use wood block or another flat stock, like an old shoe lining assembly, between C-clamp and piston. **Do not apply C-clamp directly to piston surface.** This can result in damage to piston. Be sure piston is not cocked.
3. Ensure dust boot is tight in boot groove on piston and in caliper.
4. To install inner shoe with three-finger clip attached to shoe into piston, grab each end of shoe, making it square with piston. Push firmly until shoe clip snaps into piston. Do not allow shoe or clip tangs to cock during installation.

## Rotor Service

Refer to Section 12-01, Diagnosis and to the following information for servicing and conditions requiring rotor refinishing.

Brake roughness (vibration or pedal pulsation) that is present during service brake application may be caused by rotor thickness variation or corrosion contamination buildup on the rotor braking surfaces. This thickness variation can occur with rotor wear in excess of 19311 km (12,000 miles) use. Rotor turning may thus be necessary beyond the warranty period. As a last resort, replacement is recommended for heavily scored or damaged rotors.

If pedal pulsation occurs, attempt stopping the vehicle with the transmission in NEUTRAL. If roughness is gone, the drivetrain should be inspected. If the roughness remains, inspect the brakes. Refer to Section 12-01.

Rotunda Disc Brake Lathe 054-00020 or equivalent should be used to refinish disc brake rotors.

## Rotor Refinishing

The front disc rotor is a hat section-type composite rotor of steel and cast iron. A new simplified method of measuring maximum allowable stock removal using a standard hand micrometer eliminates the need for special tools as on previous front disc rotors. However, a Rotunda mounting adapter will be required for use on the brake lathe for refinishing.

All rotor refinishing must adhere to the rule that equal amounts of rotor stock are removed from each braking surface each time a rotor is refinishing.

The minimum allowable overall rotor thickness continues to be stamped on the rotor and must not be exceeded.

## To Check Rotor:

1. With a suitable micrometer, measure the overall thickness of the rotor braking surface at four equally spaced points around the rotor.
2. Using the lowest reading from Step 1, subtract the minimum allowable thickness stamped into the rotor (22.75mm). The difference, if any, represents the total amount of material available for machining. A thickness reading less than the minimum rotor thickness requires rotor replacement.

NOTE: Using a micrometer to measure rotor thickness simplifies previous rotor measurement procedure, but it is mandatory that an equal amount of material be removed from each side of the rotor each time the rotor is turned.

3. After measuring the rotor, the rotor should be installed in the lathe arbor using the special adapter that is required for proper rotor alignment. Never use a lathe that cuts only one face of the rotor at a time; it must be a simultaneous straddle cut. Install a dial indicator to read rotor lateral runout near the center of the rotor face. If runout is 0.05mm (0.002 inch) or below, proceed to machine rotor. If runout is over 0.05mm (0.002 inch) loosen rotor on the arbor, and rotate the rotor 90 degrees. Read the runout, and if it is below 0.05mm (0.002 inch), proceed to machine the rotor. If runout is still over 0.05mm (0.002 inch), again loosen the rotor, and rotate it an additional 90 degrees.

**OVERHAUL (Continued)**

Check the runout. If runout is 0.05mm (0.002 inch) or less, proceed to machine the rotor. If the runout still exceeds 0.05mm (0.002 inch), return the rotor to the best runout position obtained. If the rotor runout can be brought below 0.13mm (0.005 inch), proceed to machine the rotor. If the rotor cannot be brought below 0.13mm (0.005-inch) runout, it must be replaced.

4. Set the cutting tool to just contact the high spots on the rotor, then adjust the cutting tool to the minimum depth required to clean up the rotor face. Equal material must be removed from each side. Do not exceed the allowable stock removal. Clean all cuttings and chips from the rotor before installing it to the axle.

**Cleaning and Inspection**

Clean all metal parts with isopropyl alcohol. Then, clean out and dry grooves and passageways with compressed air. Make sure caliper bore and component parts are thoroughly clean.

Check cylinder bore and piston for damage or excessive wear.

1. Remove wheel and tire from hub and rotor.
2. Inspect brake shoes and lining for wear. If lining is worn to within 3.2mm (1/8-inch) of shoe,

replace all four shoe and lining assemblies (complete axle set) on front or rear wheels as appropriate.

3. Visually check caliper. If caliper housing is leaking, it should be replaced. If a seal is leaking, caliper must be disassembled and new seals and dust boot installed. If a piston is seized in the bore, a new caliper housing is required. Care must be taken while removing plastic piston.



**DIAGNOSIS**

Refer to the Front Disc Brake Diagnosis charts for diagnosis procedures for front disc brakes.

**FRONT DISC BRAKE DIAGNOSIS**

<b>CONDITION</b>	<b>POSSIBLE SOURCE</b>	<b>ACTION</b>
<ul style="list-style-type: none"> <li>● <b>Squeal</b> — A loud, sharp, high-pitched moderately prolonged sound that occurs while braking. Occasional or intermittent brake squeal may result from environmental conditions such as cold, heat, wetness, snow, salt, mud, etc. This condition is not a functional one and will not affect braking effectiveness.</li> </ul>	<ol style="list-style-type: none"> <li>1. Brake lining and/or rotor surface contamination evidenced by glazed surfaces.</li> <li>2. Missing or damaged brake pad insulators.</li> <li>3. Incorrect lining usage.</li> </ol>	<ol style="list-style-type: none"> <li>1. Remove caliper assembly from spindle and remove inner and outer linings. Hand sand glaze from linings and both braking surfaces of rotor. Use Garnet Paper 100A (medium grit) or aluminum oxide 150J (medium). Turning or replacing rotors is not an effective service for squeal.</li> <li>2. Replace shoe and lining assemblies.</li> <li>3. Inspect for correct usage. Replace if necessary.</li> </ol>
<ul style="list-style-type: none"> <li>● <b>Squeal or squeak, brakes not applied.</b></li> </ul>	<ol style="list-style-type: none"> <li>1. Wheel cover attachment.</li> <li>2. Loose wheel attaching lug nuts.</li> <li>3. Misaligned or warped shield (if so equipped) causing interference with rotor.</li> <li>4. Other brake system components:               <ul style="list-style-type: none"> <li>● Loose or extra parts in brakes.</li> <li>● Worn, damaged, or insufficiently lubricated wheel bearings.</li> <li>● Improper positioning of shoe in caliper.</li> <li>● Outside diameter of rotor rubbing caliper housing.</li> <li>● Improper installation of disc brake anti-rattle clip.</li> </ul> </li> </ol>	<ol style="list-style-type: none"> <li>1. Seat covers with a rubber mallet. Service flanges or replace cover.</li> <li>2. Tighten to specification. Replace wheel if stud holes are damaged.</li> <li>3. Service or replace.</li> <li>4. Inspect, service, replace as required.</li> </ol>

CH3659-C

## DIAGNOSIS (Continued)

## FRONT DISC BRAKE DIAGNOSIS

CONDITION	POSSIBLE SOURCE	ACTION
<ul style="list-style-type: none"> <li>● Rattle, Clunk, Knock, Click — series of sharp short sounds in quick succession.</li> </ul>	Bent, loose, missing or worn components: <ol style="list-style-type: none"> <li>1. Caliper support pins.</li> <li>2. Pin insulators.</li> <li>3. Inner/outer shoe clips.</li> <li>4. Dust shield (if so equipped).</li> <li>5. Machining grooves in rotor lifting brake shoes after rotor turning.</li> <li>6. Outer disc brake shoe locating buttons not seated in caliper holes. Usually accompanied by loss of pedal.</li> <li>7. Stones or foreign material trapped inside wheel covers.</li> <li>8. Disc brake shoe end clearance in excess of 0.66mm (0.026 in.).</li> </ol>	<ol style="list-style-type: none"> <li>1. Tighten or replace.</li> <li>2. Replace as necessary.</li> <li>3. Service or replace as necessary.</li> <li>4. Service as necessary.</li> <li>5. Replace or turn.*</li> <li>6. Check and replace if necessary.</li> <li>7. Service or replace.</li> <li>8. Peen end of shoes with hammer on anvil to lengthen shoes and reinstall. Minimum end clearance 0.13mm (0.005 in.).</li> </ol>
<ul style="list-style-type: none"> <li>● Grind — A loud, harsh rubbing noise.</li> </ul>	<ol style="list-style-type: none"> <li>1. Bound caliper and/or brake shoes.</li> <li>2. If caliper is not bound, and brake linings are worn to rivets causing rotor to be scored within warranty period, customer abuse (riding brake pedal) the cause.</li> <li>3. Contaminated linings — if caliper is not bound, brake linings are not worn to rivets and rotor is scored at least 13mm (0.5 inch) wide by 1.5mm (1/16 inch) deep.</li> <li>4. Worn or damaged wheel bearings. (Verify noise is coming from bearings.)</li> <li>5. Caliper to wheel or rotor interference.</li> <li>6. Other brake system components: Warped splash shield (if so equipped) or cracked rotors.</li> <li>7. Tires rubbing against chassis or body.</li> <li>8. Rotor to knuckle interference.</li> </ol>	<ol style="list-style-type: none"> <li>1. Hand sand corrosion from knuckle brake shoe abutment surfaces.</li> <li>2. This is not a chargeable warranty claim. No warranty claims are to be accepted for lining replacement under these conditions. Service and replace as necessary.</li> <li>3. Replace or turn rotor.* Remove lining contamination as necessary.</li> <li>4. Replace bearings as necessary. Hub nut must also be replaced and staked.</li> <li>5. Replace as required.</li> <li>6. Inspect and service.</li> <li>7. Inspect and service.</li> <li>8. Replace as required.</li> </ol>

\*Turning rotors is not a chargeable warranty claim except with prior approval of Ford Parts and Service Division.

CH3718-C

## DIAGNOSIS (Continued)

## FRONT DISC BRAKE DIAGNOSIS

CONDITION	POSSIBLE SOURCE	ACTION
Roughness — An unsmooth feeling while braking in neutral evidenced by a pulsating brake pedal.	1. Corrosion build-up on rotor surfaces.	1. Make 5 to 10 stops. If roughness is still present, replace or turn rotor.*
	2. Rotor thickness variation.	2. Replace or turn rotor.*
	3. Rear brake roughness.	3. Attempt stopping the vehicle using the parking brake. If roughness is present, check drums for excessive wear or runout. Refinish or replace as necessary.
	4. Wheel/tire imbalance.	4. Verify and service as necessary.
	5. Drivetrain imbalance.	5. Attempt stopping vehicle in neutral transmission position. If roughness is gone, drivetrain should be inspected.
	6. Worn tires.	6. Replace tires.

\*Turning rotors is not a chargeable warranty claim except with prior approval of Ford Parts and Service Division.

CH3719-C

## SPECIFICATIONS

## FRONT DISC BRAKE DIMENSIONS

Component	Specification
Lining Material	B x 7503MG
Lining Size Inner and Outer	144mm x 47mm x 12mm (5.7 in. x 1.9 in. x .5 in.)
Lining Wear Limit (from shoe surface)	3.175mm (0.125 in.)
Caliper Cylinder Bore Diameter	66mm (2.598 in.)
Front Rotor Nominal Thickness	24.0mm (0.945 in.)
Front Rotor Minimum Thickness <sup>①</sup>	22.75mm (0.896 in.)
Front Rotor Diameter	258.0mm (10.16 in.)
Front Rotor Allowable Runout Off Car	0.076mm max. (0.003 in.)
Front Rotor Finish	0.40-3.2 micro-meters (10-80 micro-inches)
Front Rotor Thickness Variation	0.013mm max. (0.0005 in.)

<sup>①</sup>Minimum safe thickness is shown on each rotor.

CH3872-A

## BRAKE HYDRAULIC SYSTEM TORQUE SPECIFICATIONS

Component	N·m	Lb·Ft
Caliper Bleeder Screw	8-20	6-15
Caliper Locating Pin	24-34	18-25
Brake Hose Connection to Caliper	40-60	30-45
Hydraulic Tube Connections —		
3/8 x 24	14-24	10-18
7/16 x 24	14-24	10-18
1/2 x 20	14-24	10-18
9/16 x 18	14-24	10-18
Wheel Nuts	109-142	80-105

\*All hydraulic lines must be tightened to the specific torque value and be free of fluid leakage.

CH4013-A

## SPECIAL SERVICE TOOLS

Tool Number	Description
D80L-1013-A	3-Jaw Puller
D79P-2100-T40	Torx Drive Bit
D80L-23200-A	Heavy Duty Riveter
Rotunda 054-00020	Disc Brake Lathe
Rotunda 065-00016	Brake Parts Washer

CH4014-A

# SECTION 12-50 Brake Booster, Vacuum—Dash Mounted

SUBJECT	PAGE	SUBJECT	PAGE
<b>ADJUSTMENTS</b>		<b>REMOVAL AND INSTALLATION</b>	
Brake Booster-to-Master Cylinder Push Rod .....	12-50-1	Brake Booster, Vacuum .....	12-50-2
<b>DESCRIPTION</b> .....	12-50-1	<b>SPECIFICATIONS</b> .....	12-50-3
<b>DIAGNOSIS AND TESTING</b> .....	12-50-3	<b>VEHICLE APPLICATION</b> .....	12-50-1

## VEHICLE APPLICATION

Taurus/Sable.

## DESCRIPTION

The diaphragm-type brake booster is self-contained and is mounted on the engine side of the dash panel. The vacuum brake booster uses engine intake manifold vacuum and atmospheric pressure for its power.

**Adjustment of the push rod and replacement of the check valve are the only services permitted on the brake booster.**

If any brake booster is damaged or inoperative, replace it with a new booster. The brake booster (including the check valve) is serviced only as an assembly.

## ADJUSTMENTS

### Brake Booster-to-Master Cylinder Push Rod

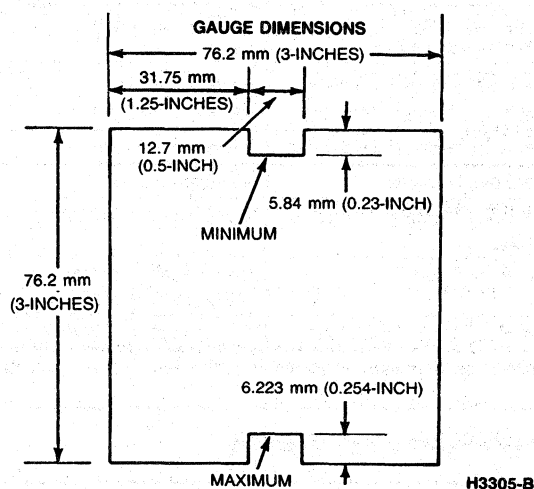
The vacuum booster has an adjustable push rod (output rod), which is used to compensate for dimensional variations in an assembled booster. The push rod length is adjusted after each power booster unit has been assembled in production. A properly adjusted push rod that remains assembled to the booster with which it was matched in production should never require a service adjustment.

A booster that is suspected of having an improper push rod length will indicate either of the following:

- A push rod that is too long will prevent the master cylinder piston from completely releasing hydraulic pressure, causing the brakes to drag.
- A push rod that is too short will have excessive brake pedal travel and cause a groaning noise to come from the booster.

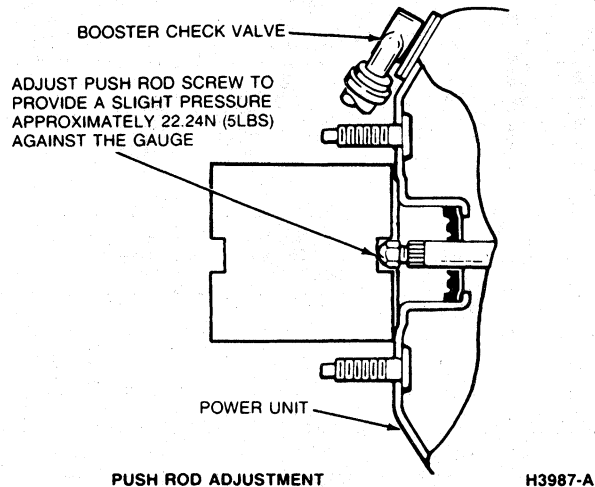
If necessary, booster push rod length can be verified by using the following procedure.

**NOTE:** A locally made push rod gauge of the following dimensions must be used.



**ADJUSTMENTS (Continued)**

1. Without disconnecting brake tubes, disconnect master cylinder and set it away from booster power unit. The master cylinder must be supported to prevent damaging brake tubes.
2. With engine running, check and adjust push rod length as shown. A force of approximately 22.24N (5 lbs) applied to push rod with gauge will ensure that push rod is seated within the power unit. If adjustment is necessary, grip rod **only** by knurled area.



**CAUTION: Do not adjust too long or brake drag could result.**

3. Install master cylinder on power unit. Gradually and alternately tighten retaining nuts to 18-33 N·m (13-25 lb-ft). Refer to Section 12-01.

5. Remove booster-to-dash panel attaching nuts. Slide booster push rod and push rod bushing off brake pedal pin.
6. Working inside engine compartment remove two screws from manifold vacuum fitting at dash panel, and position out of way.
7. Position wiring harness out of the way.
8. Remove transmission shift cable and bracket assembly.
9. Move booster forward until booster studs clear dash panel and remove booster.

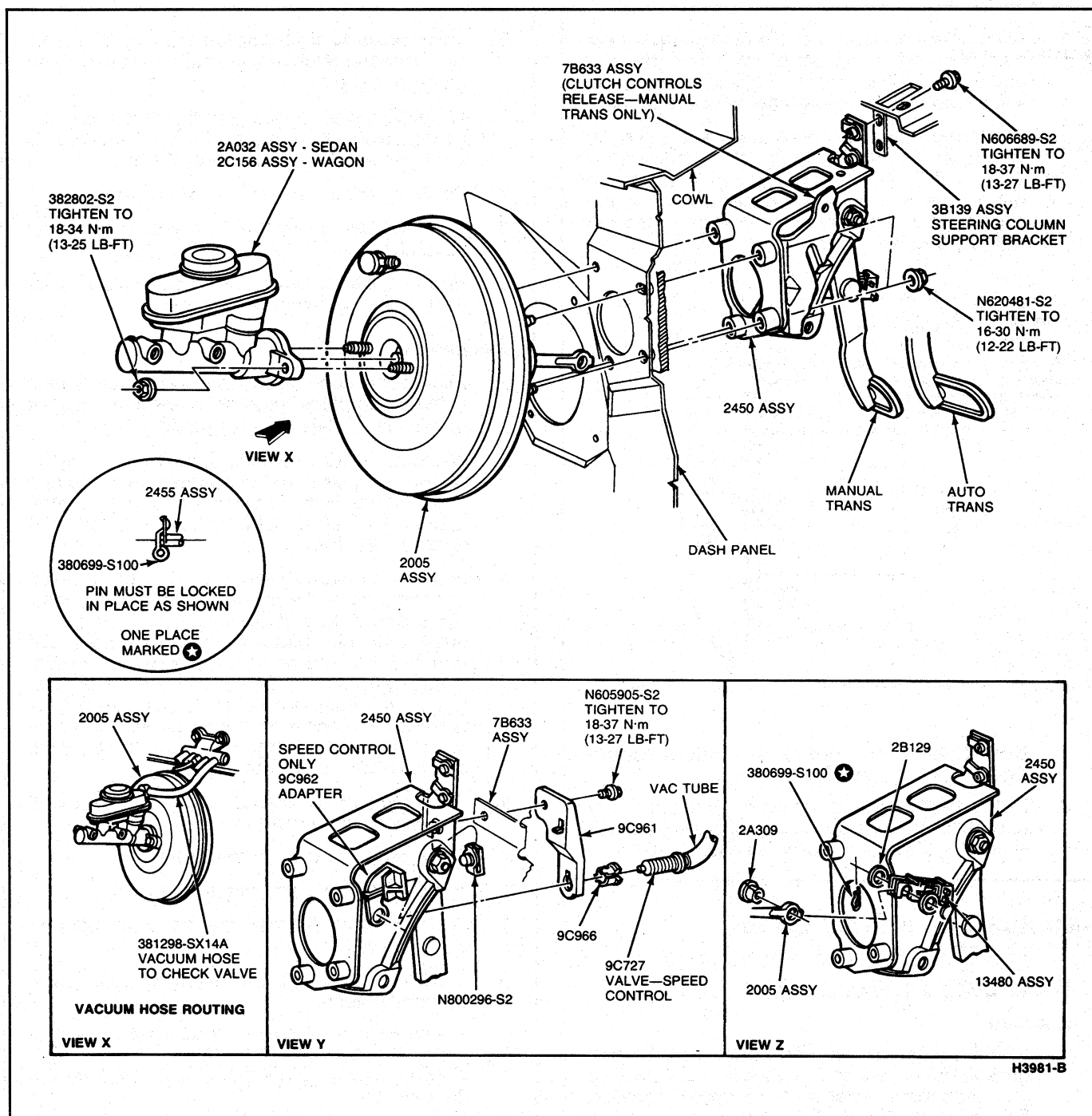
**Installation**

1. Align pedal support and support spacer inside vehicle and place booster in position on dash panel. Hand start attaching nuts.
2. Working inside vehicle, install inner nylon washer or speed control adapter, push rod and push rod bushing on brake pedal pin. Tighten booster-to-dash panel attaching nuts to 16-30 N·m (12-22 lb-ft).
3. Position stoplamp switch so that it straddles booster push rod with switch slot toward pedal blade and hole just clearing pin. Slide switch down onto pin. Slide assembly toward pedal arm, being careful not to bend or deform switch. Install nylon washer on pin and secure all parts to pin with hairpin retainer. Ensure retainer is fully installed and locked over pedal pin. Install stoplamp switch wiring connector on stoplamp switch. Refer to Section 32-20.
4. Position manifold vacuum fitting to dash panel and install two attaching screws.
5. Move wiring harness into position.
6. Install shift cable and bracket assembly.
7. Connect manifold vacuum hose to booster check valve.
8. Position master cylinder assembly on booster assembly studs.
9. Install brake tube fittings into master cylinder ports. Tighten to 14-24 N·m (10-18 lb-ft). Tighten master cylinder nuts to 18-33 N·m (13-25 lb-ft).
10. Connect warning lamp.
11. Bleed brake system. Refer to Section 12-01.
12. Adjust manual shift linkage.
13. Connect battery ground cable and start engine. Check power brake function.
14. For vehicles with speed control, refer to Section 37-05 for dump valve adjustments.

**REMOVAL AND INSTALLATION****Brake Booster, Vacuum****Removal**

1. Inside engine compartment, disconnect battery ground cable and remove tubes from primary and secondary outlet ports of master cylinder. Disconnect manifold vacuum hose from booster check valve.
2. Disconnect warning lamp.
3. Remove two nuts attaching master cylinder to brake booster assembly and remove master cylinder.
4. Working inside vehicle below instrument panel, remove stoplamp switch wiring connector from switch. Remove push rod retainer and outer nylon washer from pedal pin. Slide stoplamp switch along brake pedal pin just far enough for outer hole to clear pin. Refer to Section 32-20. Remove switch by sliding it upward. Be careful not to damage switch during removal.

## REMOVAL AND INSTALLATION (Continued)



## DIAGNOSIS AND TESTING

Refer to Section 12-01.

## SPECIFICATIONS

## TORQUE SPECIFICATIONS

Description	N·m	Lb·Ft
Booster to Dash Panel Locking Nut	16-30	12-22
Master Cylinder to Booster Locking Nuts	18-33	13-25
Brake Tube Fittings	14-24	10-18

CH3988-A

# SECTION 12-70 Parking Brake, Cable Actuated—Rear Wheels

SUBJECT	PAGE	SUBJECT	PAGE
<b>ADJUSTMENTS</b>		<b>REMOVAL AND INSTALLATION (Cont'd.)</b>	
Parking Brake .....	12-70-3	Cables, Rear .....	12-70-5
<b>DESCRIPTION</b>		Control Assembly .....	12-70-3
Control Assemblies .....	12-70-1	Parking Brake Manual Release Handle and Cable .....	12-70-4
<b>DIAGNOSIS AND TESTING</b>		<b>SPECIFICATIONS</b> .....	12-70-6
Vacuum Release Parking Brake .....	12-70-3	<b>VEHICLE APPLICATION</b> .....	12-70-1
<b>REMOVAL AND INSTALLATION</b>			
Cable, Front .....	12-70-4		

## VEHICLE APPLICATION

Taurus/Sable.

## DESCRIPTION

The parking brake system is cable actuated and controlled by an independent foot-operated parking brake control.

### Control Assemblies

An independent foot-operated parking brake control actuates the rear wheel brake shoes through a cable system.

The parking brake warning lamp can be actuated by the parking brake control. It warns the driver to release the parking brake control before driving the vehicle. If the lamp remains lit, a brake malfunction has occurred.

The automatic (vacuum) release parking brake control is optional equipment.

On the automatic vacuum-type parking brake system, the vacuum power unit with mounting bracket is bolted to the control assembly.

The vacuum-actuated diaphragm within the unit is connected by a rod to the lower end of the release lever.

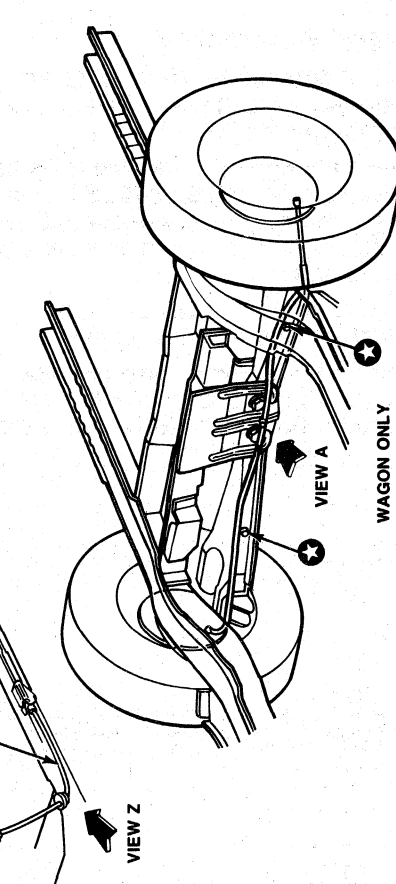
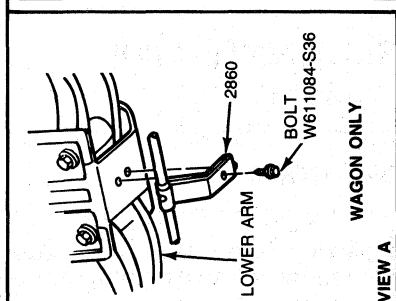
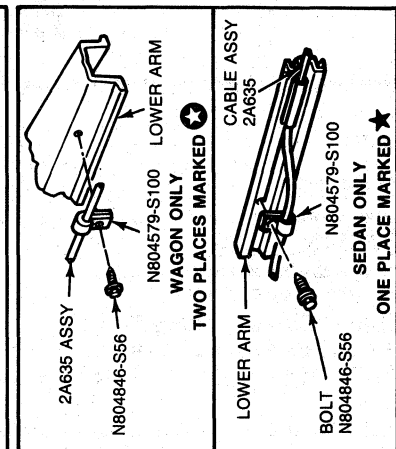
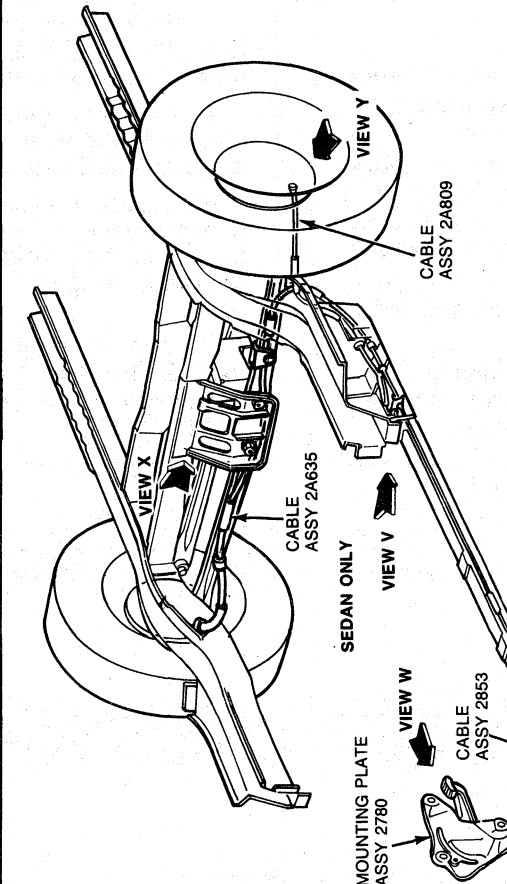
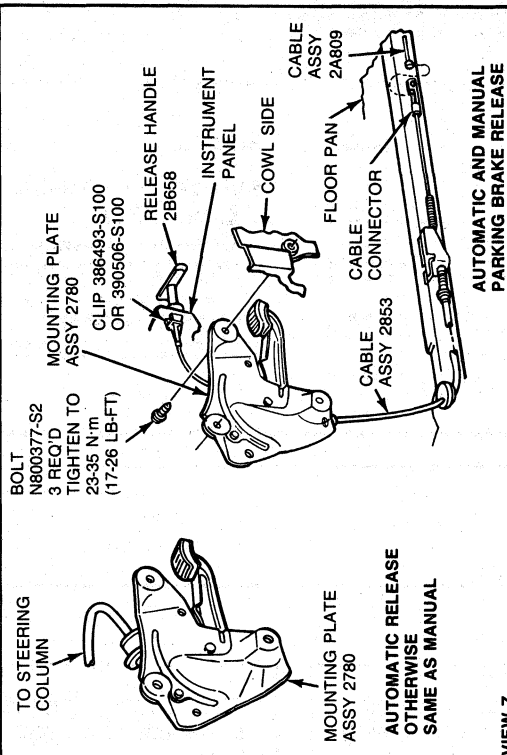
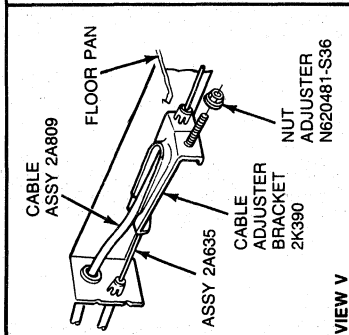
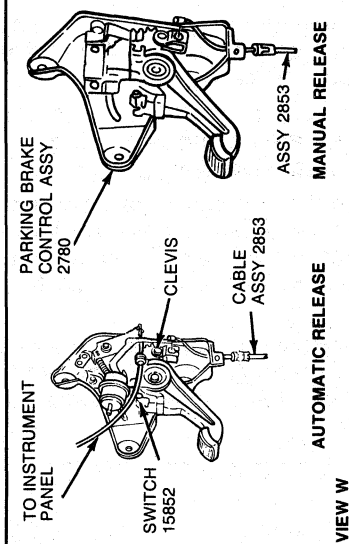
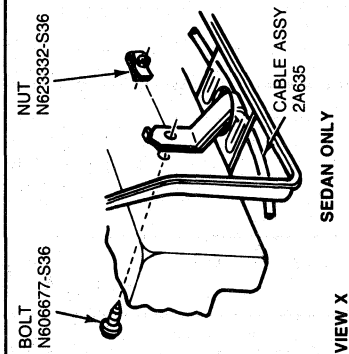
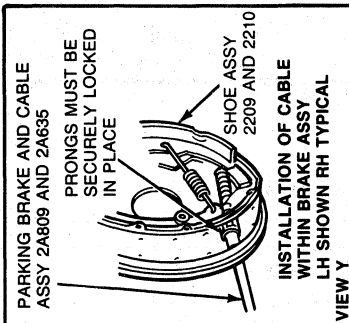
Hoses connect the vacuum motor to the engine manifold through a vacuum release switch at the steering column or floor shifter.

The vacuum motor is actuated to release the parking brake whenever the engine is running and the transmission is in a forward driving gear.

To manually release the automatic vacuum-type parking brake, a T-handle extends from the lower portion of the instrument panel, left of the steering column. Pulling on this handle releases the parking brake.

On the manually-released type, a T-handle extends from the lower portion of the LH side of the instrument panel. Pulling this handle releases the parking brake.

## DESCRIPTION (Continued)



H3310-B



## DIAGNOSIS AND TESTING

### Vacuum Release Parking Brake

Look closely at the operation of the brake linkage as the brake pedal is depressed. Then, check the operation of the brake linkage when the manual release lever is activated. These checks will indicate whether the manual parking brake control linkage is operating properly or requires service or adjustment. Adjustment may be necessary if the parking brake is unable to prevent moderate vehicle movement. Perform tests of the parking brake system and controls after ensuring the linkage and manual controls operate properly.

When testing a parking brake vacuum release system, a minimum of 34 kPa (10-in.-Hg.) should be available at all points where vacuum is applied. This can be checked with a gauge such as Rotunda Vacuum Tester 021-00014 or equivalent.

Failure to maintain 34 kPa (10-in.-Hg.) during vacuum system tests could be caused by a loose hose connection, resulting in a vacuum leak. When checking for vacuum between two points, trace the hose along its entire routing to ensure it is not crossed with another hose or connected to the wrong connection.

All of the vacuum parking brake control checks are to be performed with the engine running at idle speed.

To detect any leaks in the parking brake vacuum hoses or to find disconnected or improperly connected hoses, listen for a hissing sound along the hose routing.

**CAUTION: Do not apply air pressure to the vacuum system under any circumstances because the actuator diaphragm in the parking brake vacuum motor may be damaged.**

1. Start engine and run it at idle speed. With the transmission shift control in NEUTRAL, depress parking brake pedal to apply parking brake. Move transmission shift control to D range, and observe the parking brake sector to determine if sector returns to its zero travel position when parking brake releases. If parking brake releases, parking vacuum control is working properly.

NOTE: The parking brake vacuum release does not operate with transmission in REVERSE.

2. If parking brake does not release, test for vacuum at vacuum line connected to parking brake release vacuum motor. This can be accomplished by removing hose from each component and attaching it to vacuum gauge. Vacuum will be available at vacuum motor only when transmission selector is in D range. Connect two distributor tester vacuum hose adapters together with a coupling as a connector attaching gauge. A minimum of 34 kPa (10-inches Hg.) is required to actuate parking brake vacuum motor. If minimum reading is not present when checking each aforementioned component, it must be replaced.

### Operation Test

Check operation of the parking brake with vehicle on a hoist and parking brake fully released. If there is any slack in the cables or if rear brakes drag when wheels are turned, adjust as required.

## ADJUSTMENTS

### Parking Brake

#### Cable Adjustment

1. Make sure parking brake is fully released.
2. Place transmission in NEUTRAL. Raise vehicle on axle-type hoist. If body contact hoist is used, support rear axle with jackstands.
3. Tighten adjusting nut against cable equalizer, causing a rear wheel brake drag. (Refer to the appropriate illustration for location of the adjusting nut).

Then, loosen adjusting nut until rear brakes are fully released. There should be no brake drag. If brake cables are replaced in any system having a foot-operated control assembly, stroke parking brake control with approximately 445N (100 lbs) pedal effort, then release control and repeat this step.

4. Lower vehicle and check operation of parking brake.

## REMOVAL AND INSTALLATION

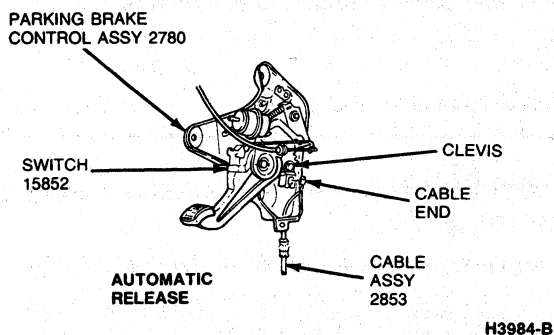
### Control Assembly

#### Removal

1. Fully release parking brake.
2. Raise vehicle. Refer to Pre-Delivery manual, Section 50-04.
3. Remove all tension from rear cables by backing off adjusting nut from equalizer or adjuster.
4. Lower vehicle.
5. Disconnect vacuum hose from vacuum release motor, if so equipped.
6. Disconnect release cable from parking brake control release arm and remove release cable grommet from parking brake control.
7. Disconnect wiring connector from parking brake warning lamp switch.

**REMOVAL AND INSTALLATION (Continued)**

8. Remove cable end from clevis at brake control.



9. Remove push pin from cowl side trim panel.
10. Remove conduit retainer from control assembly using a 13mm box end wrench to depress retaining prongs.
11. Remove three bolts and one pushpin attaching control assembly to cowl side panel.
12. Remove control assembly from vehicle.

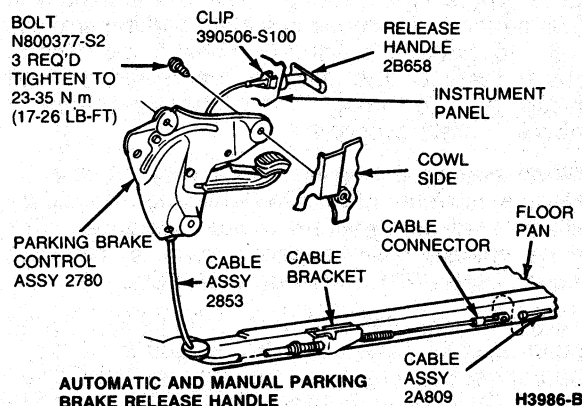
**Installation**

1. Position control assembly in vehicle.
2. Fit cable assembly through its mounting hole, and press pronged retainer in place. Ensure prongs are securely locked in place. Connect the cable end fitting to clevis at control assembly.
3. Install attaching bolts and pushpin to cowl side bracket. Tighten screws to 23-35 N·m (17-26 lb-ft).
4. Connect vacuum hose to vacuum release actuator, if so equipped.
5. Connect release cable to parking brake control release arm and install release cable grommet to parking brake control.
6. Connect wiring connector to parking brake warning lamp switch.
7. Raise vehicle. Check parking brake operation and adjust as required. Lower vehicle.

**Parking Brake Manual Release Handle and Cable Assembly****Removal**

1. Disconnect release cable from parking brake control release arm and remove release cable grommet from parking brake control.

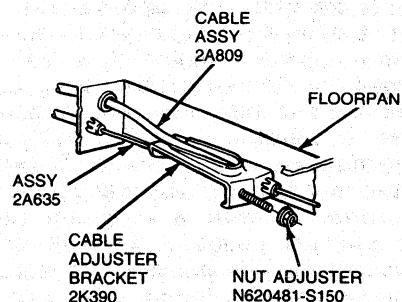
2. From under instrument panel using a screwdriver, pry off and remove retainer clip securing cable and handle to instrument panel. Pull handle and cable assembly out of instrument panel.

**Installation**

1. Start cable and handle assembly through locating hole in instrument panel and install retainer clip that secures handle to instrument panel.
2. Connect release cable to parking brake control release arm and install release cable grommet to parking brake control.

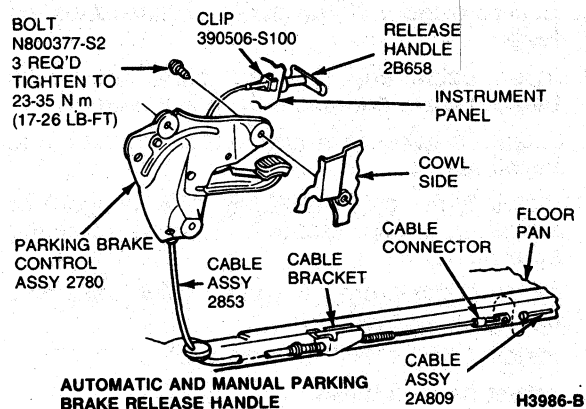
**Cable, Front****Removal**

1. Raise vehicle on hoist. Refer to the Pre-Delivery manual, Section 50-04.
2. Loosen adjuster nut at adjuster bracket.
3. Lower vehicle.
4. Disconnect cable from control assembly at clevis.
5. Raise vehicle.

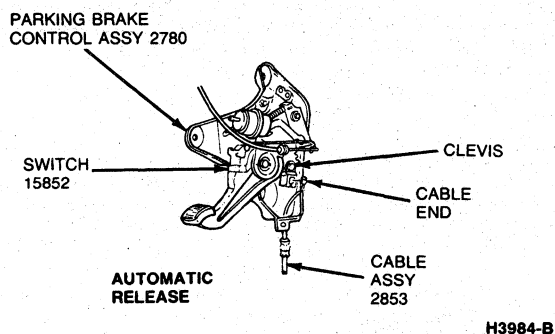


**REMOVAL AND INSTALLATION (Continued)**

6. Disconnect front cable from rear cable at cable connector.
7. Remove cable and push-in prong retainer from cable bracket, using a 13mm box end wrench to depress retaining prongs. Allow cable to hang.



8. Push grommet up through floorpan.
9. Lower vehicle.
10. Remove LH cowl side panel.
11. Pull carpet away from cowl panel.
12. From inside vehicle remove cable end from clevis and remove conduit retainer from control assembly.



13. Pull cable assembly through floorpan hole.

**Installation**

1. Start cable through hole in floorpan and secure grommet in place.
  2. Push prong retainer into parking brake housing until prongs are secure and connect cable to control clevis.
  3. Install carpeting and body side pad.
  4. Raise vehicle and position cable through front cable bracket at frame side rail and push prong into bracket.
- NOTE: Prongs must be securely locked in place.
5. Connect rear cable to front cable connector.
  6. Adjust parking brake and lower vehicle.
  7. Check parking brake operation.

**Cables, Rear****Left Cable****Removal**

1. Raise vehicle on hoist. Refer to the Pre-Delivery manual, Section 50-04.
2. Remove parking brake cable adjusting nut.
3. Remove rear cable end fitting from front cable connector.
4. Remove wheel and drum assembly.
5. Disconnect brake cable end from parking brake actuating lever. Using a 13mm box end wrench to depress the conduit retaining prongs, remove cable end pronged fitting from backing plate.
6. Push plastic snap-in grommet rearward to disconnect from side rail bracket.
7. Remove pronged connector from parking brake adjuster bracket. Remove cable assembly.

**Installation**

1. Insert cable through side rail bracket and adjuster bracket. Ensure pronged connector is securely attached to brake adjuster bracket.
2. Seat plastic snap-in grommet inside rail bracket.
3. Insert cable end into brake assembly backing plate and push pronged cable end into brake backing plate hole. Ensure prongs are locked in place.

NOTE: Cable must be located over the right cable.

4. Attach cable end to parking brake actuating lever.
5. Attach cable to front cable connector.
6. Install drum and wheel assembly.
7. Install brake cable adjusting nut.
8. Adjust parking brake and lower vehicle.
9. Check for proper operation.

**REMOVAL AND INSTALLATION (Continued)****Right Cable****Removal**

1. Raise vehicle on hoist. Refer to the Pre-Delivery manual, Section 50-04.
2. Remove parking brake cable adjusting nut.
3. Use a 13mm box end wrench to remove conduit retainer prongs and remove cable from frame side rail bracket.
4. Remove wheel and drum assembly.
5. Disconnect brake cable from parking brake actuating lever. Using a 13mm box end wrench to depress the conduit retaining prongs, remove cable end pronged fitting from brake backing plate.
6. On sedan vehicles, remove brake pressure control valve bracket at control arm.
7. **Sedan:** Remove cable retaining screw and clip from lower suspension arm and one screw from cable bracket at crossmember, and remove entire right cable assembly.

**Wagon:** Remove cable retaining clip and screw from each lower suspension arm, and one screw from cable retaining clip on lower suspension arm inner mounting bracket.

**Installation**

1. Insert cable into opening in frame side rail bracket and threaded end of cable in adjuster, and start adjuster nut on threads. Ensure pronged fitting is pressed into frame side rail bracket and securely locked in place.
2. Route cable under LH brake cable and lower suspension arms.
3. Secure cable end into parking brake actuating lever.
4. Insert cable end pronged fitting into brake backing plate and securely lock in place.
5. Attach bracket-to-crossmember bracket and install nut.
6. Install brake cable retaining clips (wagon) or screw and clip (sedan). Tighten retaining screws.
7. Install brake pressure control valve assembly bracket to control arm.
8. Install drum and wheel assembly.
9. Adjust parking brake.
10. Lower vehicle.
11. Check for proper operation.

**SPECIFICATIONS****TORQUE SPECIFICATIONS**

Description	N·m	Lb·Ft
Parking Brake Assembly to Cowl Mounting Bolts	23-35	17-26

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# STEERING

# GROUP 13

(3000)

SECTION TITLE	PAGE	SECTION TITLE	PAGE
STEERING, POWER—HOSES .....	13-55-1	STEERING PUMP, POWER—FORD MODEL	
STEERING—SERVICE .....	13-01-1	CII .....	13-51-1
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RACK-AND-PINION—FORD .....	13-46-1		

## SECTION 13-01 Steering—Service

SUBJECT	PAGE	SUBJECT	PAGE
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Steering Gear, Power .....	13-01-7	TESTING	
Steering Pump, Power .....	13-01-8	Preliminary Tests .....	13-01-1
Steering Pump, Power—Flushing .....	13-01-8	Pump Flow and Pressure Tests .....	13-01-2
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DIAGNOSIS .....	13-01-5	Start-Up Procedure .....	13-01-5
SPECIAL SERVICE TOOLS .....	13-01-9	VEHICLE APPLICATION .....	13-01-1

### VEHICLE APPLICATION

Taurus/Sable.

### TESTING

#### Preliminary Tests

Make the following preliminary tests before power steering disassembly.

#### Air Bleeding

If bubbles are present in the power steering fluid, bleed the system as follows:

1. Fill reservoir to specification.
2. Run engine until fluid reaches normal operating temperature of 74-79°C (165-175°F).

3. Turn steering wheel all the way to the left and right several times. **Do not hold wheel in the far left or right position.**
4. Check fluid level.
5. If air is still trapped in system, refer to Power Steering System Purging.

#### Fluid Level Check

1. Idle engine for two to three minutes. Turn steering wheel all the way to the left and right several times to warm fluid to 43-49°C (110-120°F).

**TESTING (Continued)**

2. Check fluid level in the power steering reservoir. Fluid level should be at the COLD FULL mark. If level is low, add Motorcraft Type F automatic transmission fluid ESW-M2C33-F or equivalent. **Do not use power steering fluid. Do not overfill reservoir.**

**Pump Belt Check**

Replace and adjust broken, glazed, or worn pump belts. Refer to Section 13-51 for adjustment procedures.

**Fluid Leak Check**

1. With engine idling, turn steering wheel left to right several times. Check all possible leakage points.
2. Tighten all loose fittings to specification. Do not over-tighten, as damage will occur. Replace damaged lines, plastic seals and O-rings.

**Turning Effort Check**

Ensure front wheels are properly aligned and tire pressures correct before checking turning effort.

1. Park vehicle on dry concrete, and set parking brake.
2. Idle engine for two to three minutes. Turn steering wheel to the left and right several times to warm fluid to 43-49°C (110-120°F).
3. With engine running, attach a pull scale to rim of steering wheel. Measure pull required to turn wheel one complete revolution in each direction. Refer to chart at end of this Section for acceptable measurements.

**Pump Flow and Pressure Tests**

Before performing pump flow and pressure test, the following checks for conditions which could cause loss of power assist must be performed, and corrective action must be taken if necessary.

1. Check pump reservoir for proper fluid level.
2. Check tires for correct air pressure.
3. Check pump belt for proper tension.

4. Check pump for correct model and vehicle application.
5. Check for correct size pulleys on pump and engine.
6. Check entire system for damage. Replace parts, if necessary.

If the above items are to specification or have been corrected and the loss of assist still exists, test power steering pump flow and pressure to determine whether the trouble is in the pump, power steering gear or hoses.

**Test Equipment**

1. Engine tachometer.
2. Thermometer: -17.8 to 148.9°C (0 to 300°F).
3. Rotunda Power Steering System Analyzer 014-00207 or equivalent.
4. Set of adapter fittings.

The test procedure used in conjunction with the Rotunda Power Steering System Analyzer provides a method for checking the complete power steering system. This analyzer can be used to determine the cause of hard steering and/or lack of assist problems.

The analyzer provides readouts for the following:

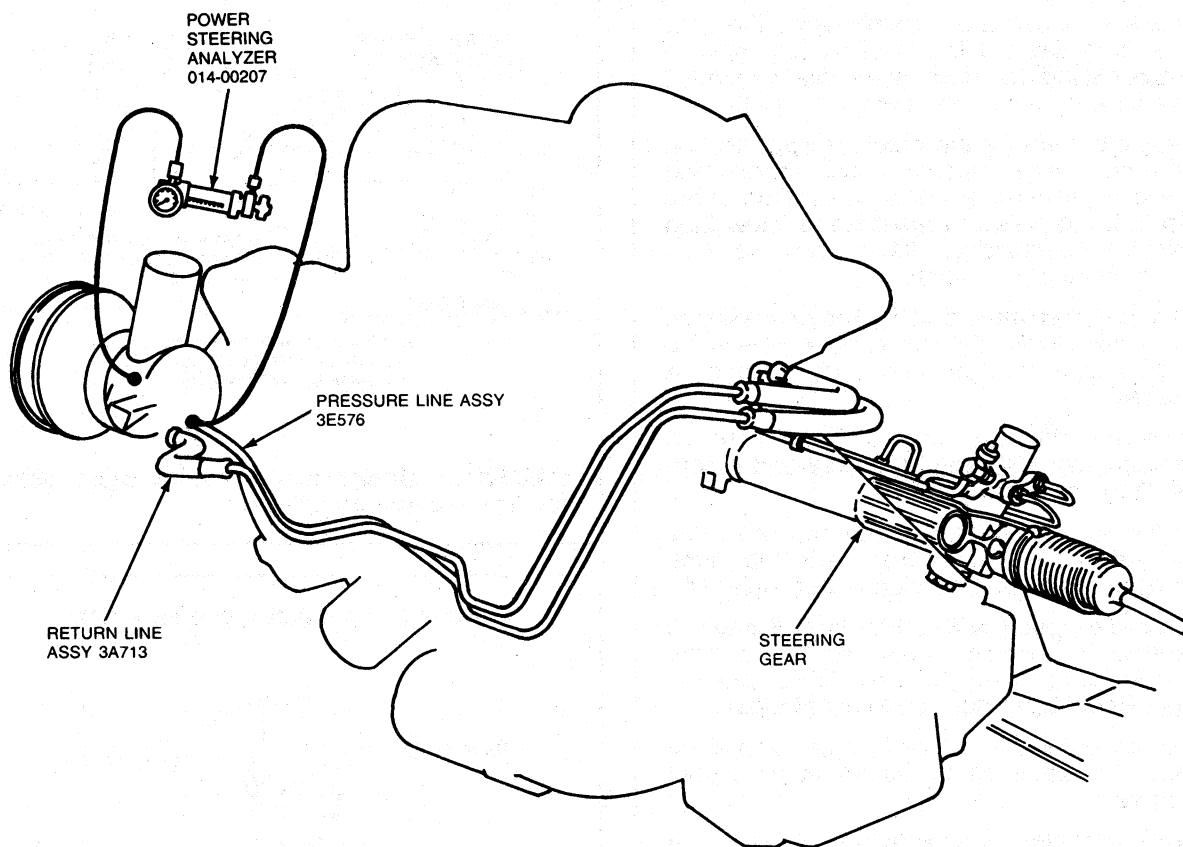
- System Backpressure.
- Pump Flow.
- Steering Gear Internal Leakage.
- Power Steering Pump Relief Pressure.

The interpretation of the above readouts will determine which of the following conditions or components are the cause of the problem:

- a. Restriction in Hoses or Fittings.
- b. Sticking Gear Valve.
- c. Insufficient Pump Capacity.
- d. Sticking Relief Valve.
- e. Binding in Suspension.

**TESTING (Continued)****Test Procedure**

1. Loosen power steering line bracket at rear of engine.
2. Disconnect the high-pressure line from the pump and connect it into the appropriate hose adapter of the analyzer.
3. Thread the other analyzer adapter into pump.
4. Connect analyzer hoses to adapters. Tighten both connections to 20 N·m (15 lb-ft) maximum.



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5. Add power steering fluid to the pump, if required. Start the engine and run it for approximately two minutes **with the idle set to specification**.
  6. Record the following:
    - a. Flow: liters/min (gallons/min) at  $78^{\circ} \pm 2^{\circ}\text{C}$  ( $172^{\circ} \pm 5^{\circ}\text{F}$ ).
    - b. Pressure: psi at  $78^{\circ} \pm 2^{\circ}\text{C}$  ( $172^{\circ} \pm 5^{\circ}\text{F}$ ) at idle with the gate valve fully open.
- If flow is below 5.7 liters/min (1.5 gallons/min), the pump may require service. However, at this point continue the diagnosis. Check flow and relief pressure against the model pump being tested.
  - If pressure is above 1034 kPa (150 psi), check hoses for restrictions.

**POWER STEERING PUMP SPECIFICATIONS**

Engine	Pump Model	Minimum Flow @ 5100 kPa (740 psi)*		Minimum Relief Pressure		Maximum Relief Pressure		Maximum Free Flow @ 1500 RPM	
		Liters/Minute 78°C (172°F)	Gallons/Minute 78°C (172°F)	kPa	PSI	kPa	PSI	Liters/Minute	Gallons/Minute
2.5L/3.0L	HBC-GF	3.4	.9	8270	1200	10200	1480	9.8	2.6
3.8L Police	HBC-GE	3.4	.9	8960	1300	10550	1530	9.8	2.6

\*NOTE: Flow depends on pump model, engine RPM and pulley drive ratio. Engine idle RPM must be set to specification when checking pump minimum flow capacity.

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**TESTING (Continued)**

7. Partially close the gate valve to build up 5100 kPa (740 psi). Observe and record flow, liters/min (gallons/min) at  $78^{\circ} \pm 2^{\circ}\text{C}$  ( $172^{\circ} \pm 5^{\circ}\text{F}$ ).

If flow drops to a level lower than the value, disassemble the pump and replace the cam pack. If the pressure plates are cracked or worn, replace them. Continue with diagnosis.

8. Completely close and partially open the gate valve three times. (Do not allow the valve to remain closed for more than five seconds.) Observe and record pressure, kPa (psi).

Check the chart for the pressure specification listed for the applicable pump model and vehicle application. Refer to illustration under Step 6. If the pressure recorded is lower than minimum specification listed, replace flow control valve in the pump.

If the pressure recorded is above maximum specification listed, the flow control valve in the pump should be removed and cleaned or replaced.

9. Increase engine speed from idle to approximately 1500 rpm. Observe and record flow, liters/min (gallons/min).

If flow exceeds the maximum free flow specified, the flow control valve in the pump should be removed and cleaned or replaced.

10. Check idle speed and set to specification, if necessary. With the engine at idle, turn (or have someone turn) steering wheel to the LH and RH stops. Record pressure and flow at stops.

Pressure developed at both stops should be nearly the same as maximum pump output pressure.

At the same time, flow should drop below 1.9 liters/min (0.5 gallon/min). If the pressure does not reach maximum output or the flow does not drop below 1.9 liters/min (0.5 gallon/min), excessive internal leakage is occurring. Remove and disassemble steering gear. Replace damaged or broken parts. Pay particular attention to rack piston and valve seals for damage.

11. Turn (or have someone turn) steering wheel slightly in both directions, and release quickly while watching the pressure gauge. The needle should move from the normal backpressure reading and snap back as the wheel is released. If it comes back slowly or sticks, the rotary valve in steering gear is sticking.

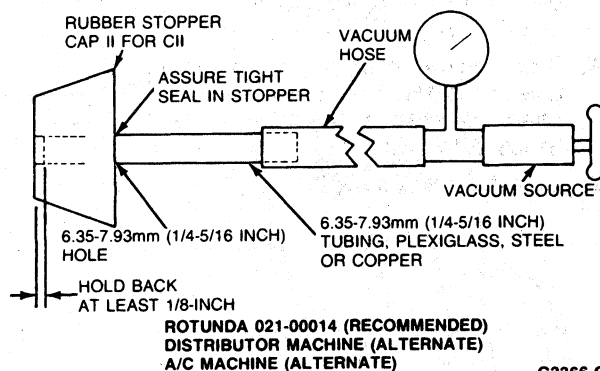
12. Remove, disassemble and clean the steering gear. Refer to Section 13-46 for disassembly. Also, flush power steering hoses and power steering pump before installing steering gear.

NOTE: If problem still exists, check ball joints and linkage. Refer to Diagnosis.

13. Disconnect and remove analyzer and connect lines.
14. Secure pressure line bracket at engine.

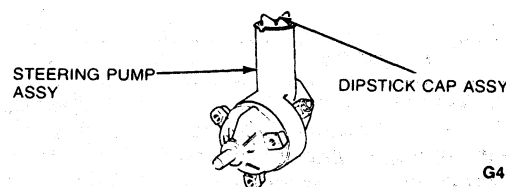
**Purging Power Steering System of Air**

Air trapped in power steering system, which causes a whine or moan-type noise, can be removed by using a power steering pump air evacuator assembly (devac tool). Fabricate as shown, or use Rotunda Vacuum Tester 021-00014 or equivalent.



**CAUTION:** Under no circumstances should engine vacuum be utilized.

1. Remove pump dipstick cap assembly.



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2. Check and fill pump reservoir with Motorcraft Type F automatic transmission fluid ESW-M2C33-F or equivalent to the COLD FULL mark on pump dipstick.
3. Disconnect ignition coil wire and raise front wheels off floor.
4. Crank engine with starter motor, and check fluid level. Do not turn steering wheel at this time.
5. Refill pump reservoir to COLD FULL mark on dipstick. Crank engine with starter motor while cycling steering wheel lock-to-lock. Check fluid level.
6. Tightly insert rubber stopper of the air evacuator assembly into pump reservoir fill neck. Install coil wire.
7. Apply 51 kPa (15 in.-Hg) maximum vacuum on pump reservoir for a minimum of three minutes with engine idling. As air purges from system, vacuum will fall off; maintain adequate vacuum with vacuum source.
8. Release vacuum and remove vacuum source. Refill reservoir to COLD FULL mark.



**TESTING (Continued)**

9. With engine idling, apply 51 kPa (15 in.-Hg) vacuum to pump reservoir. Cycle steering wheel slowly from lock-to-lock every 30 seconds for approximately five minutes. Do not hold steering wheel on stops while cycling. Maintain adequate vacuum with vacuum source as air purges.
10. Release vacuum, and remove vacuum equipment. Add additional fluid if necessary. Install dipstick.
11. Start engine and cycle steering wheel slowly. Check for oil leaks at all connections. In severe cases of aeration, it may be necessary to repeat Steps 5 through 10.
12. Lower front wheels.

**Start-Up Procedure**

After steering pump or gear overhaul, follow these steps to eliminate excessive steering system noise due to air trapped in the system during service:

1. Disconnect ignition coil wire.
2. Fill reservoir and raise front wheels off floor.
3. Crank engine with starter, and add fluid until level remains constant.
4. While cranking the engine, rotate steering wheel from lock-to-lock. **Front wheels must be off the floor during lock-to-lock rotation of steering wheel.** Check the fluid level, and add fluid if necessary.
5. Attach ignition coil wire and lower front wheels.
6. Start the engine, and allow it to run for several minutes.
7. Rotate steering wheel from lock-to-lock.
8. Turn engine off, and check fluid level. Add fluid if necessary.
9. Devac if air is still present.

**DIAGNOSIS**

Drive vehicle to determine exactly what condition exists. Check the steering system diagnostic charts and service as required.

**STEERING SYSTEM**

CONDITION	POSSIBLE SOURCE	ACTION
Front End Wander is a condition where the vehicle wanders back and forth on the roadway when it is driven straight ahead while the steering wheel is held in a firm position.	• Check tire size and pressure (front and rear).	• Be sure tire sizes are correct, and adjust tire pressures.
	• Check if vehicle is unevenly or excessively loaded.	• Adjust load.
	• Loose tie rod ends.	• Replace tie rod end assembly. Refer to Section 13-46.
	• Gear assembly loose on sub-frame.	• Tighten mounting bolts to specification. Refer to Section 13-46.
	• Loose suspension struts or ball joint(s).	• Tighten strut mounting bolts or replace ball joint(s). Refer to Section 14-10.
	• Column intermediate shaft connecting bolts loose.	• Tighten to specification at gear and column. Refer to Section 13-04.
	• Column intermediate shaft universal joints loose/worn.	• Replace intermediate shaft assembly.
	• Improper toe adjustment.	• Adjust as required.
	• Loose tie rod inner ball joints.	• Check ball housing torque. Refer to Section 13-46.

## DIAGNOSIS (Continued)

## STEERING SYSTEM — Continued

CONDITION	POSSIBLE SOURCE	ACTION
<ul style="list-style-type: none"> <li>● Pulls to One Side is a condition where the vehicle tends to pull to one side when driven on a level surface.</li> </ul>	<ul style="list-style-type: none"> <li>● Improper tire pressure.</li> <li>● Improper tire size or different type.</li> <li>● Vehicle is unevenly or excessively loaded.</li> <li>● Improper toe adjustment.</li> <li>● Damaged front suspension components.</li> <li>● Damaged rear suspension components.</li> <li>● Steering gear valve effort out of balance (Power Steering only).</li> <li>● Check front and rear brakes for proper operation.</li> <li>● Check for damaged or sagging springs on front and/or rear suspension.</li> <li>● Check rear suspension for loose/worn shock absorber struts or suspension arm attaching fasteners.</li> <li>● Bonded rubber outer tie rod ends not installed properly.</li> </ul>	<ul style="list-style-type: none"> <li>● Adjust tire pressure.</li> <li>● Replace as required.</li> <li>● Adjust load.</li> <li>● Adjust toe as required.</li> <li>● Refer to Section 14-10 for replacement.</li> <li>● Refer to Section 14-32 for replacement.</li> <li>● Place transmission in Neutral while driving and turn engine off (coasting). If vehicle does not pull with the engine off, replace the steering gear valve assembly. Refer to Section 13-46.</li> <li>● If vehicle does drift with engine off: <ul style="list-style-type: none"> <li>— Cross-switch front tire/wheel assemblies.</li> <li>— If vehicle pulls to opposite side, cross-switch tire/wheel assemblies that were on the rear to same side on the front.</li> <li>— If vehicle pull direction is not changed, check front suspension components and toe adjustment.</li> </ul> </li> <li>● Adjust if necessary.</li> <li>● Replace if necessary.</li> <li>● Replace shocks and/or tighten all attaching fasteners to torque specification.</li> <li>● Remove outer tie rod ends from front knuckle and install by aiming front wheels straight ahead and connect outer tie rod end to front knuckle.</li> </ul>

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**DIAGNOSIS (Continued)****STEERING SYSTEM — Continued**

CONDITION	POSSIBLE SOURCE	ACTION
Feedback (Rattle, chuckle, squeak, knocking noises in steering gear) is a condition where roughness is felt in the steering wheel by the driver when the vehicle is driven over rough pavement.	• Column intermediate shaft universal joints loose/worn.	• Replace intermediate shaft assembly.
	• Loose tie rod, end(s) and/or tie rod inner ball joints. Lack of lube in inner ball joint.	• Replace tie rod end(s) and/or tie rod assemblies. Refer to Section 13-46.
	• Gear assembly loose on sub-frame.	• Tighten mounting bolts to specification. Refer to Section 13-46.
	• Column intermediate shaft connecting bolts loose.	• Tighten bolts to specification at gear and column. Refer to Section 13-04.
	• Loose suspension bushings/fasteners or ball joints.	• Tighten suspension fasteners, replace worn bushings, or replace ball joints. Refer to Section 14-10.
	• Check column conditions.	• Refer to Section 13-04.
Poor Returnability-Sticky Feel is a condition noticed when the steering fails to return to center following a turn without manual effort from the driver. In addition, when the driver returns the steering wheel to center, it may have a sticky or catchy feel.	• Improper tire pressure.	• Adjust tire pressures.
	• Improper tire size or different type.	• Replace as required.
	• Column flange rubbing steering wheel and/or flange.	• Refer to Section 13-04.
	• Column intermediate shaft universal joints binding.	• Replace intermediate shaft assembly. Refer to Section 13-04.
	• Check for boot tears and/or evidence of binding or damage to tie rod ends or ball joints.	• Replace as necessary. Refer to Section 13-46.
	• Improper toe adjustment.	• Adjust toe as required. Refer to Section 14-01.
	• Column bearing binding.	• Replace bearing. Refer to Section 13-04.
	• Contamination in system.	• Flush power steering system. Refer to Section 13-01.

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**CLEANING AND INSPECTION****Steering Gear, Power**

Refer to Section 13-46 for disassembly.

**Cleaning**

1. Use a clean work bench and tools.
2. Clean the exterior of the gear with solvent. If necessary, drain off excess hydraulic fluid.
3. Handle parts carefully to avoid nicks, burrs, scratches and dirt. Do not use solvent on seals.

**Inspection**

1. Inspect input shaft bearing. Check fit of bearing on input shaft. Replace bearing if necessary.
2. Inspect valve housing for wear, scoring or burrs.
3. Check fluid passages for obstruction or leakage.
4. Inspect gear housing for cracks and stripped threads and mating surfaces for burrs. Inspect piston bore for scoring or wear. If necessary, replace housing.
5. Ensure input shaft bearing rotates freely.
6. Inspect piston rack-and-pinion shaft teeth for nicks and burrs.

**CLEANING AND INSPECTION (Continued)****Steering System, Power—Flushing**

Always flush power steering gear when replacing pump due to fluid contamination.

1. Disconnect fluid return hose at pump and place end in a container and plug return hose nipple on reservoir.
2. Fill reservoir with Motorcraft Type F automatic transmission fluid ESW-M2C33-F or equivalent.
3. Disconnect ignition coil wire, and raise front wheels off floor.
4. While adding approximately 1.89 liters (.5 gallon) of fluid, turn ignition to START position (using the ignition key), and crank engine with starter while turning steering wheel from lock-to-lock.
5. When all fluid has been added, turn ignition off and attach coil wire.
6. Remove plug from the reservoir return hose nipple. Attach return hose to nipple.
7. Check fluid level. Add fluid if necessary. **Do not overfill reservoir.**
8. Lower vehicle.
9. Start engine and turn steering wheel slowly from stop-to-stop several times. Check fluid level and adjust as required.

**Steering Pump, Power—Flushing**

If dirt is found in power steering gear, flush pump as follows:

1. Ensuring all other hoses are connected, disconnect pressure hose at gear.
2. Place end of hose in a container.
3. Fill reservoir with Motorcraft Type F automatic transmission fluid ESW-M2C33-F or equivalent.
4. Disconnect ignition coil wire.
5. While adding approximately 1.89 liters (.5 gallon) of fluid, turn ignition to START position and crank engine with starter. As soon as all fluid has been added, turn ignition off.
6. Attach pressure hose at gear.
7. Check fluid level.
8. Attach coil wire.
9. Start engine and turn steering wheel slowly from side to side to expel any air trapped in the system. Check and adjust fluid level.

**Steering Pump, Power****Cleaning**

Wash all parts except seals in a chlorinated solvent, and dry with compressed air.

**Inspection**

To determine when to replace power steering pump components, follow these guidelines. **Some components must be replaced regardless of condition.**

1. Reuse outlet fitting if corners are not rounded and threads are intact.
2. Replace all seals except the rotor shaft seal. Do not remove rotor shaft seal if it does not leak.
3. Reuse reservoir assembly if O-ring surfaces are not damaged.
4. Reuse housing or housing assembly if O-ring and snap ring surfaces are not damaged.
5. Reuse upper and lower pressure plates if there is no scoring on wear surface. Polish phosphate coating, if necessary, but do not remove it.
6. Reuse rotor and cam assembly if wear is limited to removal of phosphate coating on cam contour. Do not disassemble unit. Push rotor part-way through cam insert, being careful not to dislodge slippers and springs. Check cam ID for scoring or burring. Check rotor faces and OD for scoring and chipping.

**Do not service or refinish the upper and lower pressure plates, cam or rotor assembly. If wear or burring is evident, replace them with new components.**

7. Install a new rotor and cam assembly if slippers are worn. Replace springs if they are bent or broken.
8. Reuse rotor shaft if thrust faces, bushing diameter, and shaft seal diameter are not excessively worn or scored.
9. Reuse housing and bushing assembly if all threaded holes are not damaged beyond service, and bushing diameter is not scored or worn 0.01mm (.0005-inch) over 18mm (.6897-inch) maximum. Service threaded holes by drilling out the damaged threads and installing helicoil inserts. If bushing is scored or excessively worn, install a new housing and bushing assembly.
10. Reuse valve body if valve bore is free of nicks and scoring. Valve must fall freely in valve bore. Replace valve housing and/or valve if valve sticks in bore.

## SPECIFICATIONS

## STATIC STEERING WHEEL TURNING EFFORT

Vehicle	Power
Taurus/Sable	9.0 lbs.

CG4164-A

## POWER STEERING RELIEF PRESSURE

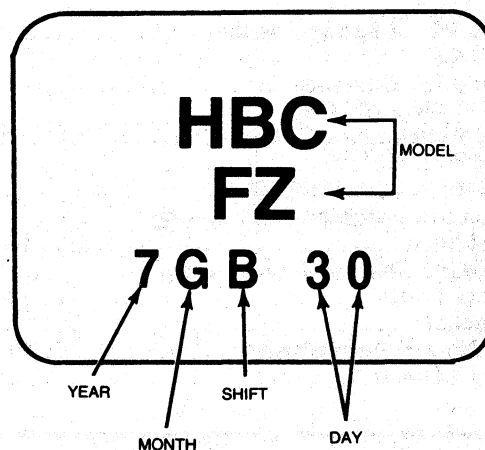
Vehicle	Min. Relief Pressure	
	kPa	psi
Taurus/Sable 2.5L/3.0L	8270	1200
Taurus Police 3.8L	8960	1300

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## POWER STEERING PUMP MODEL IDENTIFICATION

THE POWER STEERING PUMPS HAVE A SERVICE IDENTIFICATION TAG TO IDENTIFY ASSEMBLIES FOR SERVICE PURPOSES. TAGS CONTAIN INFORMATION AS SHOWN BELOW.

TAG LOCATION: ON RESERVOIR BODY



CG4166-B

## SPECIAL SERVICE TOOLS

## ROTUNDA EQUIPMENT

Model	Description
014-00207	Power Steering System Analyzer
021-00014	Vacuum Tester

CG2993-E

# SECTION 13-04 Steering Column

SUBJECT	PAGE	SUBJECT	PAGE
<b>ADJUSTMENTS</b>		<b>DISASSEMBLY AND ASSEMBLY (Cont'd.)</b>	
Steering Wheel Spoke Position .....	13-04-3	Steering Shaft and/or Steering Shaft	
<b>DESCRIPTION</b>		Lower Bearing .....	13-04-36
Fixed and Tilt Columns .....	13-04-1	Tilt Lock Lever and/or Tilt Lever Release	
<b>DIAGNOSIS AND TESTING</b>		Cable .....	13-04-33
Ignition Switch .....	13-04-3	<b>REMOVAL AND INSTALLATION</b>	
Steering Column .....	13-04-5	Ignition Lock Cylinder Assembly .....	13-04-18
<b>DISASSEMBLY AND ASSEMBLY</b>		Multi-function Switch .....	13-04-15
Ignition Lock Actuator and Steering		Shaft Bearing, Upper—Fixed and Tilt	
Wheel Lock .....	13-04-36	Column .....	13-04-15
Intermediate Shaft and/or Steering		Steering Column .....	13-04-9
Column Boots .....	13-04-39	Steering Wheel .....	13-04-9
Shift Socket .....	13-04-36	<b>SPECIFICATIONS</b> .....	13-04-40
Speed Control Horn Brush .....	13-04-38	<b>VEHICLE APPLICATION</b> .....	13-04-1
Steering Column .....	13-04-19		

## VEHICLE APPLICATION

Taurus/Sable.

## DESCRIPTION

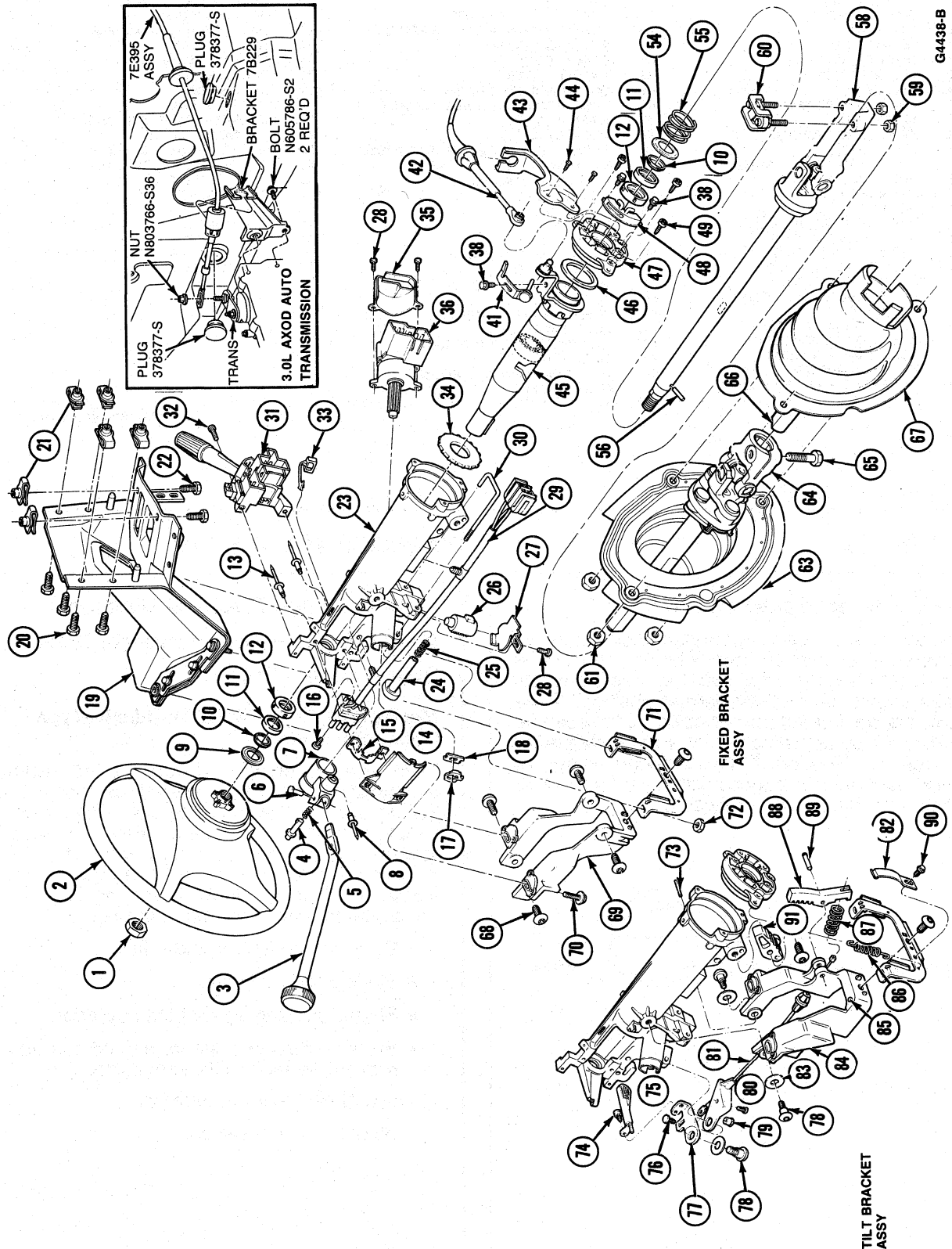
NOTE: All fasteners are important parts in that they could affect the performance of vital parts and systems, and/or could result in major service expenses. They must be replaced with fasteners of the same part number if replacement becomes necessary. Do not use a replacement part of lesser quality or substitute design. Torque values must be used as specified during assembly to ensure proper function to these parts.

## Fixed and Tilt Columns

The column is of a modular construction and features easy-to-service electrical switches. The multi-function switch combines the turn signal, headlamp dimmer, flash-to-pass, cornering lamps, hazard warning, windshield wiper switching and windshield washer into one switch body. Refer to Section 32-42 for multi-function switch service.

## DESCRIPTION (Continued)

## Steering Column, Fixed—Exploded View



## DESCRIPTION (Continued)

- |                                |                                     |                                       |
|--------------------------------|-------------------------------------|---------------------------------------|
| 1. NUT N803843 — S100          | 31. TURN SIGNAL 13K359              | 69. FIXED BRACKET ASSY 3B140          |
| 2. WHEEL 3600                  | 32. SCREW 52794 2 REQ'D             | 70. SCREW/WASHER ASSY N804140 2 REQ'D |
| 3. SHIFT LEVER 7202            | 33. WIRE RETAINER 14A163            | 71. BRACKET 3B632                     |
| 4. PLUNGER 7361                | *34. BEARING 3K618                  | 72. NUT N621939 2 REQ'D               |
| 5. SPRING 7B071                | 35. COVER 3F714                     | 73. PIN SERVICED IN 3F643             |
| 6. PIN 7G357                   | 36. IGNITION SWITCH 11572           | 74. SCREW N802953                     |
| 7. SOCKET 7228                 | 38. SCREW N804444 — S2 — 3 REQ'D    | 75. HANDLE SHANK ASSY 3F609           |
| 8. RIVET 380098                | 41. ACTUATOR 2B624                  | 76. BOLT N804087                      |
| 9. SPACER 3D640                | 42. CABLE 7E395                     | 77. BRACKET 3D544                     |
| 10. RING 3L539                 | 43. BRACKET 7E364                   | 78. BOLT N804088                      |
| 11. BEARING ASSY 3517          | 44. SCREW N605771 2 REQ'D           | 79. NUT N804084                       |
| 12. SLEEVE 3518                | 45. TUBE AND BEARING ASSY 3K521     | 80. SCREW 390345                      |
| 13. RIVET SERVICED IN 3F643    | 46. WASHER 3C708                    | 81. BRACKET/CABLE ASSY 3F700          |
| *14. COVER 3A673               | 47. RETAINER 3E738                  | 82. SPRING 3D655                      |
| 15. INSERT SERVICED IN 3F643   | 48. PARKING BRAKE REL. SWITCH 2B623 | 83. WASHER N804085 3 REQ'D            |
| 16. SCREW N804445 — S2         | 49. 3 SCREW ATTACH RETAINER         | 84. TILT BRACKET ASSY 3B140           |
| 17. RETAINER 3F579             | TO COLUMN N804130                   | 85. BUMPER 3D656                      |
| 18. BEARING 3E700              | 54. SPACER 3D672                    | 86. SPRING 3D655                      |
| 19. SUPPORT BRACKET ASSY 3B139 | 55. SPRING 3C674                    | 87. SPRING 3D655                      |
| 20. BOLT N605905 4 REQ'D       | 56. PIN 3E718                       | 88. LEVER 3B662                       |
| 21. NUT N804132 6 REQ'D        | 58. SHAFT ASSY 3E729                | 89. PIN N804090                       |
| 22. BOLT N605905 2 REQ'D       | 59. NUT N620457 2 REQ'D             | 90. SCREW N804409 7 TOTAL REQ'D       |
| 23. HOUSING ASSY 3F643         | 60. PLATE ASSY 3C088                | 91. LOCATOR 3F716                     |
| *24. KEY RELEASE KNOB 3F531    | 61. NUT N804795-S2 3 REQ'D          |                                       |
| *25. SPRING 3E696              | 63. BOOT 3E735                      |                                       |
| 26. ACTUATOR ASSY 3E723        | 64. INTERMEDIATE SHAFT              |                                       |
| 27. ACTUATOR COVER 3E745       | 65. BOLT N803942                    |                                       |
| 28. BOLT N804089 3 REQ'D       | 66. STEERING GEAR INPUT SHAFT       |                                       |
| 29. BRUSH ASSY 9C899           | 67. BOOT 3E735                      |                                       |
| *30. KEY RELEASE LEVER 3F528   | 68. TORX BOLT N804086 5 REQ'D       |                                       |
|                                | ALSO 2 REQ'D                        |                                       |

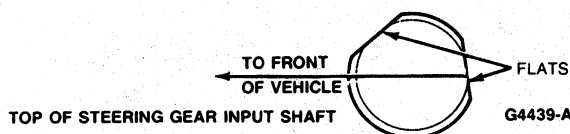
\*FLOOR SHIFT ONLY

G4066-B

## ADJUSTMENTS

## Steering Wheel Spoke Position

When the flats on the steering gear input shaft are positioned as shown, the front wheels should be in the straight-ahead position and the steering wheel spokes should be in their normal position. If the spokes are not in their normal position, they can be repositioned by adjusting the tie rods or adjusting toe. Refer to Section 14-01. Steering wheel 12 o'clock mark must be aligned with steering shaft 12 o'clock mark when toe is adjusted.



## DIAGNOSIS AND TESTING

## Ignition Switch Electrical Diagnosis

## Continuity Test—Blade Terminal—Type

Refer to Section 31-20.

## Mechanical Test—Blade Terminal—Type Connector Switch

Test the steering column ignition system mechanical operation by rotating the lock cylinder/key through all switch positions. The movement should feel smooth without sticking or binding. The ignition system should return from the START position back to the RUN position without assistance (spring return). If sticking or binding is encountered, check for the following:

- Burrs on the lock cylinder key.
- Binding lock cylinder.
- Shroud rubbing against lock cylinder.
- Burrs or foreign material around the actuator rack in the lock cylinder housing.
- Insufficient lube on actuator.
- Binding ignition switch.



## DIAGNOSIS AND TESTING (Continued)

## IGNITION SWITCH MECHANICAL DIAGNOSIS

CONDITION	POSSIBLE SOURCE	ACTION
<ul style="list-style-type: none"> <li>• High key efforts.</li> </ul>	<ul style="list-style-type: none"> <li>• Damaged lock cylinder.</li> <li>• Shrouds mis-aligned.</li> <li>• Casting/actuator binds, sticks, grabs, with key rotation.</li> <li>• Damaged ignition switch.</li> </ul>	<ul style="list-style-type: none"> <li>• Lubricate cylinder and check for burrs on key. If effort is still excessive, replace lock cylinder.</li> <li>• Align shroud to fit properly.</li> <li>• If improper fit between casting and actuator exists, replace parts.</li> <li>• If burrs are found on actuator surfaces which contact the casting during key travel, gently file these surfaces until smooth. At no time attempt to file teeth of actuator.</li> <li>• If serious burrs are found on casting surface which contact actuator during key travel, replace the casting.</li> <li>• If actuator teeth show excessive wear or are burred, replace actuator.</li> <li>• Assemble lock housing assembly taking care to thoroughly lube all internal components and check key efforts. If still high, replace lock housing assembly.</li> <li>• Replace the ignition switch.</li> </ul>
<ul style="list-style-type: none"> <li>• Key release mechanism is hard to activate.</li> </ul>	<ul style="list-style-type: none"> <li>• Key release rod bent.</li> </ul>	<ul style="list-style-type: none"> <li>• If problem is not severe, try to manually straighten rod.</li> <li>• Test operation of key release mechanism.</li> <li>• If operation is poor, replace entire rod assembly.</li> </ul>

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**DIAGNOSIS AND TESTING (Continued)****Steering Column**

Refer to the charts for steering column diagnosis.

**STEERING COLUMN DIAGNOSIS**

<b>CONDITION</b>	<b>POSSIBLE SOURCE</b>	<b>ACTION</b>
<ul style="list-style-type: none"> <li>● Squeak, moan when steering wheel turned.</li> </ul>	<ul style="list-style-type: none"> <li>● Gear rolled up or down allowing input shaft or pinch bolt to contact boot.</li> </ul>	<ul style="list-style-type: none"> <li>● Reposition rack and pinion to proper position and/or reposition boot. Refer to Section 13-32 or 13-46.</li> </ul>
<ul style="list-style-type: none"> <li>● Engine Compartment noise, fumes, heat, vapors and/or water and liquids enter passenger compartment.</li> </ul>	<ul style="list-style-type: none"> <li>● Foam ring distorted leaving gap to lower shaft.</li> <li>● Foam ring missing.</li> <li>● Boot attaching nuts missing.</li> <li>● Boot mispositioned.</li> <li>● Dash absorber under boot sealing surface.</li> <li>● Dash panel surface deformed.</li> <li>● Boot missing.</li> <li>● Boot cut or torn.</li> <li>● Improper assembly of power steering isolator plastic sleeve.</li> </ul>	<ul style="list-style-type: none"> <li>● Replace boots with visual gaps. Realign gear and/or boot to specifications. If problem isn't resolved, replace boot.</li> <li>● Replace boot.</li> <li>● Install nuts.</li> <li>● Reposition boot.</li> <li>● Reposition absorber under gap-hinder lip.</li> <li>● Replace rope caulk on sealing surface of boot.</li> <li>● Install new boot.</li> <li>● Install new boot.</li> <li>● Replace boot.</li> </ul>

**CG4441-B**

## DIAGNOSIS AND TESTING (Continued)

## STEERING COLUMN DIAGNOSIS — Continued

CONDITION	POSSIBLE SOURCE	ACTION
<ul style="list-style-type: none"> <li>● Rubbing noise.</li> </ul>	<ul style="list-style-type: none"> <li>● Intermediate Shaft Area               <ul style="list-style-type: none"> <li>● Boot mispositioned on intermediate shaft.</li> <li>● U-joint bearings damaged or contaminated.</li> </ul> </li> <li>● Lower Column Area               <ul style="list-style-type: none"> <li>● Contamination in column tube.</li> <li>● Damaged, fractured bearing or retainer.</li> </ul> </li> <li>● Upper Column Area               <ul style="list-style-type: none"> <li>● Wheel rubbing on shroud.</li> <li>● Damaged upper bearing sleeve, lock housing or retainer.</li> </ul> </li> <li>● Contamination in column assembly.</li> <li>● Damaged bearing.</li> <li>● Damaged outer tube shaft or components.</li> </ul>	<ul style="list-style-type: none"> <li>● Install properly.</li> <li>● Replace intermediate shaft.</li> <li>● Remove foreign matter.</li> <li>● Replace bearing and retainer.</li> <li>● Install shroud to proper location.</li> <li>● Remove shroud and check for proper installation of lock housing, upper bearing and sleeve, upper bearing retainer plate and upper bearing snap ring. Install as required.</li> <li>● Remove foreign matter.</li> <li>● Replace bearing.</li> <li>● Replace shaft, lock housing or outer tube.</li> </ul>

CG4442-A

## DIAGNOSIS AND TESTING (Continued)

## STEERING COLUMN DIAGNOSIS — Continued

CONDITION	POSSIBLE SOURCE	ACTION
<ul style="list-style-type: none"> <li>• Rattles, loose steering.</li> </ul>	<ul style="list-style-type: none"> <li>• Intermediate Shaft Area               <ul style="list-style-type: none"> <li>• Improper boot assembly.</li> <li>• Improper interference fit between plastic collar and intermediate shaft.</li> <li>• Bearing seals missing.</li> <li>• Improper or over tightened clamp nut.</li> <li>• Excessive universal joint lash.</li> <li>• Power steering isolator rubber bond separation.</li> </ul> </li> <li>• Lower Column Area               <ul style="list-style-type: none"> <li>• Loose intermediate shaft to column or column to support attachment.</li> <li>• Improper assembly or bearing out of specification.</li> </ul> </li> <li>• Upper Column Area               <ul style="list-style-type: none"> <li>• Improper shroud assembly.</li> <li>• Column to support bracket loose.</li> <li>• Loose shaft to upper bearing.</li> <li>• Loose upper bearing to lock housing or missing sleeve.</li> <li>• Lock housing assembly.</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• Install and tighten screws.</li> <li>• Install to proper location. Replace if necessary.</li> <li>• Replace intermediate shaft.</li> <li>• Install properly and tighten clamp.</li> <li>• Replace intermediate shaft.</li> <li>• Replace intermediate shaft.</li> <li>• Tighten attachments.</li> <li>• Replace bearing or sleeve and retainer.</li> <li>• Install and tighten shroud.</li> <li>• Tighten attachment.</li> <li>• Replace bearing or shaft.</li> <li>• Replace sleeve, bearing, or lock housing.</li> <li>• Replace parts as required.</li> </ul>

CG4443-A

**DIAGNOSIS AND TESTING (Continued)****STEERING COLUMN DIAGNOSIS — Continued**

CONDITION	POSSIBLE SOURCE	ACTION
<ul style="list-style-type: none"> <li>● Binding/Heavy Effort/No Returnability/Column Grounded/Sticks/Binds/Grabs</li> </ul>	<ul style="list-style-type: none"> <li>● Improper installation of dash boot.</li> <li>● Improper assembled universal joint.</li> <li>● Improper adjustment at intermediate shaft to steering column connection.</li> <li>● Upper column.</li> </ul>	<ul style="list-style-type: none"> <li>● Reposition boot.</li> <li>● Replace intermediate shaft.</li> <li>● Loosen clamp between steering and intermediate shafts. Rotate steering wheel one revolution in both directions. Tighten clamps.</li> <li>● Remove column and check column for binding while disconnected from intermediate shaft.</li> </ul> <p>If it binds:</p> <ul style="list-style-type: none"> <li>A. Remove column shaft and check it for straightness — replace shaft.</li> <li>B. Check upper and lower bearing for ease of rotation — replace.</li> <li>C. Check for foreign matter in column — remove foreign matter.</li> <li>D. Check for contact of shaft to other components — replace parts required.</li> </ul>

**CG4444-A**

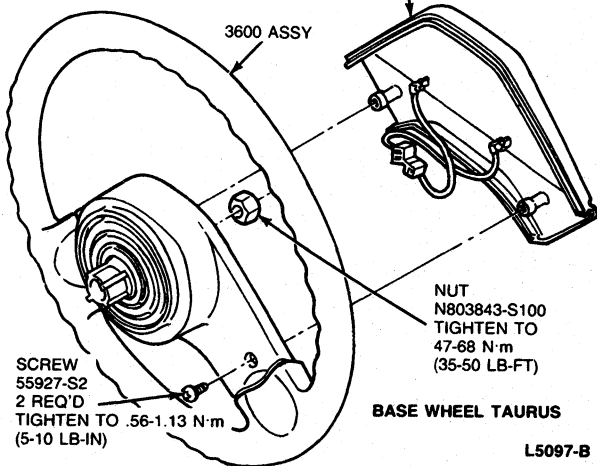
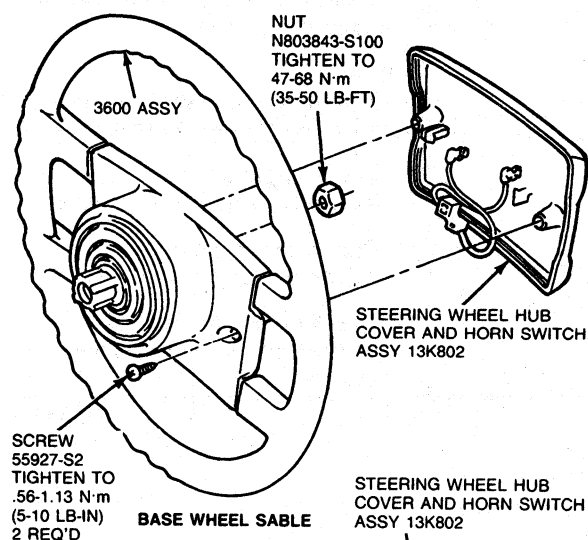
## REMOVAL AND INSTALLATION

NOTE: For Removal and Installation of the horn blow pad and switch refer to Section 35-80.

### Steering Wheel

#### Removal

1. Disconnect battery ground cable.
2. Remove steering wheel horn pad cover by removing two screws from back of steering wheel.



3. Remove and discard steering wheel attaching nut.
4. Remove steering wheel from upper shaft by grasping rim of steering wheel and pull off. Do not use a steering wheel puller.

For vehicles with speed control system, refer to Section 37-05.

#### Installation

1. Position steering wheel on end of steering wheel shaft. Align mark on steering wheel with mark on shaft to ensure straight-ahead steering wheel position corresponds to straight-ahead position of front wheels.

**CAUTION:** The multi-function switch lever must be in **NEUTRAL** position before installing steering wheel or damage to the switch cam may result.

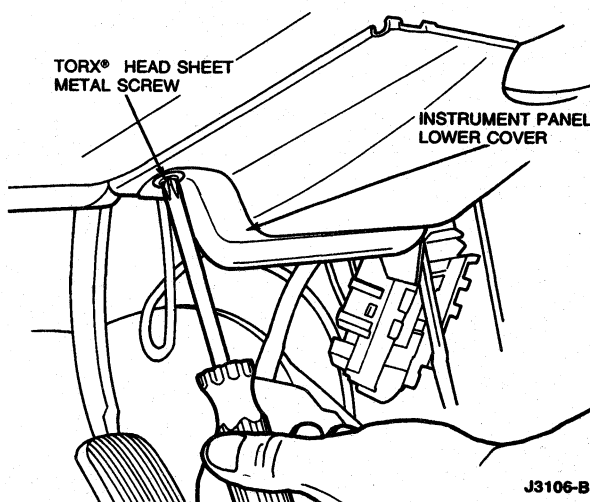
2. Install new service wheel nut. Tighten nut to 47-68 N·m (35-55 lb-ft).
3. Install steering wheel horn pad cover with two screws. Tighten to 0.5-1.13 N·m (5-10 lb-in).
4. Connect battery ground cable.
5. Check steering column for proper operation.

### Steering Column

NOTE: All steering column components are assembled with fasteners. They are designed with a thread locking system to prevent loosening due to vibrations associated with normal vehicle operation.

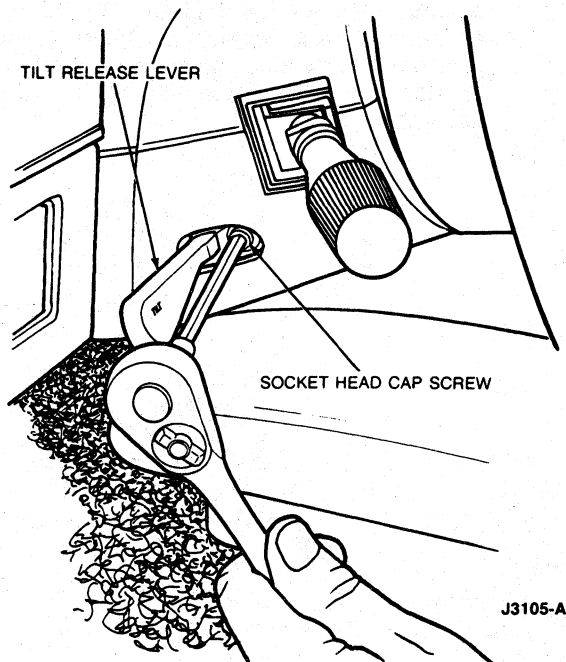
#### Removal

1. Disconnect battery ground cable.
2. Remove steering column cover from lower portion of instrument panel by removing four self-tapping screws.

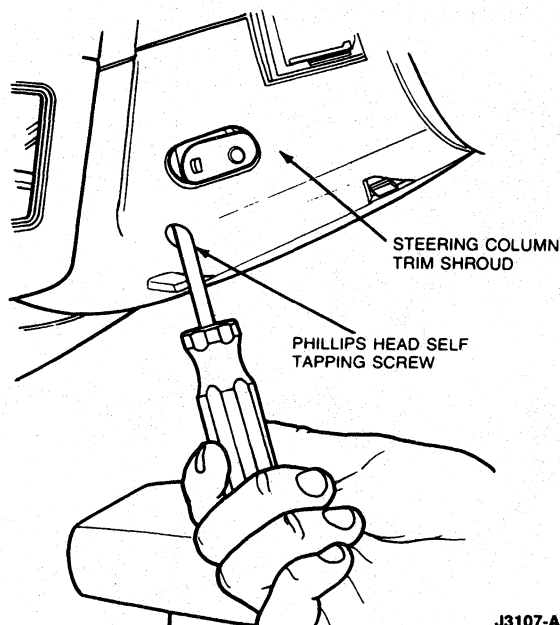


## REMOVAL AND INSTALLATION (Continued)

3. On tilt columns, remove tilt release lever by removing one retaining screw.



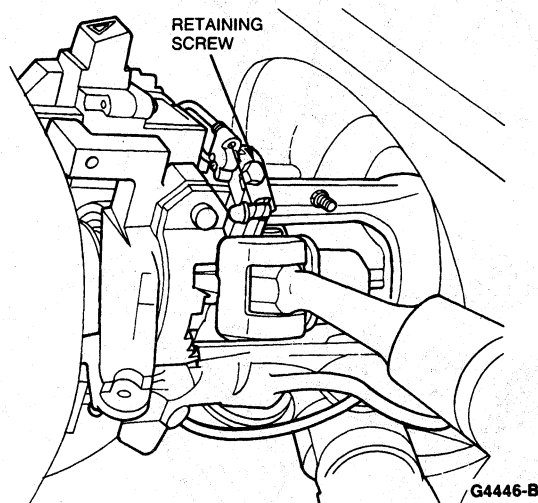
4. Remove ignition lock cylinder. Refer to Section 31-20.  
5. Remove shrouds by removing three self-tapping screws from bottom of lower shroud.



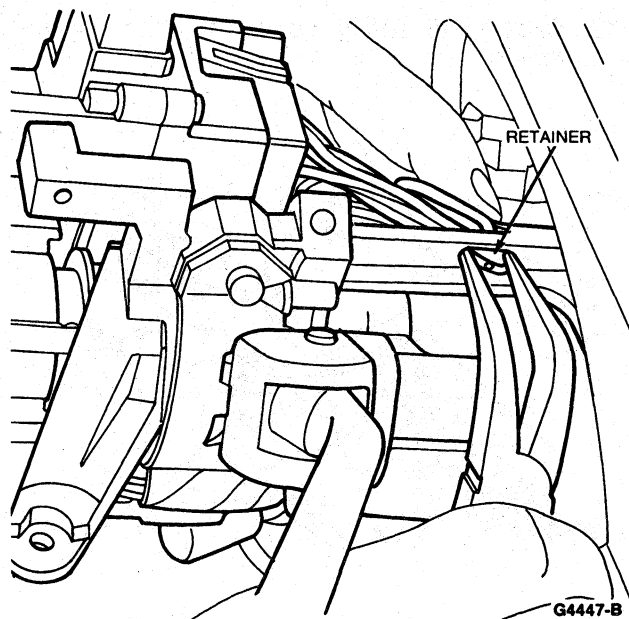
6. Remove horn pad and steering wheel assembly.

7. **Column Shift:**

- a. Disconnect PRNDL cable from lock cylinder housing by removing retaining screw.

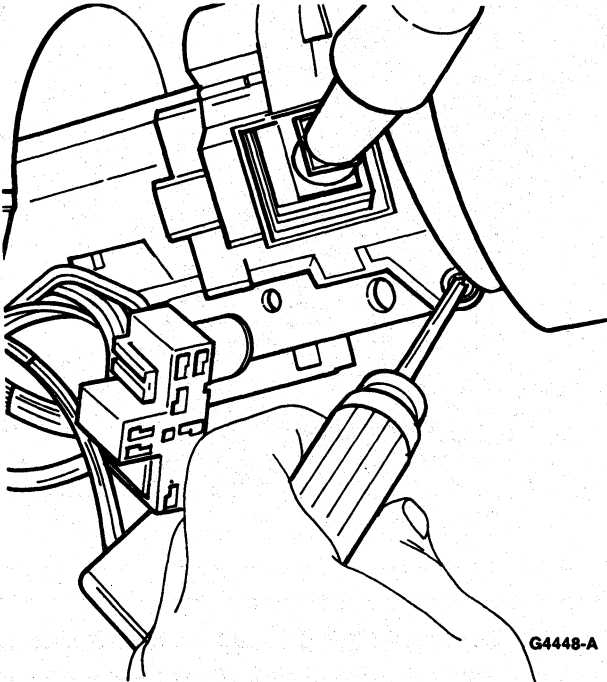


- b. Disconnect PRNDL cable from shift socket.  
c. Remove PRNDL cable from retaining hook on bottom of lock cylinder housing.  
8. Disconnect speed control/horn brush wiring connector from main wiring harness.  
9. Remove multi-function switch wiring harness retainer from lock cylinder housing by squeezing end of retainer and pushing out.

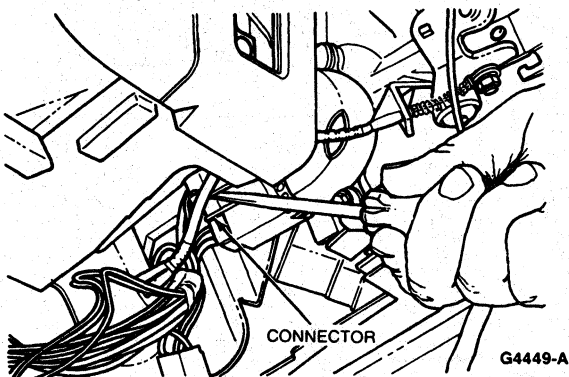


**REMOVAL AND INSTALLATION (Continued)**

10. Disconnect multi-function switch connector from switch and remove multi-function switch from lock cylinder housing by removing two self-tapping screws.



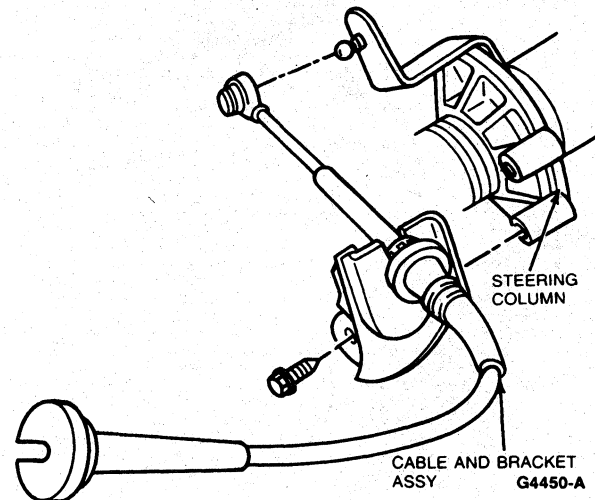
11. Disconnect key warning buzzer switch wiring connector from main wiring harness.
12. Disconnect wiring connector from ignition switch.



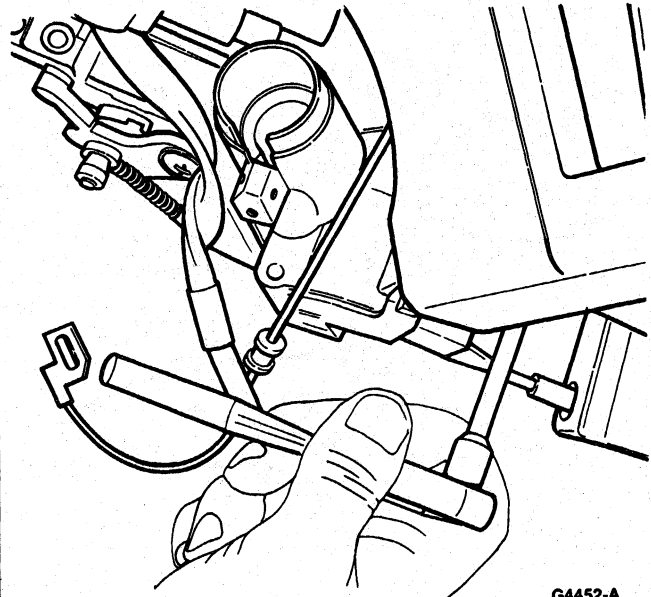
13. Disconnect steering shaft from intermediate shaft by removing two nuts and one U-clamp.

14. **Column Shift:**

- a. Remove shift cable plastic terminal from column selector lever pivot ball using a screwdriver and prying between plastic terminal and selector lever. Be careful not to damage the cable during or after assembly.



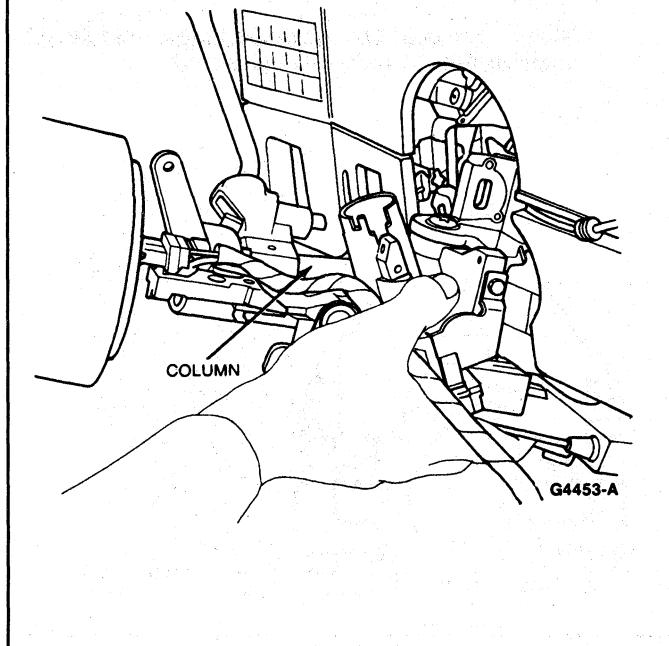
- b. Remove shift cable bracket (with shift cable still attached) from lock cylinder housing by removing two retaining screws.
15. For vehicles with an automatic parking brake release mechanism, remove vacuum hoses from parking brake release switch.
16. While supporting column assembly, unbolt column assembly from steering column support bracket by removing four nuts.



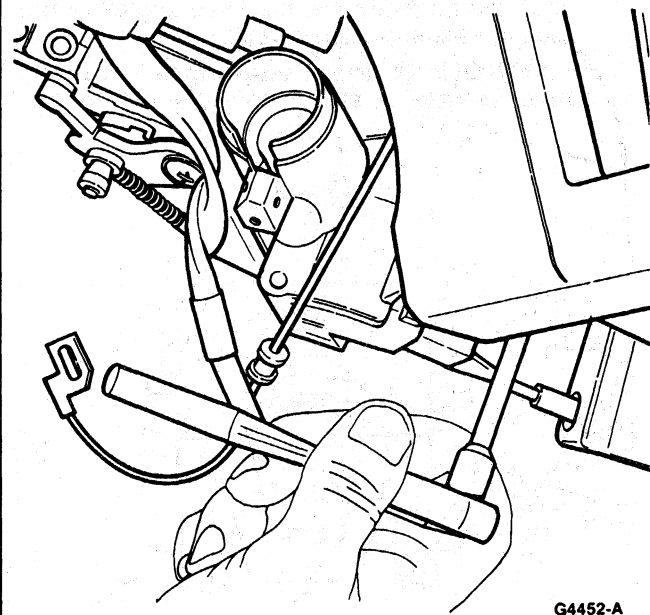


## REMOVAL AND INSTALLATION (Continued)

17. Carefully, lower steering column assembly and remove from vehicle.

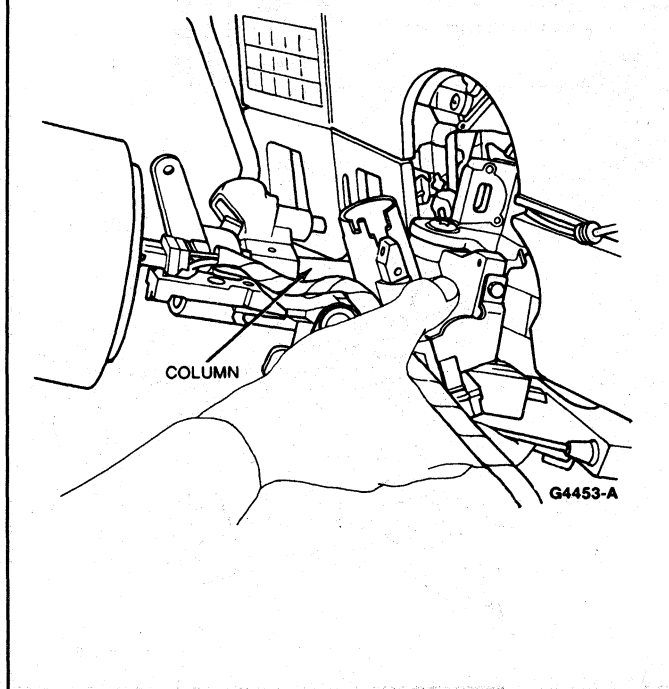


2. Hand start four retaining nuts that attach column assembly to column support bracket.
3. Center column assembly in instrument opening. Tighten four nuts to 21-33 N·m (15-25 lb-ft).

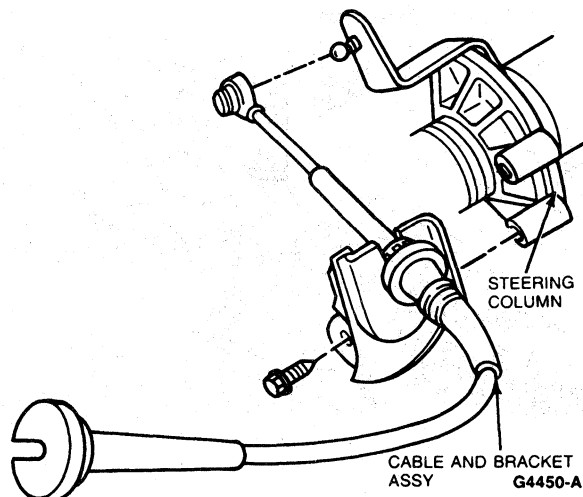


### Installation

1. Carefully raise steering column assembly into position and align four mounting holes over four support bracket studs.



4. For vehicles with an automatic parking brake release mechanism, install vacuum hoses on parking brake release switch.
5. **Column Shift:**
- Attach shift cable bracket (with shift cable attached) to lock cylinder housing with two retaining screws. Tighten to 7-9 N·m (5-7 lb-ft).
  - Snap transmission shift cable terminal to selector lever pivot ball on steering column.



## REMOVAL AND INSTALLATION (Continued)

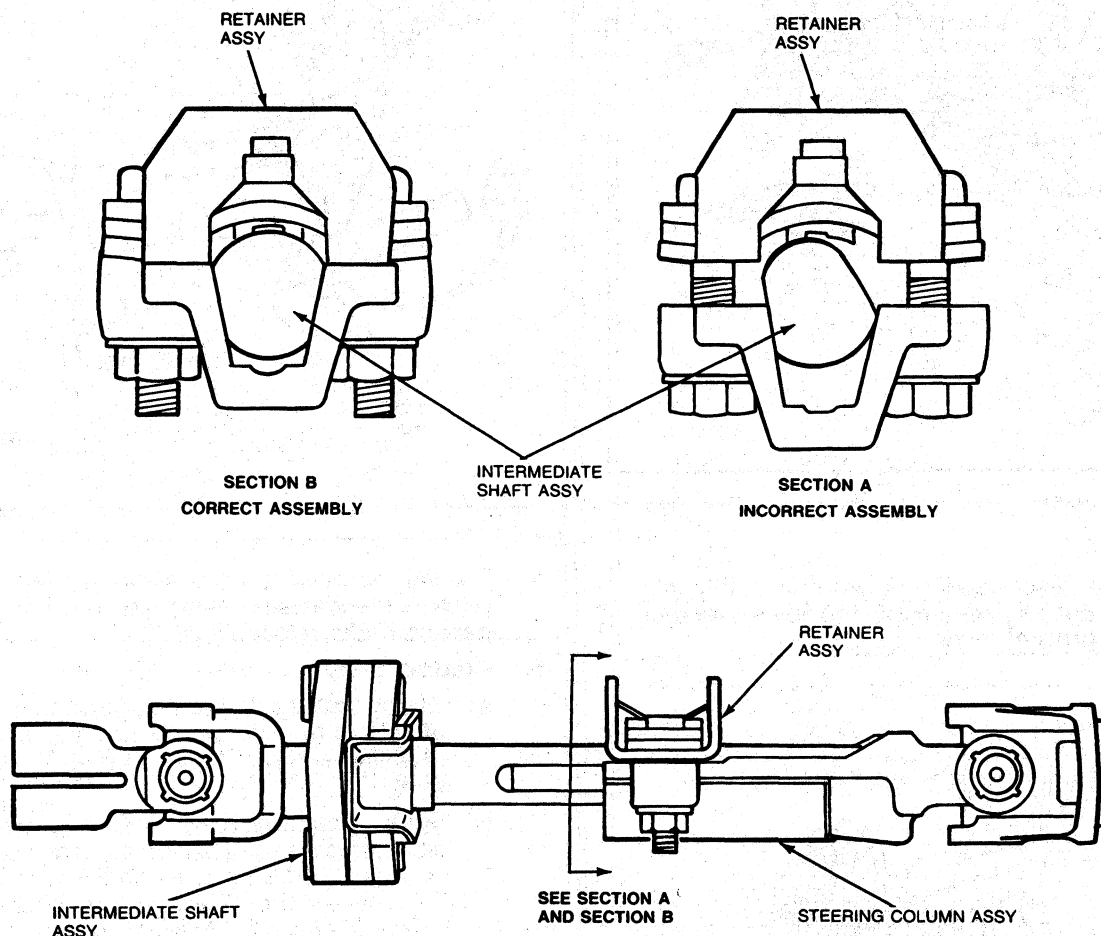
6. Connect steering shaft to intermediate shaft with one U-clamp and two hex nuts. When installing the steering column to intermediate shaft, connect intermediate shaft to steering column with retainer assembly and two nuts. Ensure the "vee-angle" of the intermediate shaft fits correctly into the "vee-angle" of the mating steering column yoke.

**CAUTION:** If the "vee-angle" on the intermediate shaft is mis-aligned to the

column yoke, and the retainer is tightened to specification, the retainer plate will be bent, and then, **MUST** be replaced.

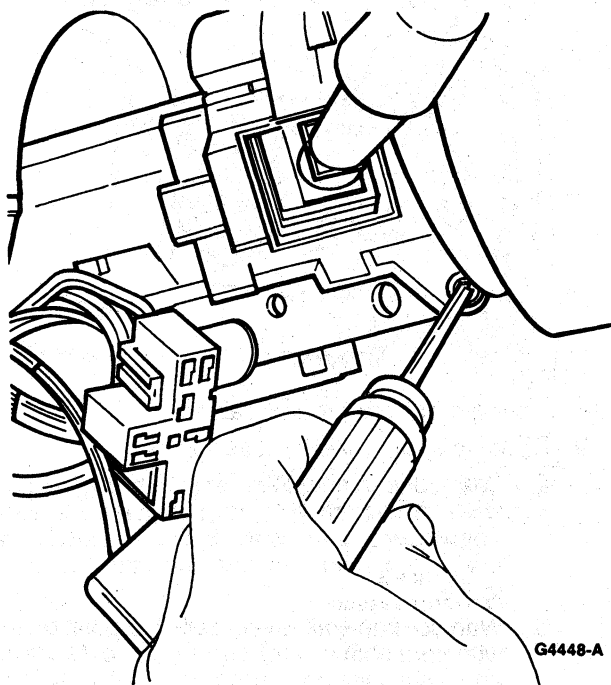
After correctly installing the steering column to intermediate shaft, tighten nuts to 21-33 N·m (15-25 lb-ft).

**NOTE:** Tilt columns must be in the middle tilt position before nuts are tightened.

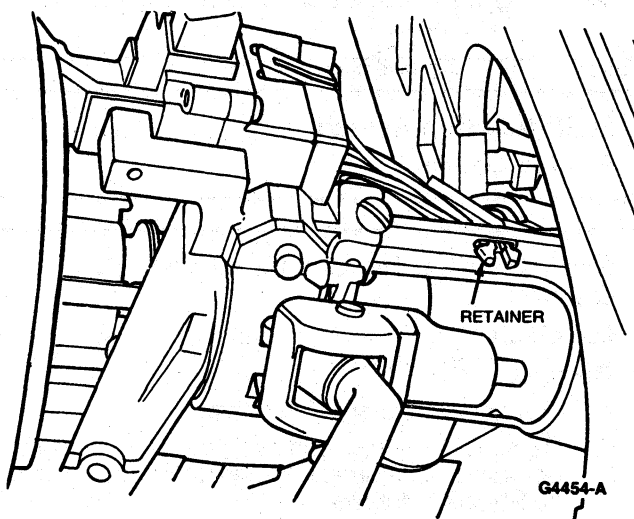


## REMOVAL AND INSTALLATION (Continued)

7. Install main harness wiring connector to ignition switch.
8. Install key warning buzzer switch wiring connector to main wiring harness.
9. Install multi-function switch to lock cylinder housing with two self-tapping screws. Tighten to 2.0-2.9 N·m (18-26 lb-in).



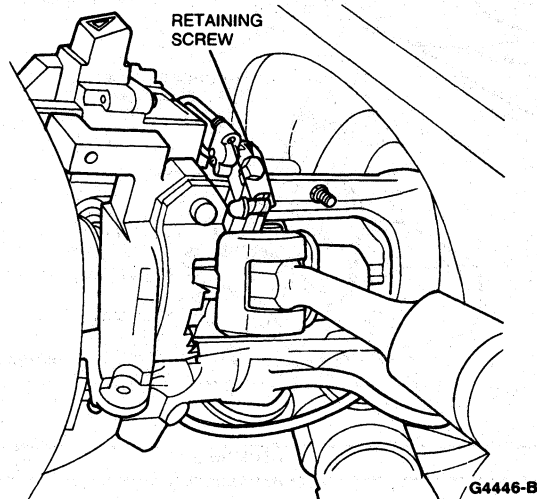
10. Install multi-function switch wiring harness retainer over shroud mounting boss and snap it into the slot in lock cylinder housing.



11. Connect speed control/horn brush wiring connector to main wiring harness.

## 12. Column Shift:

- a. Install PRNDL cable into retaining hook on lock cylinder housing.
- b. Connect PRNDL cable to shift socket.
- c. Loosely install PRNDL cable onto lock cylinder housing with one retaining screw.



- d. Adjust PRNDL cable as follows:

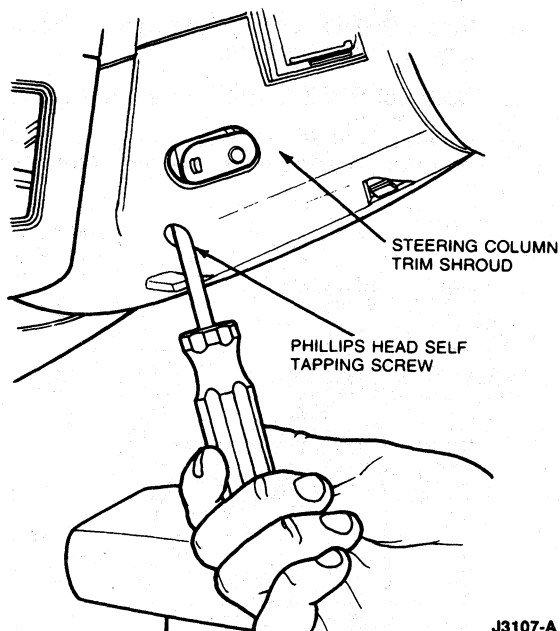
- Place shift lever in D (DRIVE) position with CLC transmission or in OD (OVERDRIVE) position with AXOD transmissions.
- Adjust PRNDL cable until PRNDL pointer is centered on D for CLC transmission or on OD for AXOD transmission.
- Tighten hex-head screw to 2.0-3.4 N·m (18-30 lb-in).
- Cycle shift lever through all of the positions and check that the PRNDL pointer is centered over proper letter or number in each position.

NOTE: Ensure multi-function switch is in the NEUTRAL position before installing steering wheel.

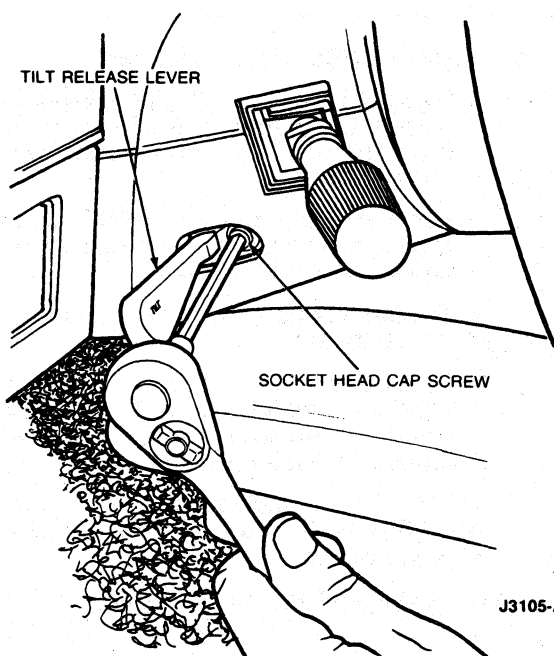
13. Install steering wheel and horn pad.

**REMOVAL AND INSTALLATION (Continued)**

14. Install shrouds with retaining screws. Tighten to 0.7-1.1 N·m (6-10 lb-in).

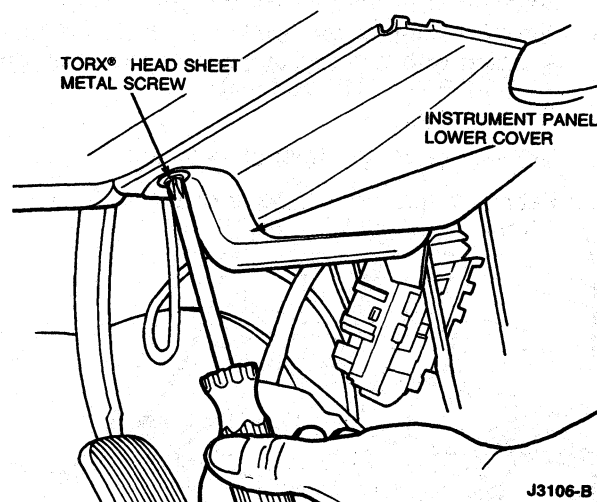


15. On tilt columns only, install tilt release lever with one socket head capscrew. Tighten to 8.8-12.2 N·m (6.5-9.0 lb-ft).



16. Install ignition lock cylinder. Refer to Section 31-20.

17. Install steering column cover from lower portion of instrument panel with four self-tapping screws.



18. Connect battery ground cable.
19. Check column functions as follows:
- With column shift lever in PARK position or with floor shift key release button depressed, and with ignition switch in LOCK position; ensure steering column locks.
  - With column shift lever in DRIVE position or with floor shift key release button extended, and with ignition switch in RUN position; rotate ignition switch toward LOCK position until it stops. In this position, ensure that engine electrical off has been achieved and that steering shaft **does not** lock.
  - For tilt columns, check column tilt travel through its entire range to ensure there is no interference between the column and instrument panel.
  - Cycle multi-function switch through all of its functions.

**Multi-function Switch**

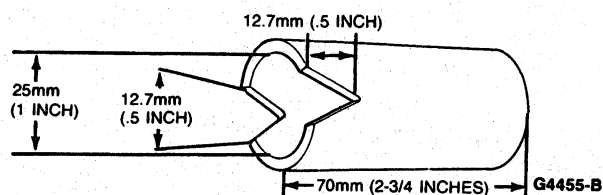
Refer to Section 32-42.

**Shaft Bearing, Upper—Fixed and Tilt Column****In-Vehicle****Removal**

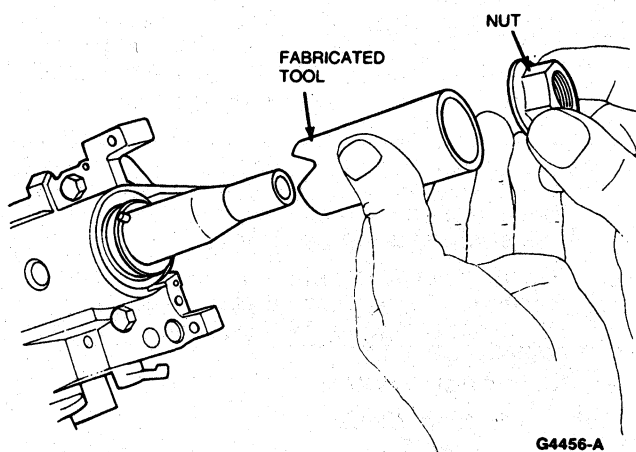
- Disconnect battery ground cable.
- Remove steering column cover from lower portion of instrument panel by removing two self-tapping screws.
- Remove ignition lock cylinder. Refer to Section 31-20.

**REMOVAL AND INSTALLATION (Continued)**

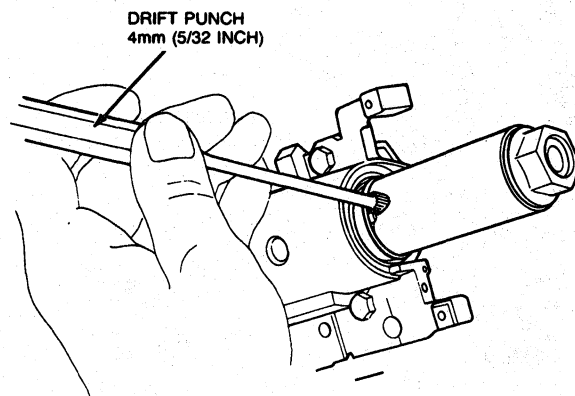
4. On tilt columns, remove tilt release lever by removing one socket head capscrew.
5. Remove shrouds by removing three Philips head self-tapping screws from bottom of lower shroud.
6. Remove multi-function switch.
7. Remove horn pad.
8. Remove steering wheel as outlined.
9. Fabricate tool from a piece of tubing 25mm x 70mm (1 inch x 2 3/4 inch).



10. Install tool on steering shaft aligning clearance slot over shaft retaining pin.
11. Install steering wheel nut. Tighten nut enough to relieve spring pressure on shaft retaining pin.

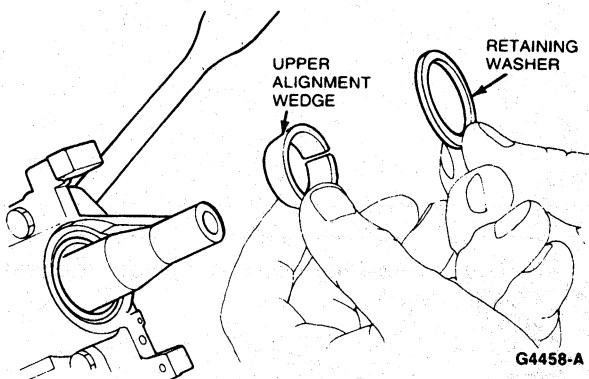


12. Using a 4mm (5/32-inch) diameter drift punch tap retaining pin out of steering shaft and discard pin.



G4457-A

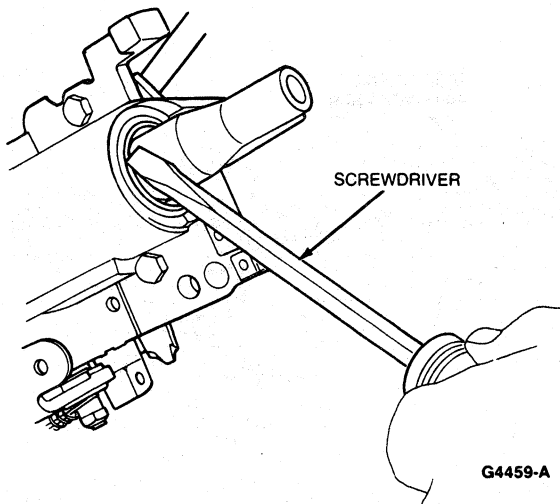
13. Remove steering wheel nut and tool.
14. Remove steering shaft retaining washer and upper alignment wedge from steering shaft.



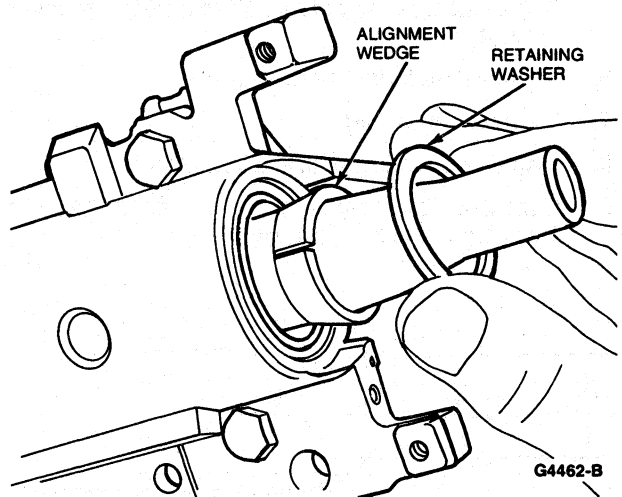
G4458-A

**REMOVAL AND INSTALLATION (Continued)**

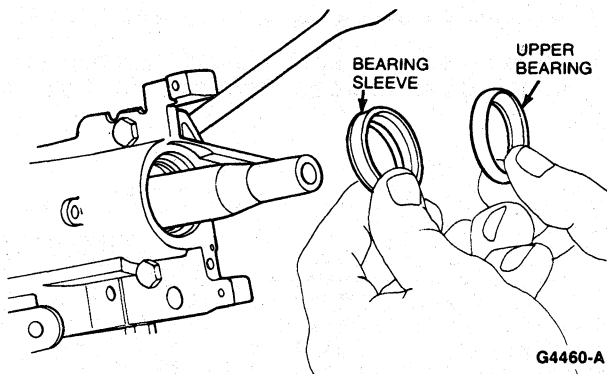
15. Insert a small screwdriver between inner and outer race of bearing and gently pry bearing and bearing sleeve out of lock cylinder housing bearing pocket.



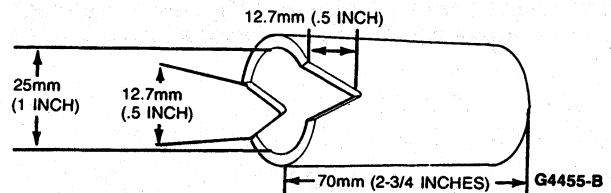
3. Install upper alignment wedge and retaining washer over steering shaft.

**Installation**

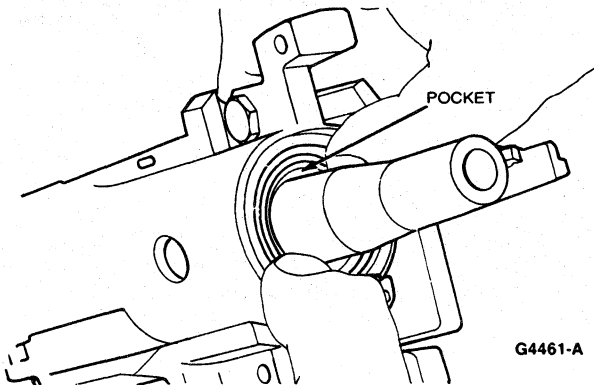
1. Slip bearing sleeve over upper bearing.



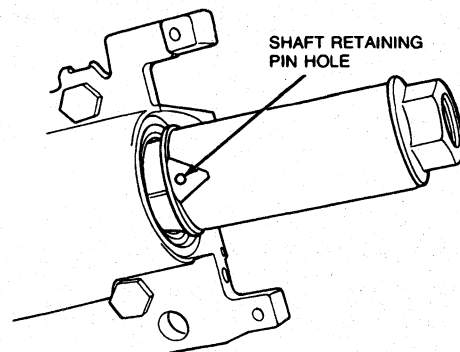
4. Fabricate a tool from a piece of tubing 25mm x 70mm (1 inch x 2-3/4 inch).



2. Install upper bearing into lock cylinder housing bearing pocket.

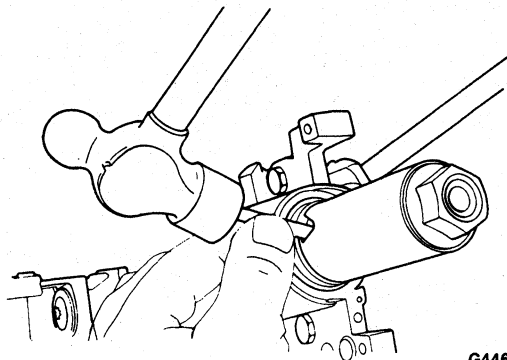


5. Install tool on shaft aligning pin clearance slot with shaft retaining pin hole.
6. Install steering wheel nut. Tighten nut to compress steering shaft preload spring enough to provide adequate clearance to shaft retaining pin hole.



**REMOVAL AND INSTALLATION (Continued)**

7. Install shaft retaining pin by tapping it into the hole until same amount of pin extends from either side of the shaft.



G4464-A

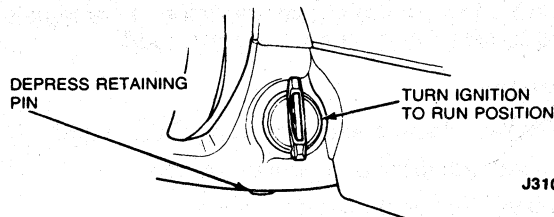
8. Remove steering wheel nut and tool.
9. Install steering wheel as outlined.
10. Install multi-function switch.
11. Install horn pad as outlined.
12. Install shrouds with three Philips head self-tapping screws. Tighten to 0.7-1.1 N·m (6-10 lb-in).
13. For tilt columns only, install tilt release lever with one socket head capscrew. Tighten to 8.8-12.2 N·m (6.5-9.0 lb-ft).
14. Install ignition lock cylinder. Refer to Section 31-20.
15. Install steering column cover from lower portion of instrument panel with two self-tapping screws.
16. Connect battery ground cable.

**Ignition Lock Cylinder Assembly**

**NOTE:** The following procedure applies to vehicles that have functional lock cylinders. Lock cylinder keys are available for these vehicles, or the lock cylinder key numbers are known and the proper key can be made.

**Removal**

1. Disconnect battery ground cable.
2. Turn lock cylinder key to RUN position.
3. Place 3.17mm (1/8-inch) diameter wire pin or small drift punch in hole in trim shroud under lock cylinder. Depress retaining pin while pulling out on lock cylinder to remove it from column housing.



J3104-A

**Installation**

1. Install lock cylinder by turning it to RUN position and depressing retaining pin. Insert lock cylinder into lock cylinder housing. Ensure cylinder is fully seated and aligned in interlocking washer before turning key to OFF position. This will permit cylinder retaining pin to extend into cylinder housing hole.
2. Rotate lock cylinder, using lock cylinder key, to ensure correct mechanical operation in all positions.
3. Connect battery ground cable.

The following procedure applies to vehicles in which the ignition lock is inoperative and the lock cylinder cannot be rotated due to a lost or broken lock cylinder key, the key number is not known, or the lock cylinder cap is damaged and/or broken to the extent that the lock cylinder cannot be rotated.

**Removal**

1. Disconnect battery ground cable.
2. Remove steering wheel.
3. Remove two trim shroud halves by removing three attaching screws.
4. Remove electrical connector from key warning switch.
5. Using a 1/8-inch diameter drill, drill out retaining pin, being cautious not to drill deeper than 12.7mm (1/2-inch).
6. Place a chisel at base of ignition lock cylinder cap and, using a hammer, strike chisel with sharp blows to break cap away from lock cylinder.
7. Using a 3/8-inch diameter drill, drill down middle of ignition lock key slot approximately 44mm (1-3/4 inch) until lock cylinder breaks loose from breakaway base of lock cylinder. Remove lock cylinder and drill shavings from lock cylinder housing.
8. Remove retainer, washer, ignition switch and actuator. Thoroughly clean all drill shavings and other foreign materials from casting.

**REMOVAL AND INSTALLATION (Continued)**

9. Carefully inspect lock cylinder housing for damage from the above operation. If damage is apparent, housing must be replaced.

**Installation**

1. Replace lock cylinder housing if damaged.
2. Install actuator and ignition switch.
3. Install trim and electrical parts.
4. Install new ignition lock cylinder.
5. Check lock cylinder operation.

**DISASSEMBLY AND ASSEMBLY****Steering Column****Disassembly**

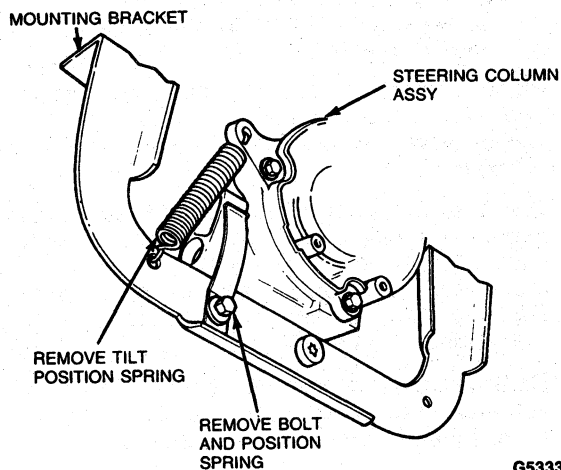
1. Disconnect battery ground cable.
2. Remove steering wheel assembly.
3. Remove steering column from vehicle as outlined.

NOTE: Disconnect shift cable and bracket from column before column removal.

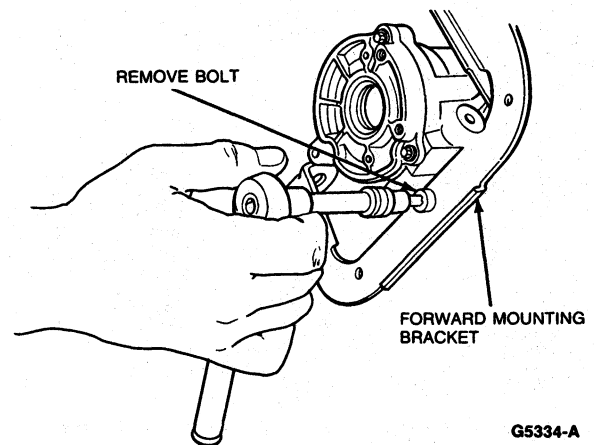
4. Disengage speed control/horn brush wiring from lock cylinder housing by removing two wiring retainers from holes.
5. Remove speed control/horn brush by removing one hex-head self-tapping screw.
6. Remove key warning buzzer switch by gently lifting switch retaining arm and sliding out.
7. **Fixed Columns:** Remove the intermediate bracket and forward bracket by removing five Torx® head bolts.

**Tilt Column**

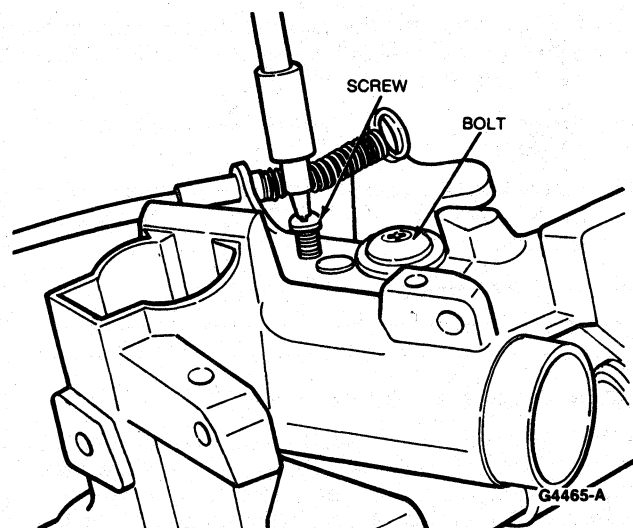
- a. Remove tilt position spring and detent position spring.



- b. Remove forward bracket from intermediate bracket by removing one Torx® head bolt.



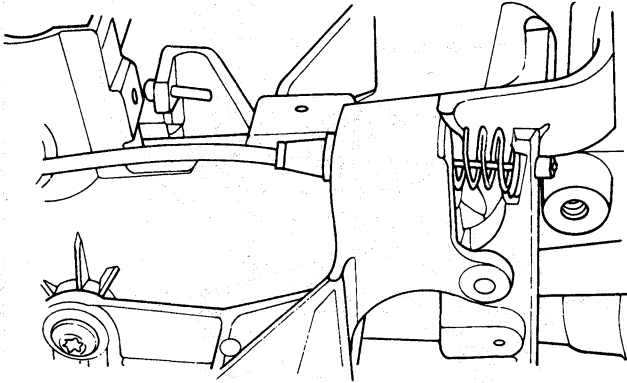
- c. Loosen tilt release cable and tilt release lever by removing one Torx® head bolt and one Torx® head self-tapping screw.



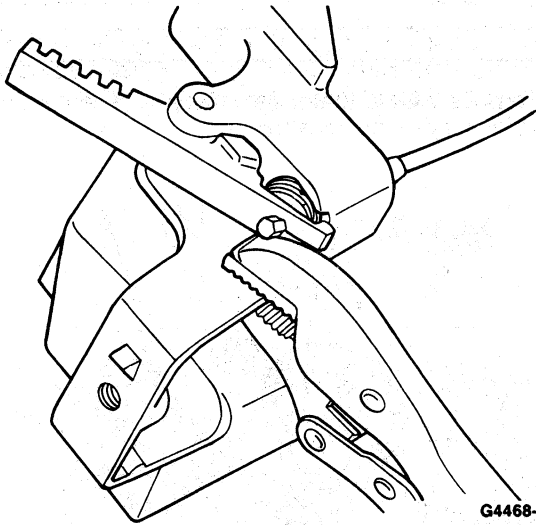


**DISASSEMBLY AND ASSEMBLY (Continued)**

- d. Move tilt lock lever to full open position and clamp in that position with vise grip pliers.

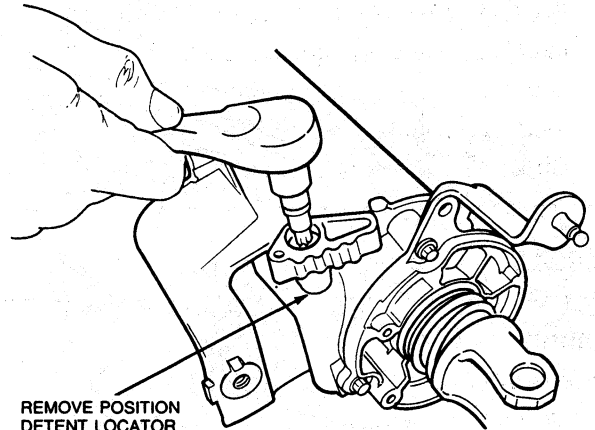


G4466-A



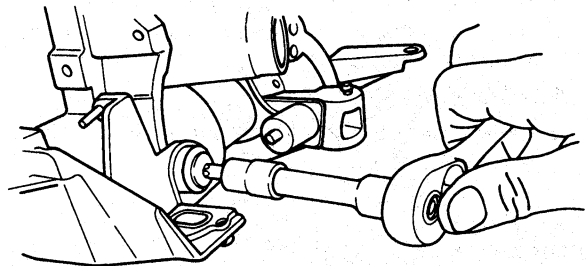
G4468-A

- e. Remove bolt and position detent locator.



G5335-A

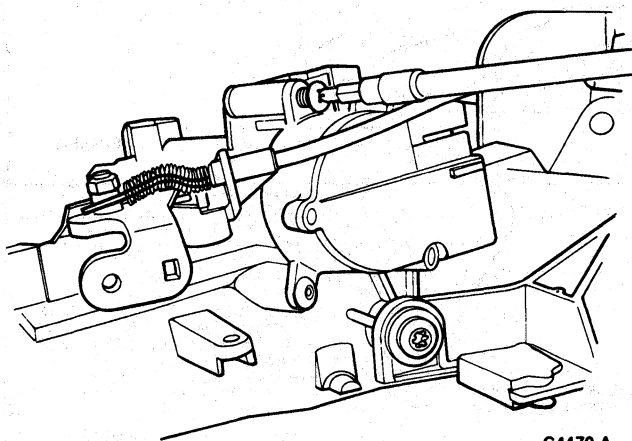
- f. Remove intermediate mounting bracket by removing two Torx® head shoulder bolts and spring washers.



G4469-A

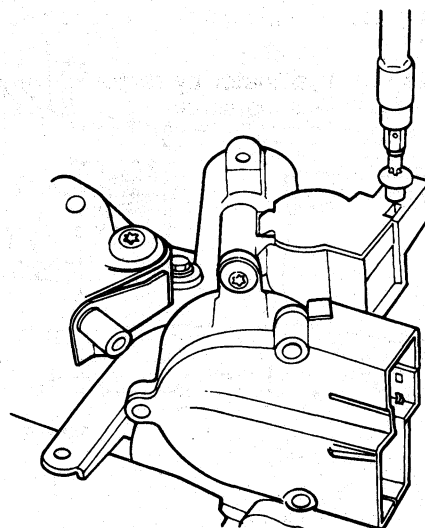
**DISASSEMBLY AND ASSEMBLY (Continued)**

8. Remove ignition switch and cover by removing two tamper resistant Torx® head bolts.

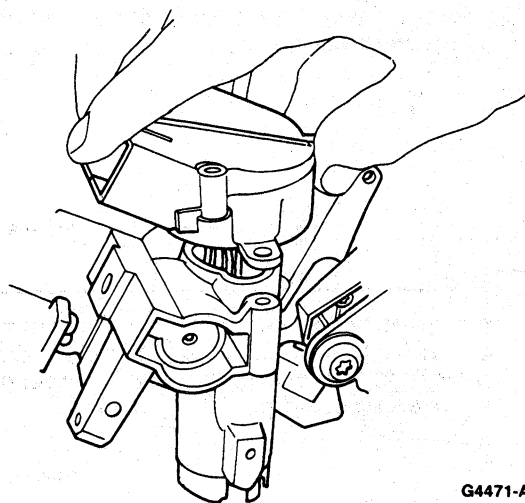


G4470-A

9. Remove lock actuator cover by removing one tamper resistant Torx® head bolt.

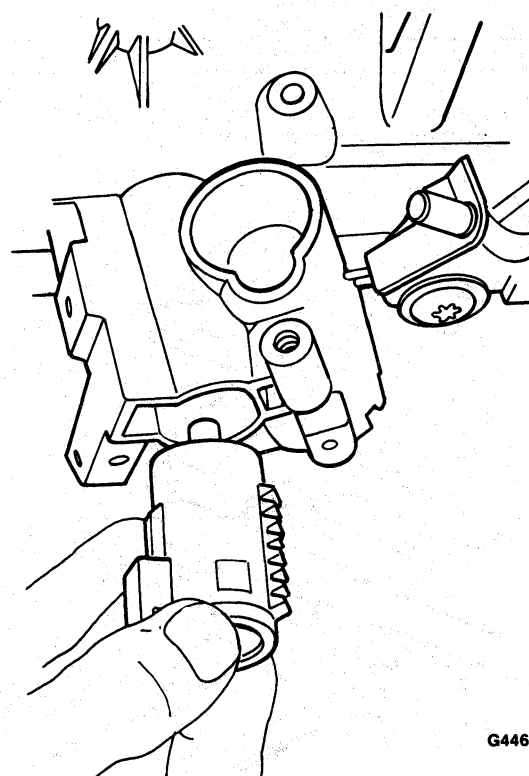


G4779-A



G4471-A

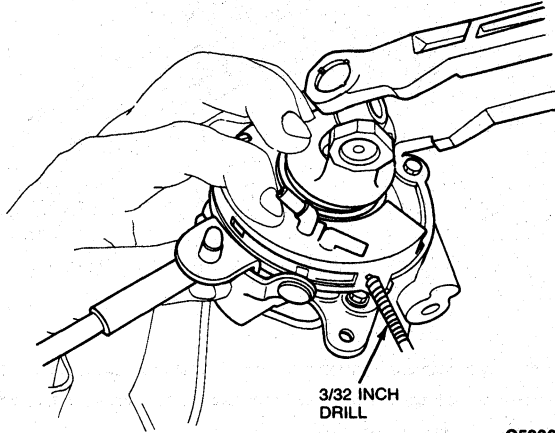
10. Remove lock actuator assembly by sliding it out of lock cylinder housing.



G4467-A

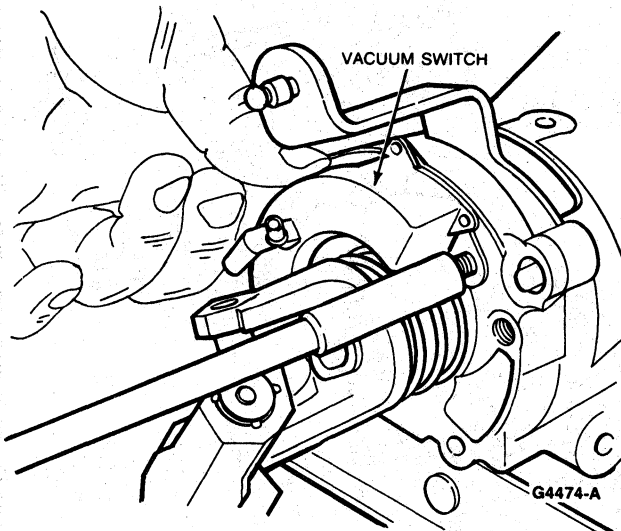
**DISASSEMBLY AND ASSEMBLY (Continued)****11. Parking brake release vacuum switch removal:**

- a. Place transmission selector lever in D (DRIVE) position.
- b. Insert a 3/32-inch diameter drill into hole in side of vacuum switch to lock in proper position.
- c. Remove switch actuator by removing one hex-head self-tapping screw.



G5336-A

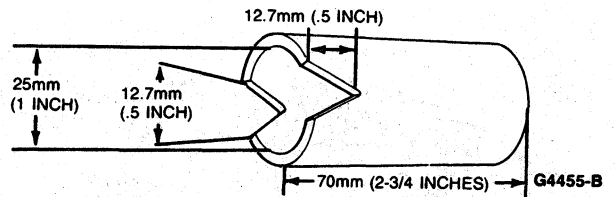
- d. Remove switch by removing two hex-head self-tapping screws.



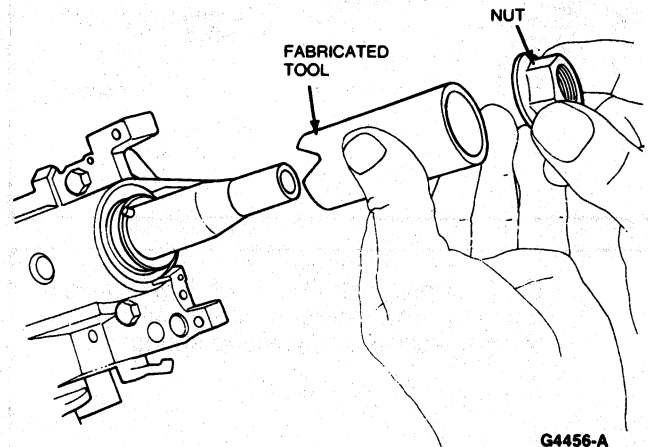
G4474-A

**12. Steering shaft removal:**

- a. Fabricate a tool from a piece of tubing 25mm x 70mm (1 inch x 2-3/4 inch).

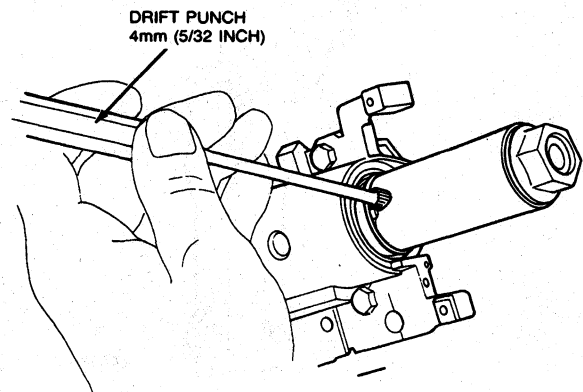


- b. Install tool on shaft aligning clearance slot over shaft retaining pin.
- c. Install steering wheel nut. Tighten nut enough to relieve spring pressure on shaft retaining pin.



G4456-A

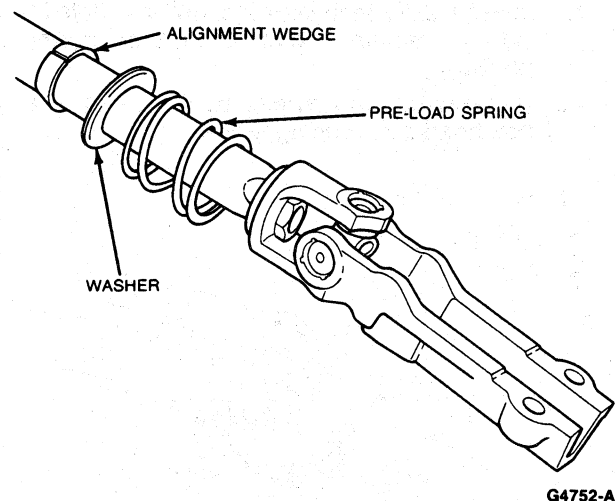
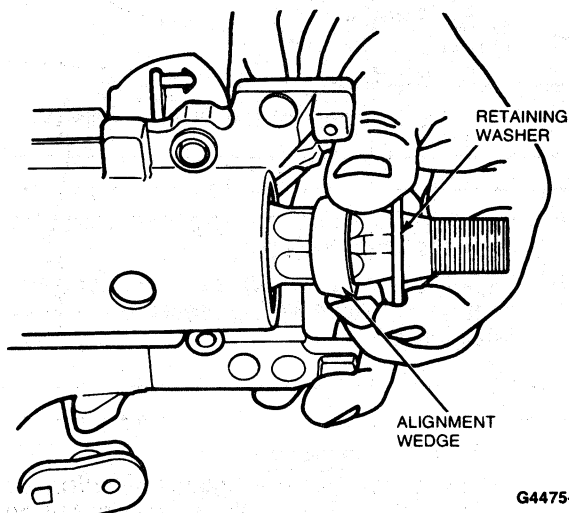
- d. Using a 4mm (5/32-inch) diameter drift punch, tap retaining pin out of steering shaft and discard pin.



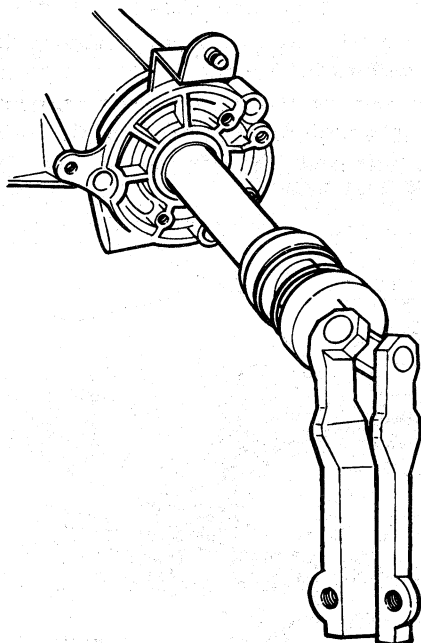
G4457-A

**DISASSEMBLY AND ASSEMBLY (Continued)**

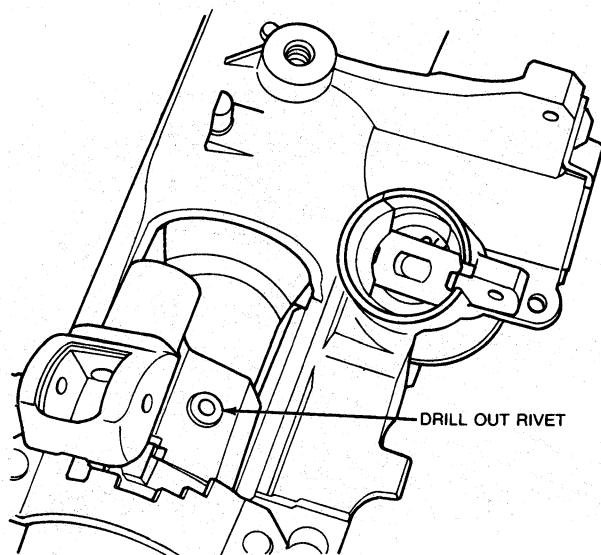
- e. Remove steering wheel nut and tool.
- f. Remove steering shaft retaining washer and upper alignment wedge from steering shaft.



- g. Slide steering shaft out of lock cylinder housing and remove lower alignment wedge, washer and preload spring.

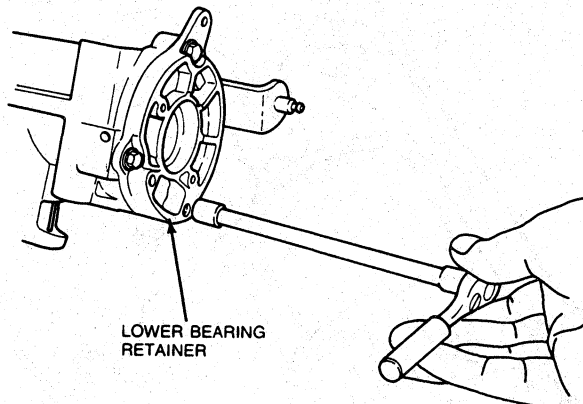
**13. Column Shift Tube:**

- a. Using a 4mm (5/32-inch) diameter drift punch tap retaining pin out of shift socket and shift lever. Discard pin and pin retainer.
- b. Remove shift lever from shift socket.
- c. Rotate shift socket fully counterclockwise.
- d. Using 3/16-inch drill, carefully drill out pop rivet that attaches shift socket to shift tube.



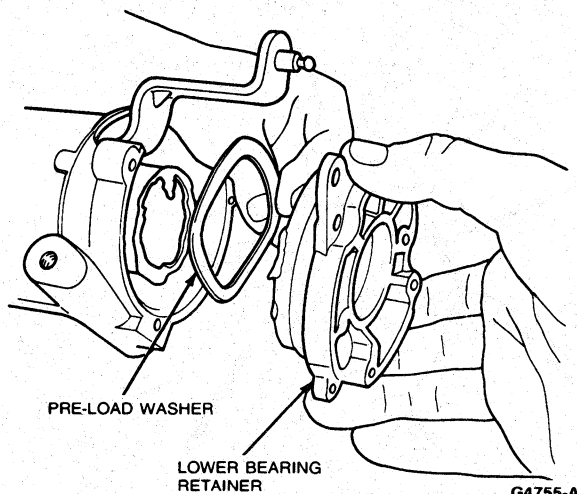
**DISASSEMBLY AND ASSEMBLY (Continued)**

- e. Remove lower bearing retainer by removing three hex-head bolts.



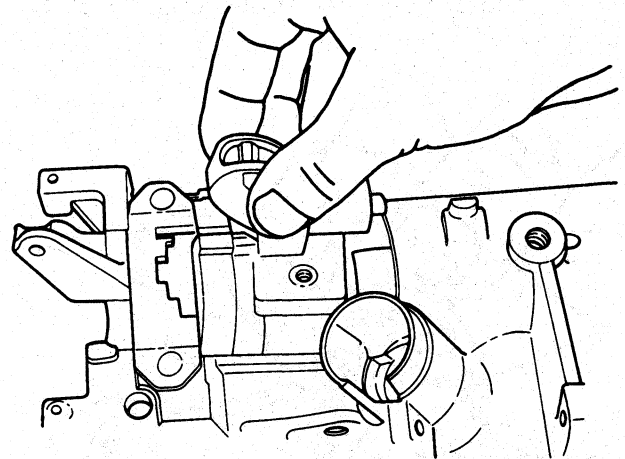
G4754-A

- f. Remove bearing retainer, shift tube preload washer and shift tube.



G4755-A

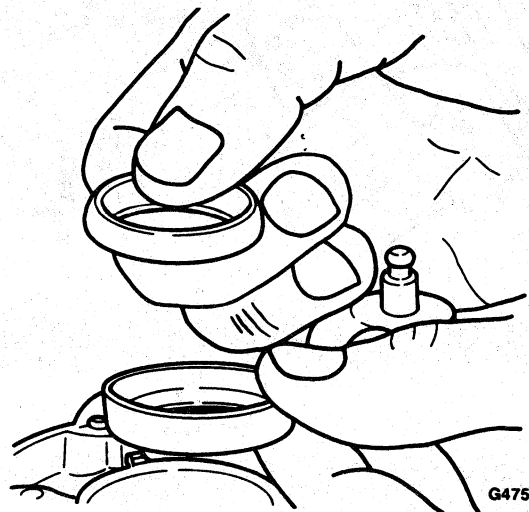
- g. Remove shift socket assembly.



G4756-A

**Floor Shift:**

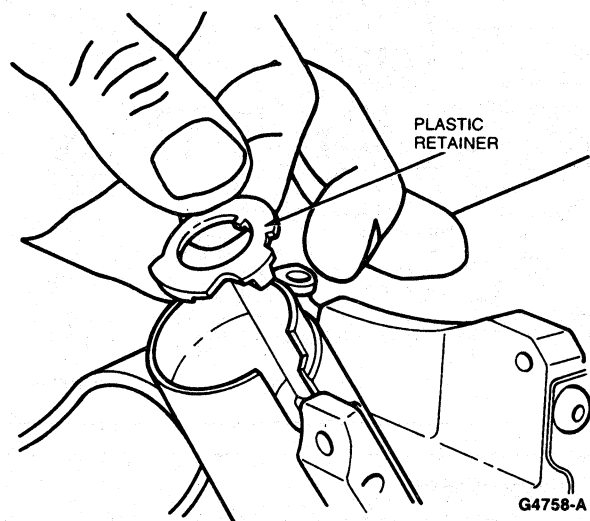
- a. Remove key release actuating button by clamping vise grip pliers around button shank and against button head and sharply rapping pliers until button is free. Discard button.
  - b. Remove return spring from actuator and remove actuator.
  - c. To remove steering shaft center bearing from lock cylinder housing, insert a large diameter socket into shift socket opening and attach it to a long extension inserted through upper bearing opening in housing. Place socket against bearing and gently tap extension until bearing is free.
14. Remove upper bearing from housing by pushing it out from backside.
  15. Remove lower bearing from lower bearing retainer by pushing it out from backside.
  16. Slip bearing sleeves off bearings.



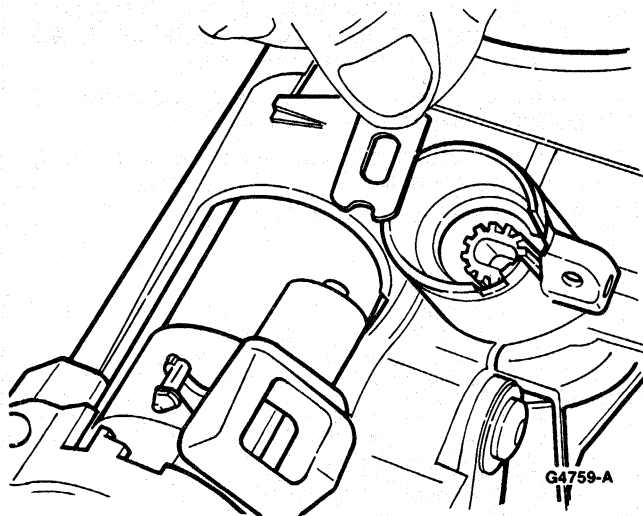
G4757-A

**DISASSEMBLY AND ASSEMBLY (Continued)**

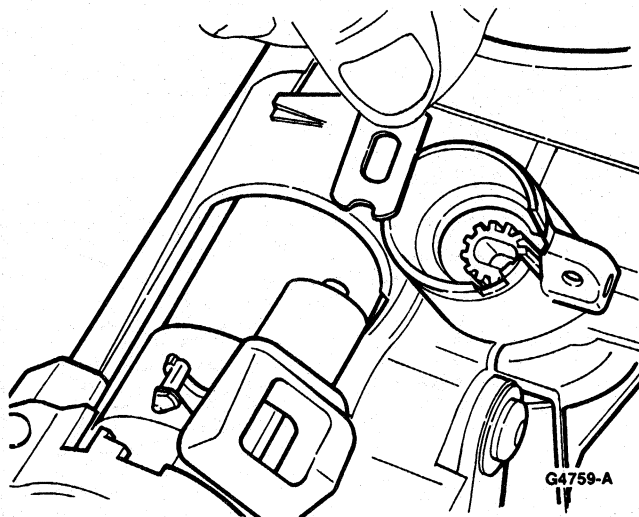
17. Remove plastic bearing retainer from lock cylinder bore.



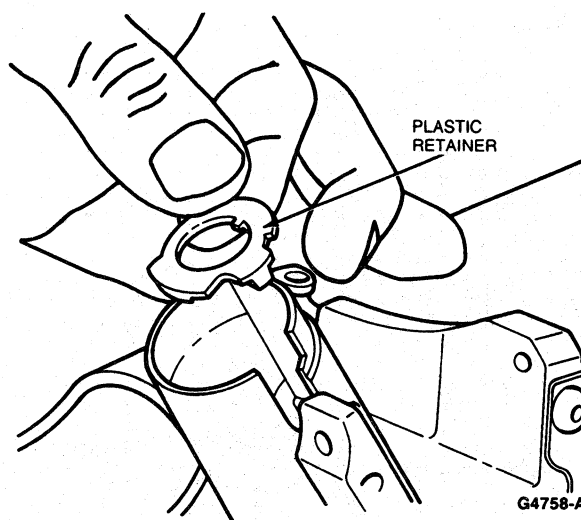
18. Remove metal bearing from lock cylinder bore.

**Assembly**

1. Install metal bearing into lock cylinder bore.

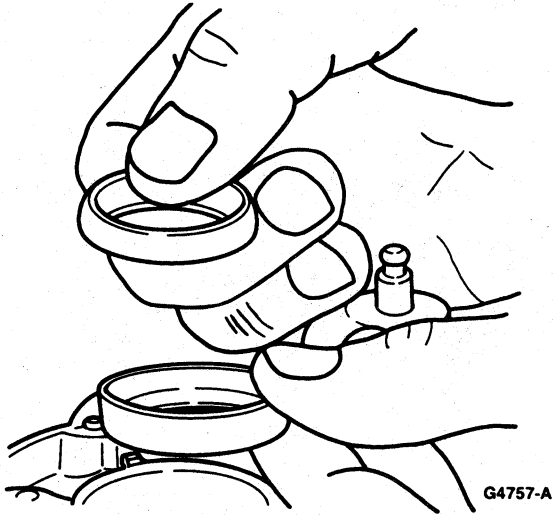


2. Install plastic bearing retainer into lock cylinder bore.

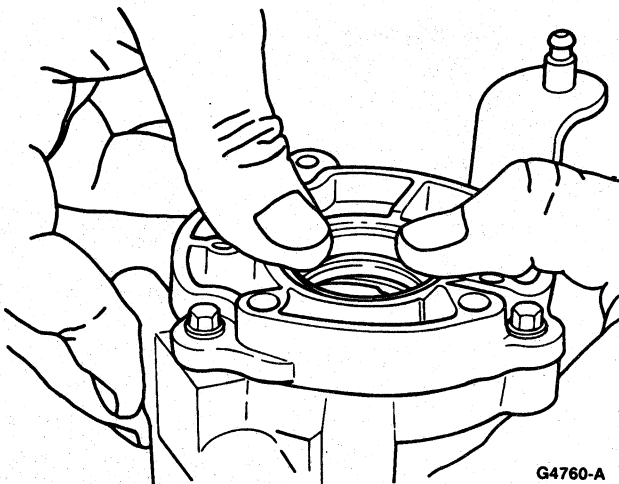


**DISASSEMBLY AND ASSEMBLY (Continued)**

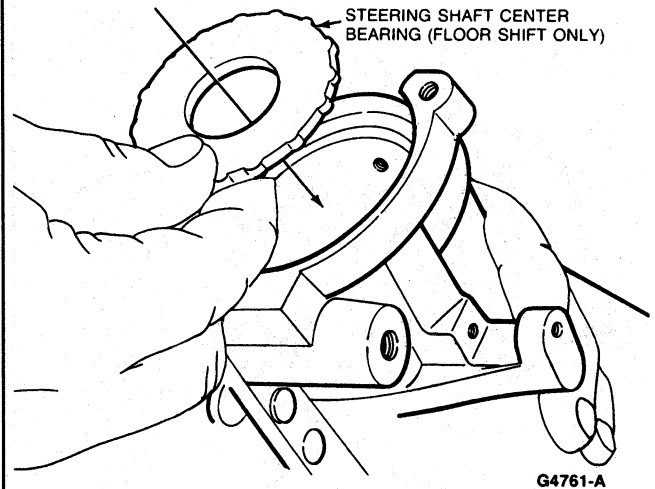
3. Slip bearing sleeves over upper and lower bearings.



4. Install lower bearing and sleeve assembly into lower bearing retainer.
5. Install upper bearing and sleeve assembly into lock cylinder housing.

**6. Floor Shift:**

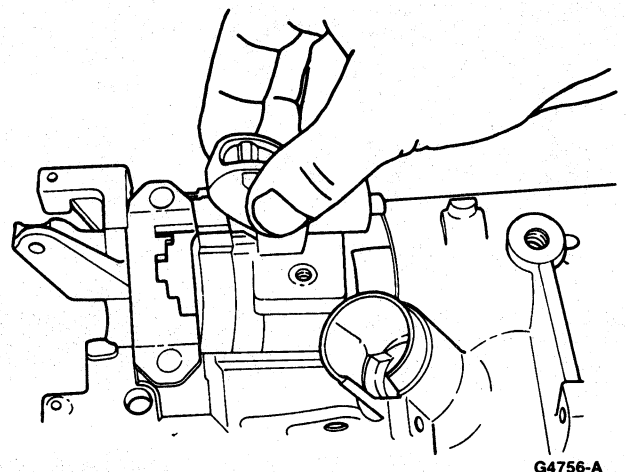
- a. Install steering shaft center bearing into lock cylinder housing. Insert a large diameter socket attached to a long extension into lower opening of housing. Place socket against bearing and gently tap extension until bearing is seated.



- b. Install key release actuator into lock cylinder housing and install return spring over actuator.
- c. Install a new key release actuating button over actuator and apply pressure to button head while supporting actuator until button snaps in place.

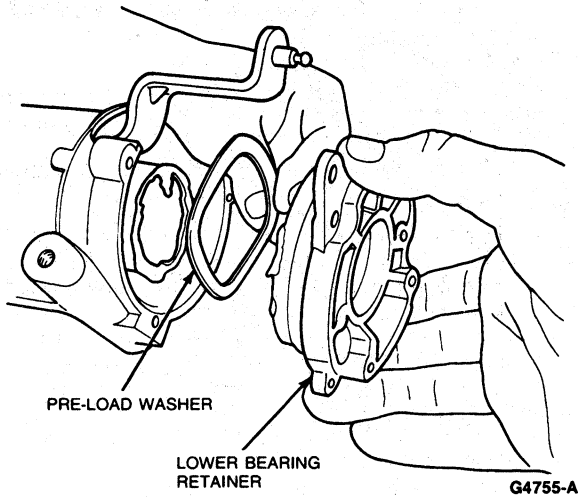
**Column Shift:**

- a. Install shift socket assembly into lock cylinder housing.

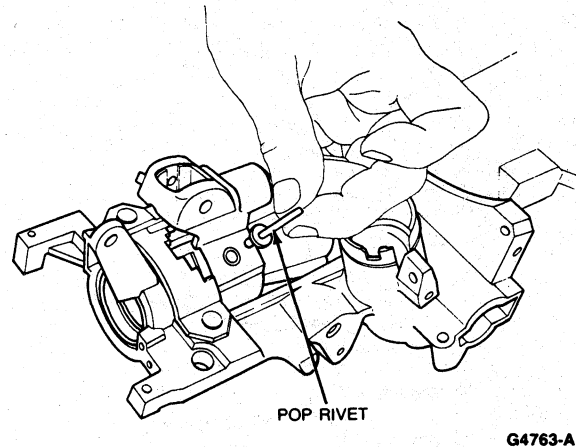


**DISASSEMBLY AND ASSEMBLY (Continued)**

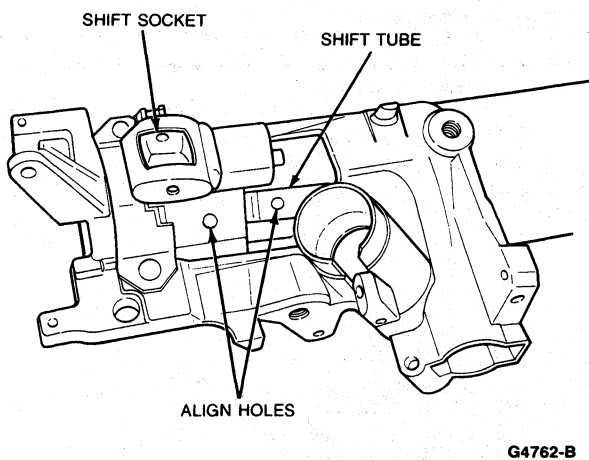
- b. Install shift tube into lock cylinder housing and into shift socket assembly.
- c. Position shift tube preload washer on shift tube.
- d. Install lower bearing retainer on lock cylinder housing and hand tighten three hex-head bolts.



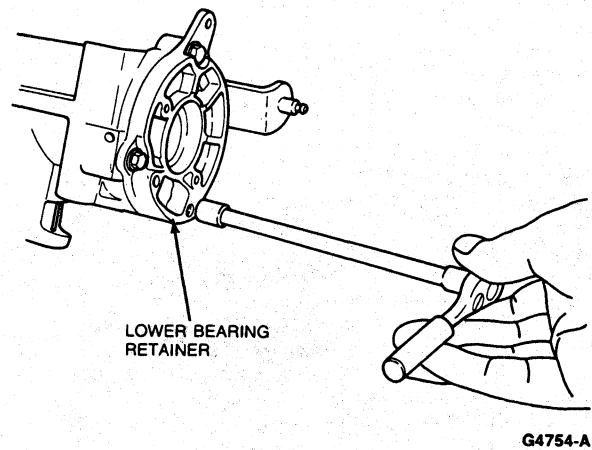
- f. Using a 3/16-inch pop rivet, attach shift socket to shift tube.



- e. Rotate shift socket fully counterclockwise and align hole in shift socket with hole in shift tube.



- g. Tighten three hex-head bolts attaching lower bearing retainer to lock cylinder housing to 4.7-6.8 N·m (42-60 lb-in).

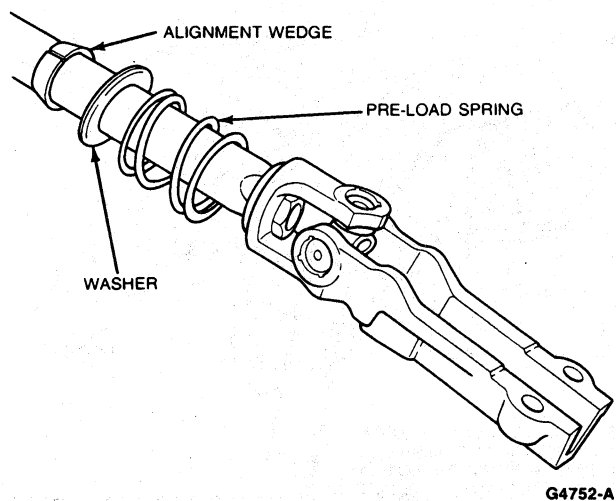


- h. Install shift lever into shift socket.
- i. Attach shift lever-to-shift socket with new pin and pin retainer.

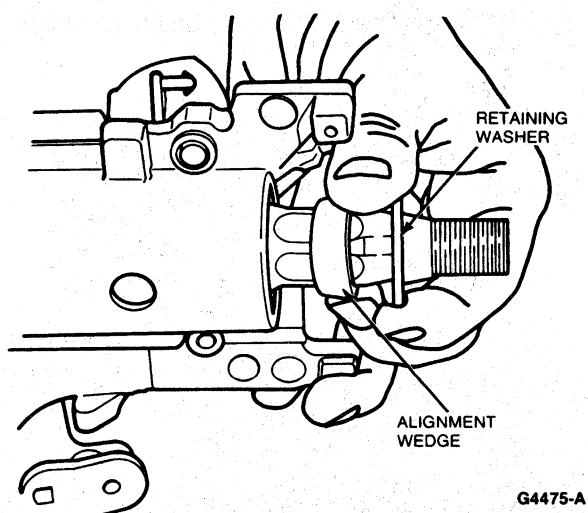


**DISASSEMBLY AND ASSEMBLY (Continued)****7. Steering shaft installation:**

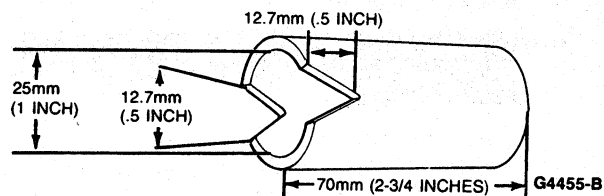
- a. Install preload spring, washer and lower alignment wedge over steering shaft and slide steering shaft into lock cylinder housing.



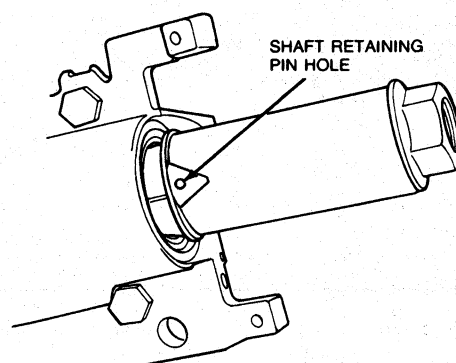
- b. Install upper alignment wedge and retaining washer over steering shaft.



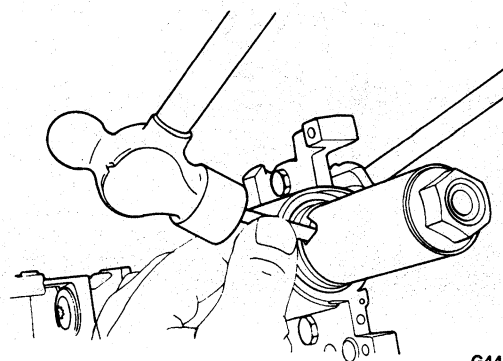
- c. Fabricate tool from a piece of tubing 25mm x 70mm (1 inch x 2-3/4 inch).



- d. Install tool on shaft aligning pin clearance slot over shaft retaining pin hole.
- e. Install steering wheel nut. Tighten nut to compress spring enough to provide adequate clearance to shaft retaining pin hole.



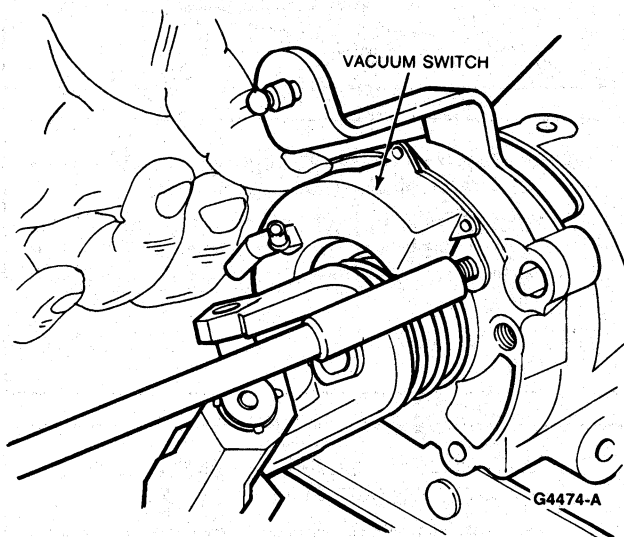
- f. Install shaft retaining pin by tapping it into hole until same amount of pin extends from either side of shaft.



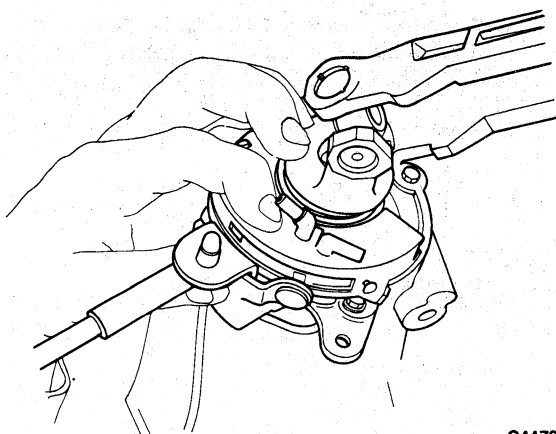
- g. Remove steering wheel nut and tool.

**DISASSEMBLY AND ASSEMBLY (Continued)****8. Parking brake release vacuum switch installation:**

- a. Place transmission selector lever in D (DRIVE) position.
- b. Install vacuum switch with two hex-head self-tapping screws. Tighten to 2.3-3.6 N·m (20-32 lb-in).



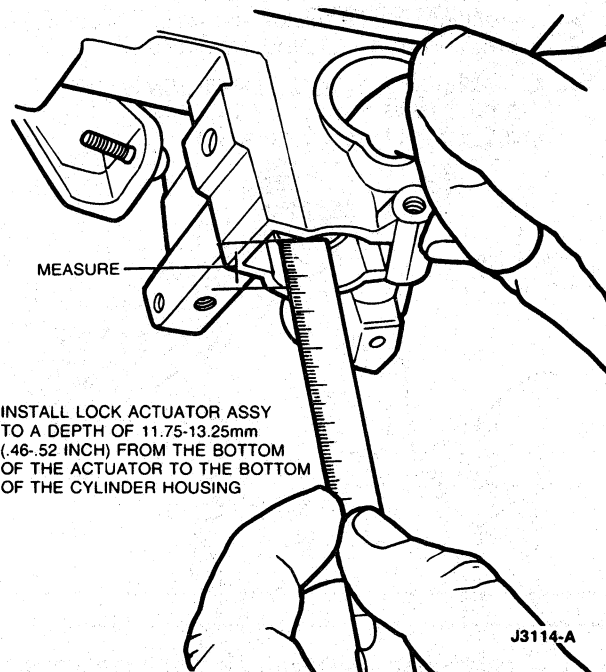
- c. Install switch actuator to lower shift arm with one hex-head self-tapping screw. Tighten to 2.3-3.6 N·m (20-32 lb-in).



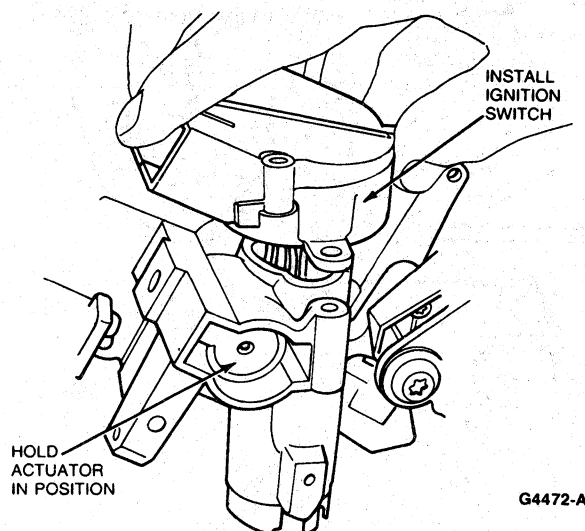
- d. Remove drill from hole in side of vacuum switch.

**9. Ignition switch and lock actuator installation:**

- a. Ensure ignition switch is in RUN position by rotating driveshaft fully clockwise to START position and releasing.
- b. Install lock actuator assembly to a depth of 11.75-13.25mm (0.46-0.52 inch) from bottom of actuator assembly to bottom of lock cylinder housing.

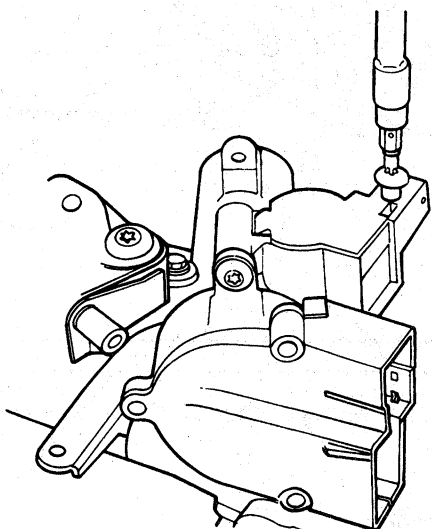


- c. While holding actuator assembly at proper depth, install ignition switch.



**DISASSEMBLY AND ASSEMBLY (Continued)**

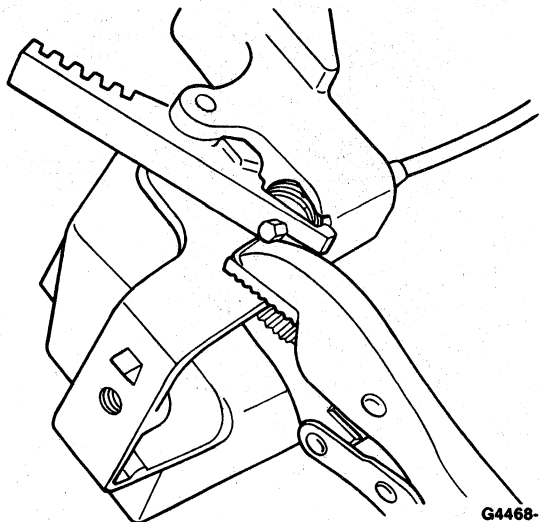
- d. Install ignition switch cover and attach switch and cover to housing with two tamper resistant Torx® head bolts. Tighten to 3.4-5.4 N·m (30-48 lb-in).
- e. Install lock cylinder.
- f. Rotate ignition switch to LOCK position and measure depth of actuator assembly. The actuator assembly must be 23.5-25.5mm (.92-1.00 inch) inside lock cylinder housing. If depth measured does not meet specification, actuator assembly must be removed and installed as outlined.
- g. Install lock actuator cover plate with a tamper resistant Torx® head bolt. Tighten to 3.4-5.4 N·m (30-48 lb-in).



G4779-A

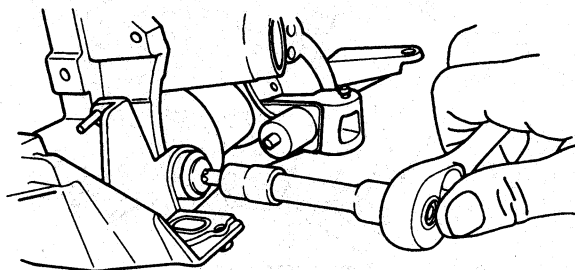
**10. Tilt Column:**

- a. Move tilt lock lever on intermediate mounting bracket to full open position and clamp in that position with vise grip pliers.



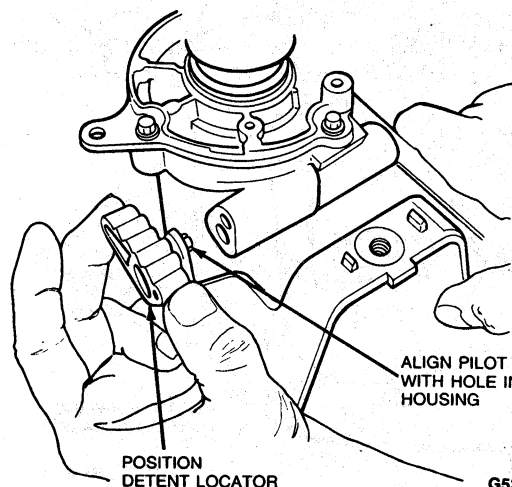
G4468-A

- b. Install intermediate mounting bracket to lock cylinder housing with two Torx® head shoulder bolts and spring washers. Tighten to 21-33 N·m (15-25 lb-ft).

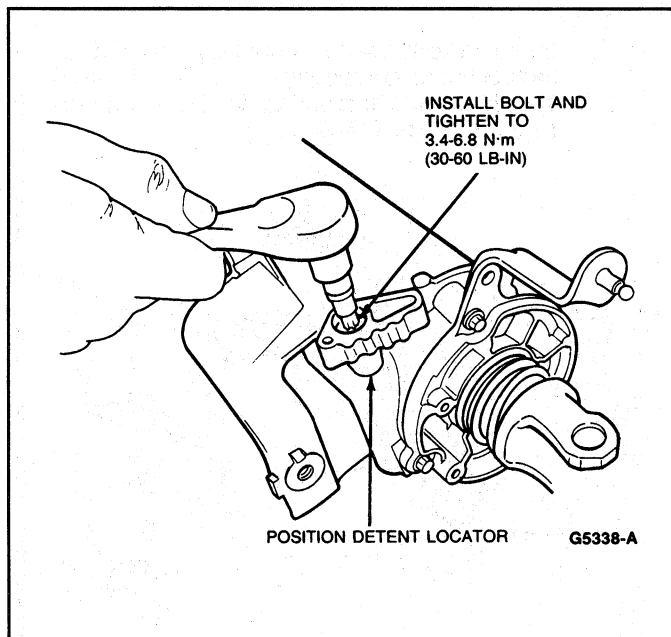


G4469-A

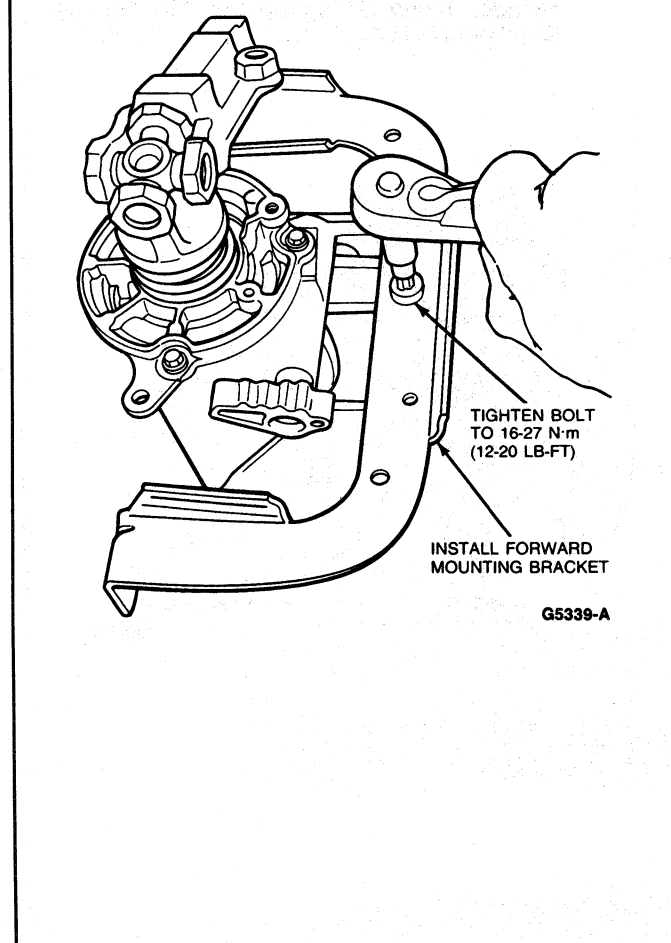
- c. With column placed in mid-tilt position, remove vise grip pliers.
- d. Install position detent locator to lock cylinder housing. Tighten bolt to 3.4-6.8 N·m (30-60 lb-in).



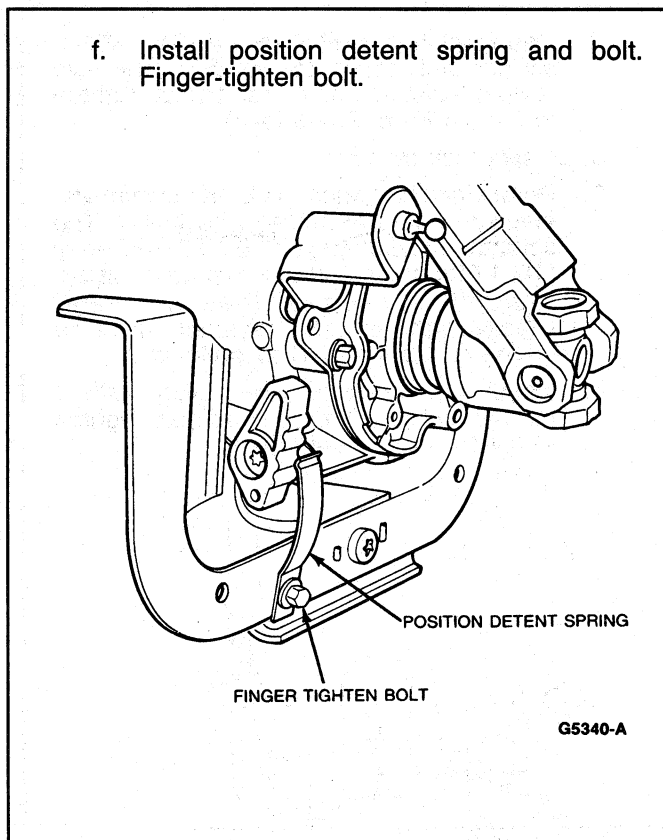
G5337-A

**DISASSEMBLY AND ASSEMBLY (Continued)**

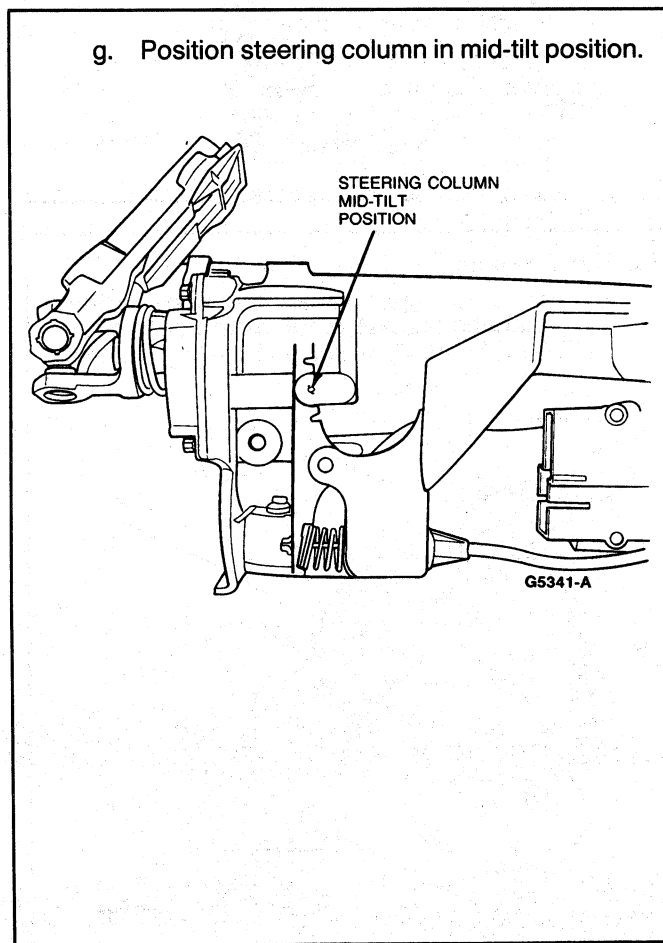
- e. Install forward mounting bracket to intermediate bracket with one Torx® head bolt. Tighten to 16-27 N·m (12-20 lb-ft).



- f. Install position detent spring and bolt. Finger-tighten bolt.

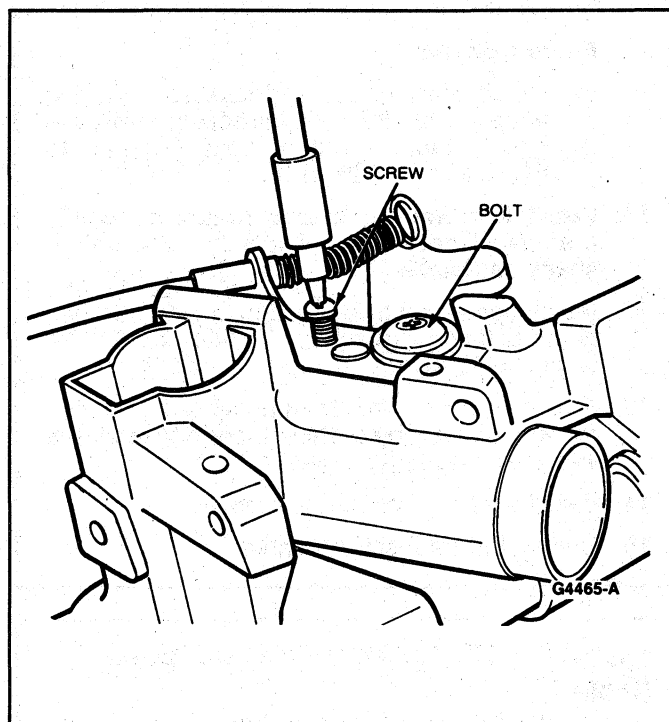
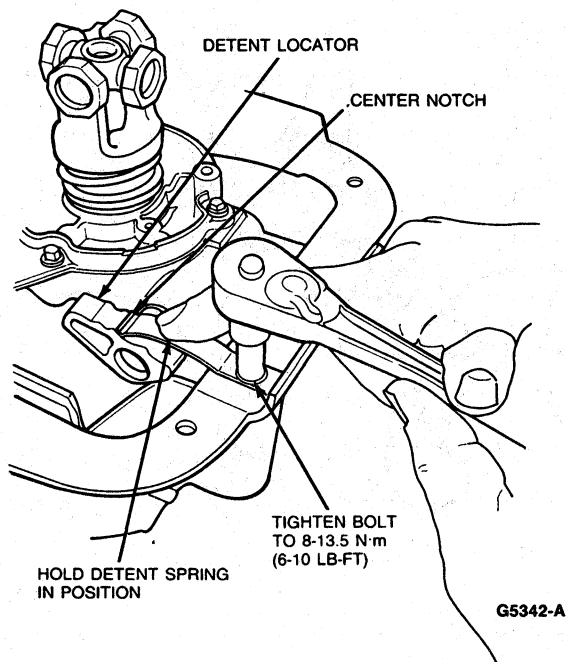


- g. Position steering column in mid-tilt position.

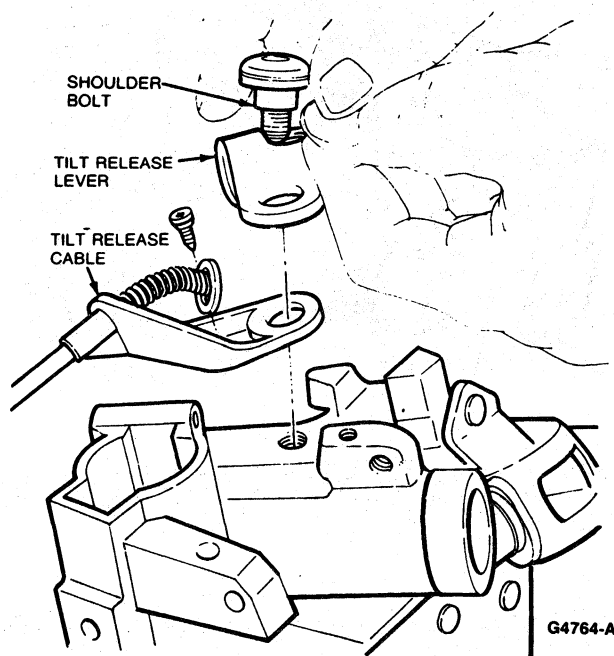


## DISASSEMBLY AND ASSEMBLY (Continued)

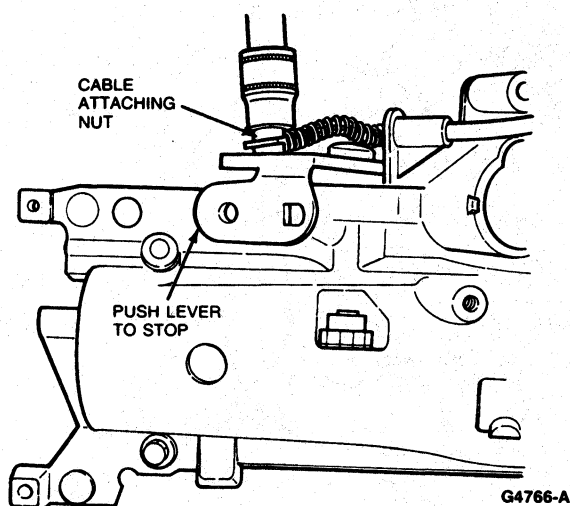
Align detent spring to center notch in detent locator. Tighten bolt to 8-13.5 N·m (6-10 lb-ft).



- h. Install tilt position spring.
- i. Install tilt release cable and tilt release lever to lock cylinder housing with one Torx® head shoulder bolt and spring washer and with one Torx® head self-tapping screw. Tighten shoulder bolt to 21-33 N·m (15-25 lb-ft) and self-tapping screw to 4.1-6.8 N·m (36-60 lb-in).



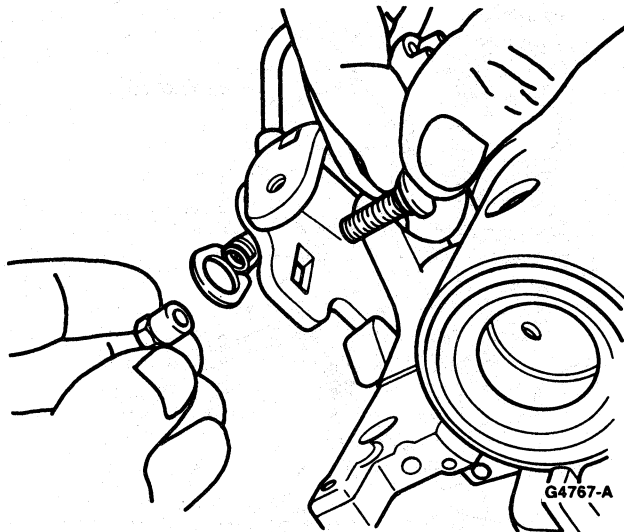
- j. Loosen cable adjusting nut. Push tilt release lever toward lower end of column until it reaches stop on cable bracket. While holding lever in this position, tighten adjusting nut to 4.1-6.8 N·m (36-60 lb-in).



**DISASSEMBLY AND ASSEMBLY (Continued)****Fixed Column:**

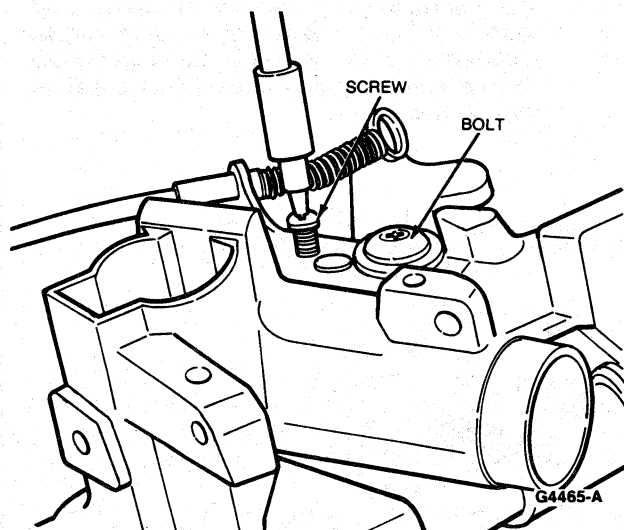
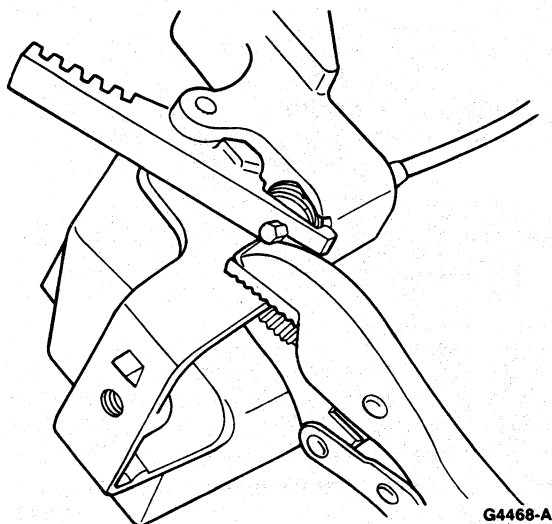
- a. Install intermediate and forward mounting brackets to lock cylinder housing with five Torx® head shoulder bolts. Tighten to 21-33 N·m (15-25 lb-ft).
11. Install key warning buzzer switch by gently pressing it onto lock cylinder housing until it snaps into place.
12. Install speed control/horn brush with one hex head self-tapping screw. Tighten to 2.0-3.4 N·m (18-30 lb-in).
13. Attach speed control/horn brush wiring to lock cylinder housing by pushing two wiring retainers into their respective holes.
14. Install steering column as outlined.
15. Connect battery ground cable.

4. Remove tilt release cable end from tilt release lever.

**Tilt Lock Lever and/or Tilt Lever Release Cable****Removal**

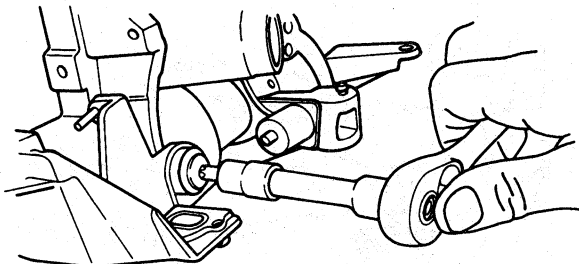
1. Disconnect battery ground cable.
2. Remove steering column assembly as outlined.
3. Move tilt lock lever on intermediate mounting bracket to full open position and clamp.

5. Remove tilt release lever and cable from lock cylinder housing by removing Torx® head screw and self-tapping screw.



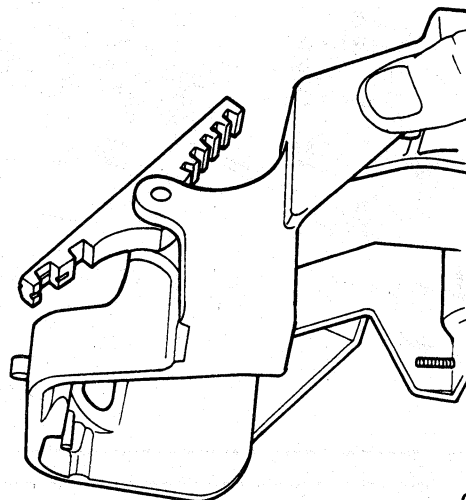
**DISASSEMBLY AND ASSEMBLY (Continued)**

6. Remove intermediate mounting bracket from lock cylinder housing by removing two Torx® head shoulder bolts and spring washer.



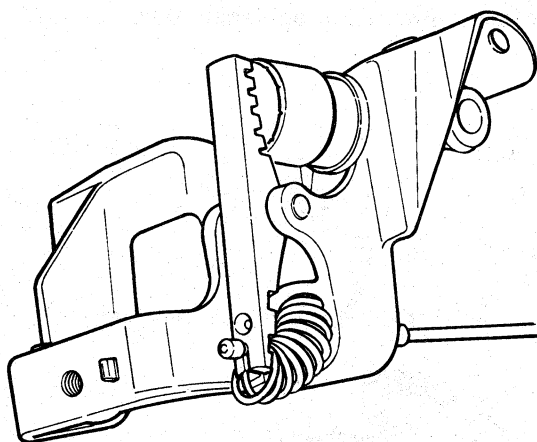
G4469-A

8. With a drift and hammer remove pin retaining tilt lock lever to intermediate mounting bracket. NOTE: Use a wood block to support bracket. Remove tilt lock lever.



G4770-A

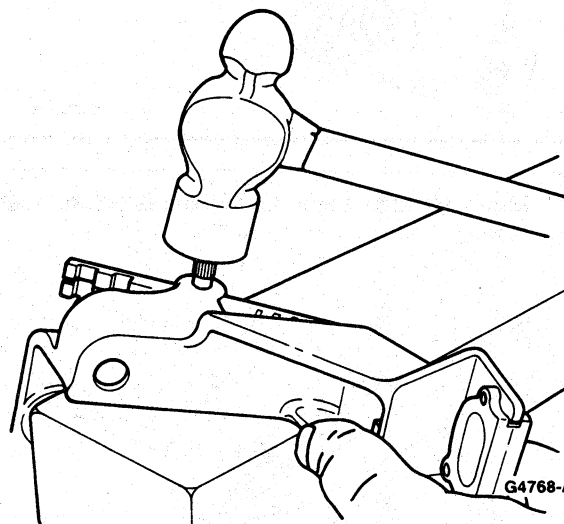
7. Position spacer between intermediate mounting bracket and tilt lock lever. Move spring as shown and remove cable from slot in tilt lock lever. Remove spacer and spring.



G4769-A

**Installation**

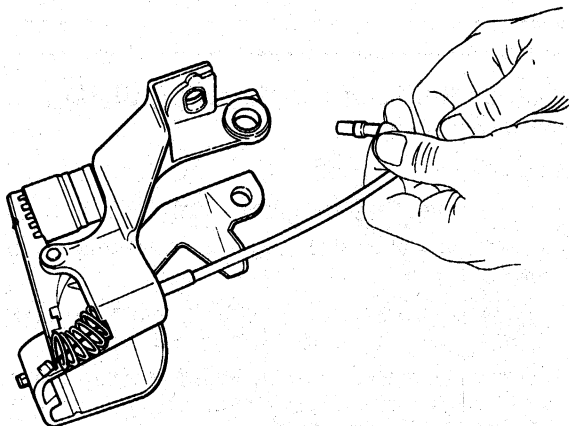
1. Position tilt lock lever on intermediate mounting bracket and install a new pin. NOTE: Use a wood block to support bracket.



G4768-A

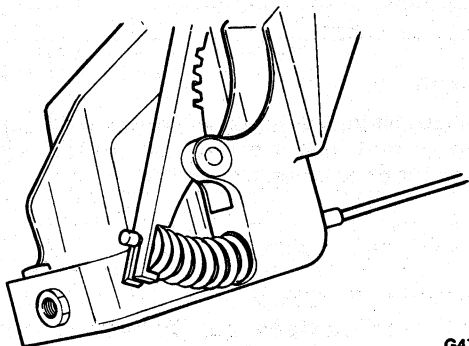
**DISASSEMBLY AND ASSEMBLY (Continued)**

2. Install spring and spacer as shown. Install tilt lever release cable end into tilt lock lever slot.



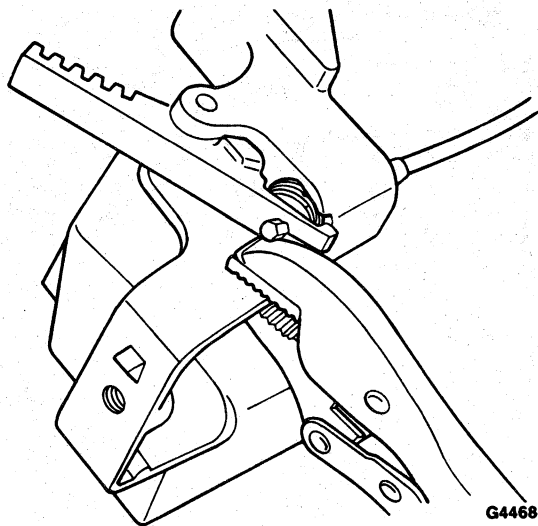
G4771-A

3. Remove spacer and position spring as shown.



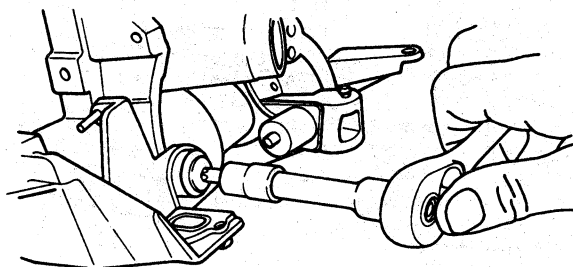
G4772-A

4. Move tilt lock lever to full open position and clamp.



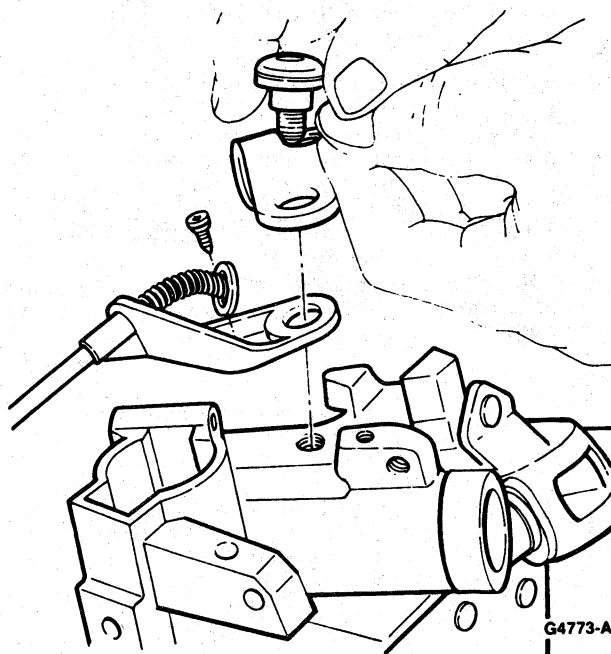
G4468-A

5. Install intermediate mounting bracket on lock cylinder housing with two spring washer and Torx® head bolts. Tighten to 21-33 N·m (15-25 lb-ft).



G4469-A

6. With column placed in mid-tilt position, remove clamp from bracket.
7. Install tilt release cable and tilt release lever on lock cylinder housing with one Torx® head bolt and one self-tapping screw. Tighten bolt to 21-33 N·m (15-25 lb-ft). Tighten screw to 4.1-6.8 N·m (36-60 lb-in). Ensure tilt release lever rotates freely after tightening bolt.

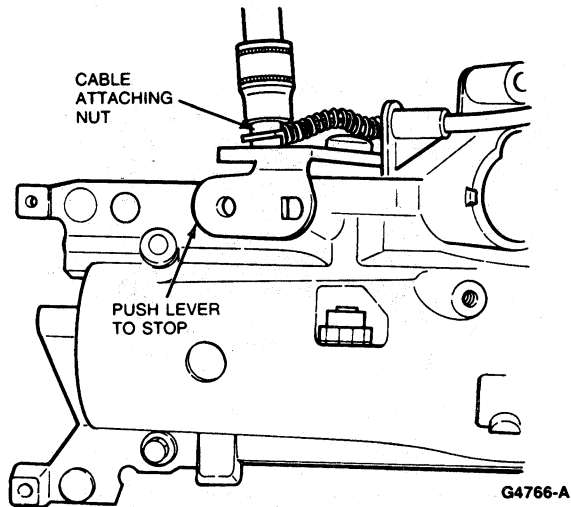


G4773-A



**DISASSEMBLY AND ASSEMBLY (Continued)**

8. Loosely install cable adjusting nut to tilt release lever. Push tilt release lever toward lower end of column until it reaches stop on cable bracket. While holding lever in this position, tighten adjusting nut to 4.1-6.8 N·m (36-60 lb-in).



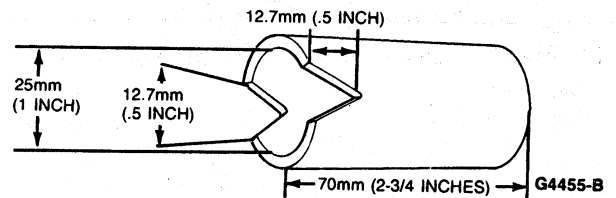
9. Install steering column as outlined.
10. Connect battery ground cable.
11. Check steering column for proper operation.

**Ignition Lock Actuator and Steering Wheel Lock**

Refer to Section 31-20.

**Steering Shaft and/or Steering Shaft Lower Bearing****Removal**

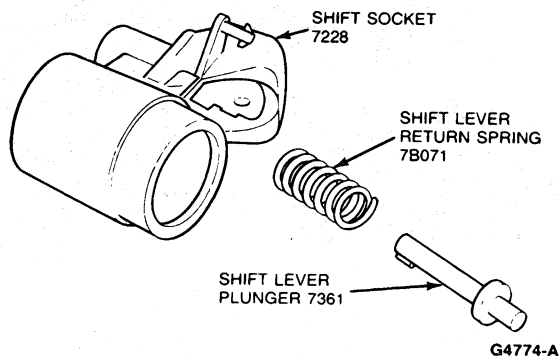
1. Disconnect battery ground cable.
2. Remove steering column assembly from vehicle.
3. Remove parking brake release vacuum switch from bottom of column, if so equipped.
4. Fabricate a tool from a piece of tubing 25mm x 70mm (1 inch x 2-3/4 inch).

**Shift Socket****Disassembly**

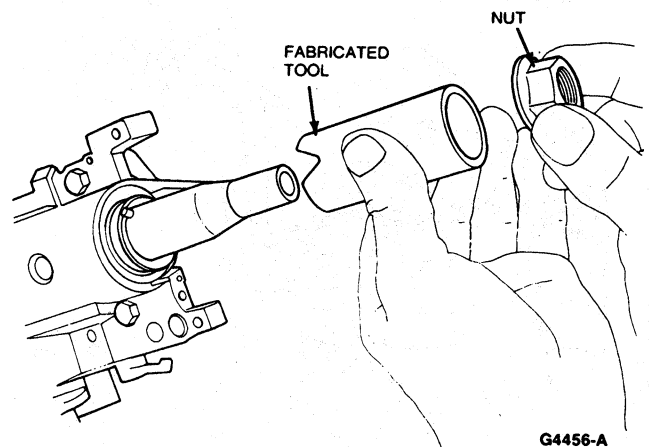
1. Grasp flats on shift lever plunger flange with needlenose pliers, push down and rotate counterclockwise 90 degrees.
2. Remove shift lever plunger.
3. Remove shift lever return spring.

**Assembly**

1. Install shift lever return spring into shift socket.
2. Insert shift lever plunger into shift socket. Ensure key on plunger is in line with keyway in socket.
3. Grasp flats on shift lever plunger flange with needlenose pliers, push down and rotate clockwise 90 degrees.

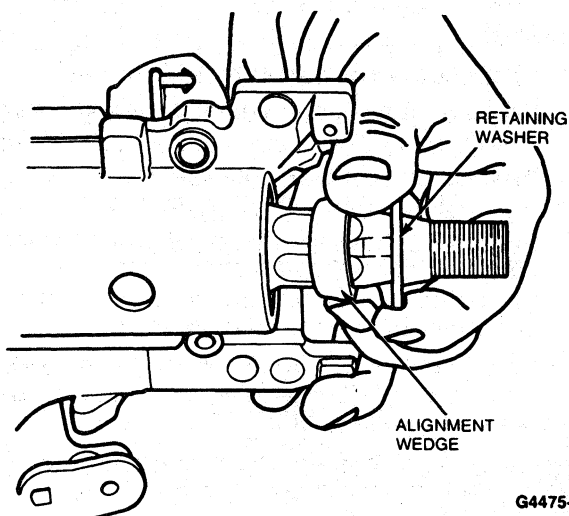


5. Install tool on shaft aligning clearance slot over shaft retaining pin.
6. Install steering wheel nut. Tighten nut enough to relieve spring pressure on shaft retaining pin.

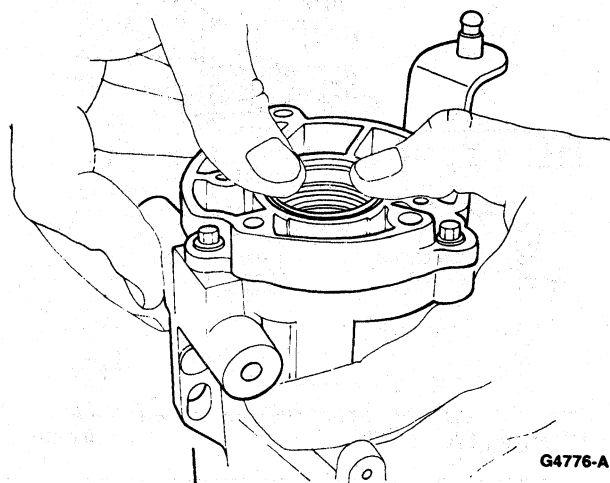


**DISASSEMBLY AND ASSEMBLY (Continued)**

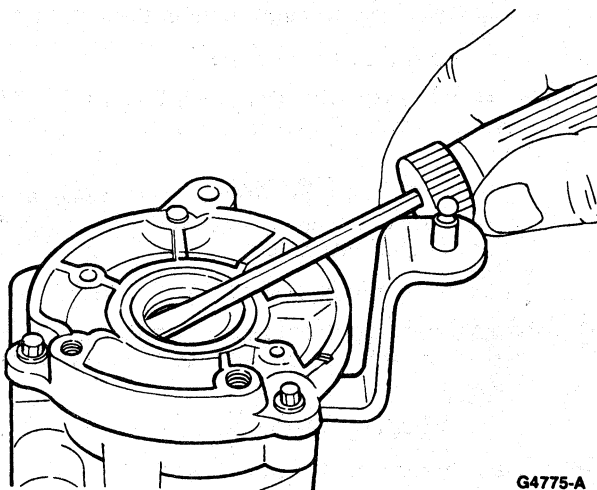
7. Using a 4mm (5/32-inch) diameter drift punch, tap retaining pin out of steering shaft and discard pin.
8. Remove steering wheel nut and tool.
9. Remove steering shaft retaining washer and upper alignment wedge from steering shaft.

**Installation**

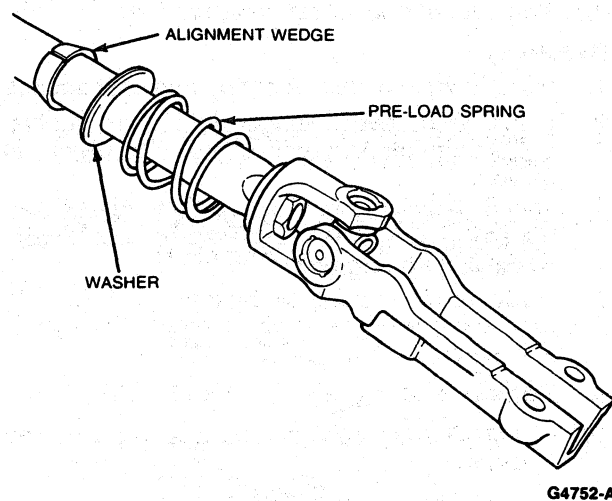
1. Push sleeve and bearing assembly into lower bearing retainer plate until they bottom. Ensure sleeve is not deformed.

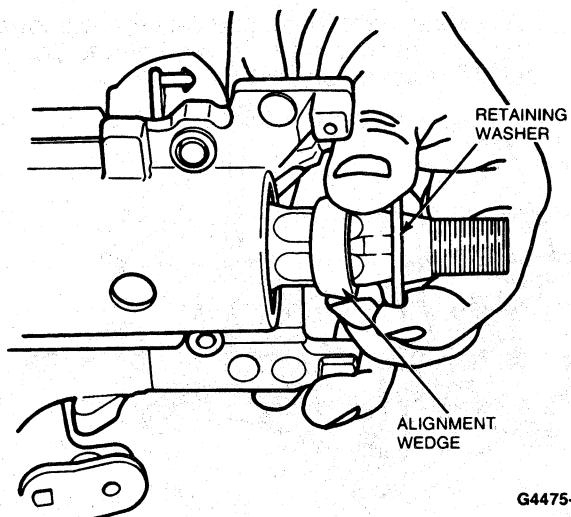


10. Slide steering shaft out of lock cylinder housing.
11. Insert a small screwdriver between inner and outer race of bearing and gently pry bearing and sleeve assembly out of lower bearing retainer.



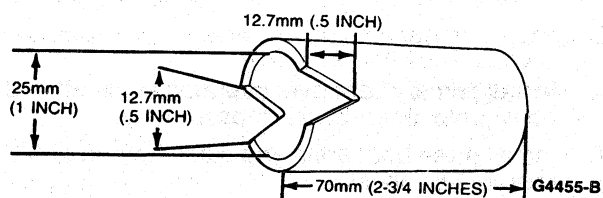
2. Slide steering shaft into lock cylinder housing.
3. Install upper alignment wedge and retaining washer over steering shaft.



**DISASSEMBLY AND ASSEMBLY (Continued)**

4. Install parking brake release vacuum switch, if so equipped.

5. Fabricate a tool from a piece of tubing 25mm x 70mm (1 inch x 2-3/4 inch).



6. Install tool on shaft aligning pin clearance slot over shaft retaining pin hole.
7. Install steering wheel nut. Tighten nut to compress spring enough to provide adequate clearance to shaft retaining pin hole.
8. Install shaft retaining pin by tapping it into hole until same amount of pin extends from either side of shaft.
9. Remove steering wheel nut and tool.
10. Install steering column and check for proper operation.
11. Connect battery ground cable.

**Speed Control Horn Brush****Removal**

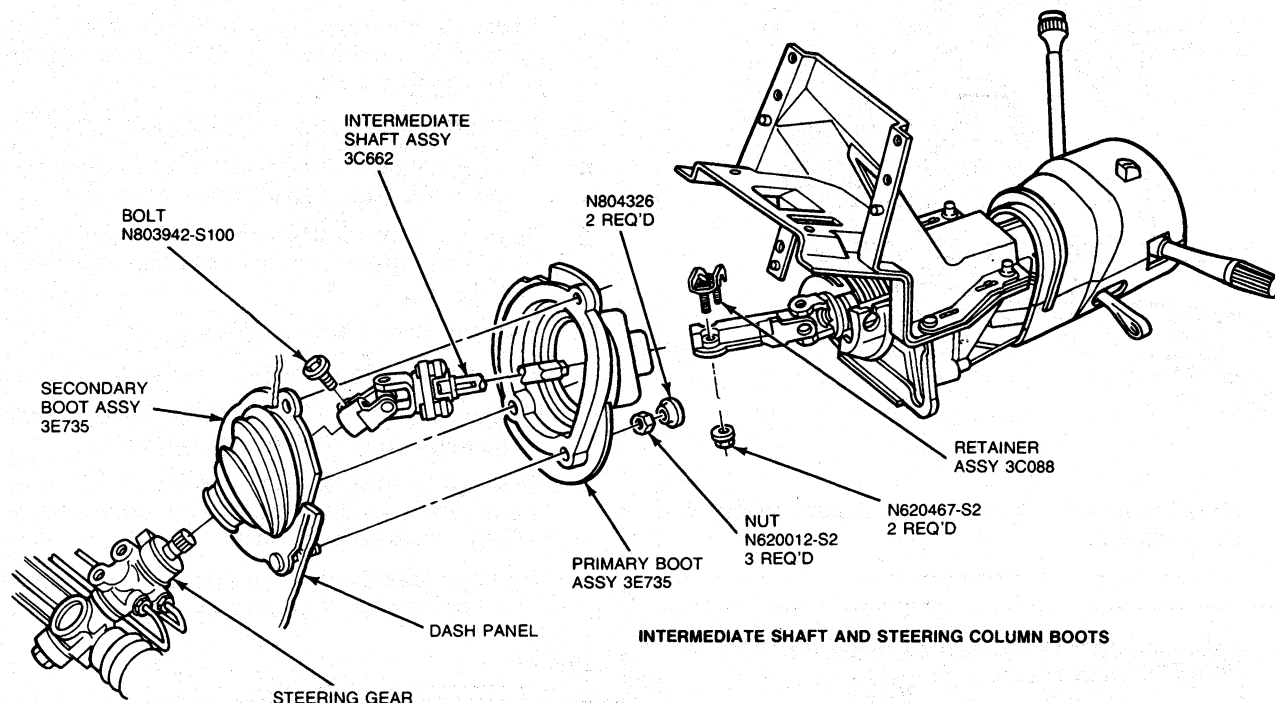
1. Disconnect battery ground cable.
2. Remove steering column cover from lower portion of instrument panel by removing four self-tapping screws.
3. Remove ignition lock cylinder as outlined.
4. For tilt columns only, remove tilt release lever by removing one socket head capscrew.
5. Remove shrouds by removing three Phillips head self-tapping screws from bottom of lower shroud.
6. Remove horn pad as outlined.
7. Remove steering wheel as outlined.
8. Disconnect speed control/horn brush wiring connector from main wiring harness.
9. Disengage speed control/horn brush wiring from lock cylinder housing by removing two wiring retainers from holes.
10. Remove speed control/horn brush by removing one hex-head self-tapping screw.

**Installation**

1. Install speed control/horn brush with one hex-head self-tapping screw. Tighten to 2.0-3.4 N·m (18-30 lb-in).
2. Attach speed control/horn brush wiring to lock cylinder housing by pushing two wiring retainers into their respective holes.
3. Connect speed control/horn brush wiring connector to main wiring harness.
4. Install steering wheel as outlined.
5. Install horn pad as outlined.
6. Install shrouds with three Phillips head self-tapping screws. Tighten to 0.7-1.1 N·m (6-10 lb-in).
7. For tilt columns only, install tilt release lever with one socket head capscrew. Tighten to 8.8-12.2 N·m (6.5-9.0 lb-ft).
8. Install ignition lock cylinder as outlined.
9. Install steering column cover from lower portion of instrument panel with two self-tapping screws.
10. Connect battery ground cable.
11. Check speed control/horn function.

## DISASSEMBLY AND ASSEMBLY (Continued)

## Intermediate Shaft and/or Steering Column Boots



G4777-B

## Removal

1. Remove two nuts and retainer assembly attaching intermediate shaft assembly to steering column.
2. Remove three nuts attaching primary boot to dash panel and remove boot.
3. Push secondary boot up to expose intermediate shaft assembly attachment to steering gear input shaft.
4. Remove bolt retaining intermediate shaft assembly to steering gear input shaft.
5. From inside of vehicle, remove intermediate shaft.
6. Remove secondary boot.

## Installation

1. Turn secondary boot inside out and position over three mounting studs. Push boot through dash panel opening. Push out any visible puckers in boot.
2. Install intermediate shaft through boot and to steering gear input shaft. Tighten bolt to 41-57 N·m (30-42 lb-ft).

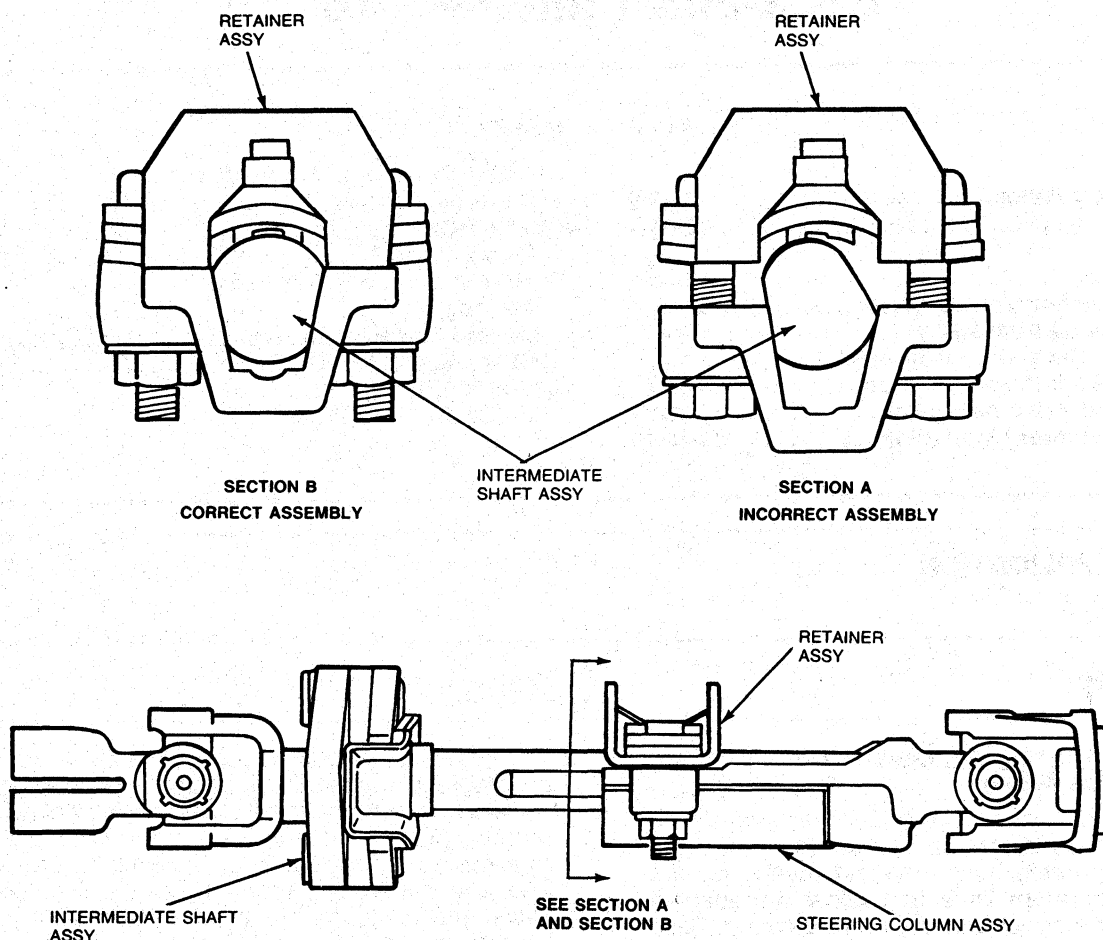
3. Install primary boot over intermediate shaft and down onto three studs in dash panel.
4. Install three boot attaching nuts. Tighten to 5-7 N·m (41-61 lb-in).
5. Connect intermediate shaft to steering column with retainer assembly and two nuts. When installing the steering column to intermediate shaft, connect intermediate shaft to steering column with retainer assembly and two nuts. Ensure the "vee-angle" of the intermediate shaft fits correctly into the "vee-angle" of the mating steering column yoke.

**CAUTION:** If the "vee-angle" on the intermediate shaft is mis-aligned to the column yoke, and the retainer is tightened to specification, the retainer plate will be bent, and then, **MUST** be replaced.

After correctly installing the steering column to intermediate shaft, tighten nuts to 21-33 N·m (15-25 lb-ft).

**DISASSEMBLY AND ASSEMBLY (Continued)**

6. Check steering column for proper operation.



G5332-A

**SPECIFICATIONS****TORQUE SPECIFICATIONS**

Description	N·m	Lb·Ft	Description	N·m	Lb·Ft
Steering Wheel Nut	47-68	35-50	Steering Column Boots to Dash Panel-Nuts	5.4-6.7	4-5
Steering Column Support Bracket to Body-Bolts	20-34	15-25	Intermediate Shaft to Steering Gear Input Shaft-Bolt	40-57	30-42
Actuator Cover to Lock Cylinder Housing-Bolt	3.4-5.4	30-48 lb-in	Steering Column Forward Mounting Bracket to Support-Nut	21-33	15-25
Multifunction Switch to Lock Cylinder Housing-Screw	2-3	18-26 lb-in	Intermediate Bracket to Forward Mounting Bracket-Bolt	21-33	15-25
Ignition Switch and Cover to Lock Cylinder Housing-Bolts	3.4-5.4	30-48 lb-in	Intermediate Bracket to Lock Cylinder Housing-Bolt	21-33	15-25
Vacuum Switch Actuator to Shift Arm-Screw	2.3-3.6	20-32 lb-in	Intermediate Bracket to Support Bracket-Screw	21-33	15-25
Vacuum Switch to Lower Bearing Retainer Plate-Screw	2.3-3.6	20-32 lb-in	Tilt Lever Handle to Tilt Bracket-Screw	9-11	6.5-8.5
Lower Bearing Retainer Plate to Lock Cylinder Housing-Screw	4.7-6.7	42-60 lb-in	Tilt Lever Bracket to Lock Cylinder Housing-Bolt	9-12	6.5-9
Steering Column Lower Shaft to Intermediate Shaft-Nuts	20-34	15-25	Tilt Cable Adjusting Nut	3.4-6.8	30-60 lb-in

CG4778-B

# SECTION 13-46 Steering Gear, Integral Power Rack-and-Pinion—Ford

SUBJECT	PAGE	SUBJECT	PAGE
<b>ADJUSTMENTS</b>		<b>DISASSEMBLY AND ASSEMBLY (Cont'd.)</b>	
Rack Yoke Plug Preload .....	13-46-8	Tie Rods, Bellows .....	13-46-10
<b>DESCRIPTION</b> .....	13-46-1	<b>OPERATION</b>	
<b>DIAGNOSIS</b>		Rotary Valve .....	13-46-3
External Leakage .....	13-46-6	<b>REMOVAL AND INSTALLATION</b>	
Tie Rod Articulation Torque Check .....	13-46-8	Steering Gear .....	13-46-9
<b>DISASSEMBLY AND ASSEMBLY</b>		Tie Rod End Replacement .....	13-46-9
Gear Housing, Rack Yoke Plug, Rack		<b>SPECIAL SERVICE TOOLS</b> .....	13-46-26
Assembly, Rack Bushing, Oil Seals .....	13-46-21	<b>SPECIFICATIONS</b> .....	13-46-26
Input Shaft and Valve Assembly .....	13-46-12	<b>VEHICLE APPLICATION</b> .....	13-46-1
Pressure and Return Line Fitting .....	13-46-25		

## VEHICLE APPLICATION

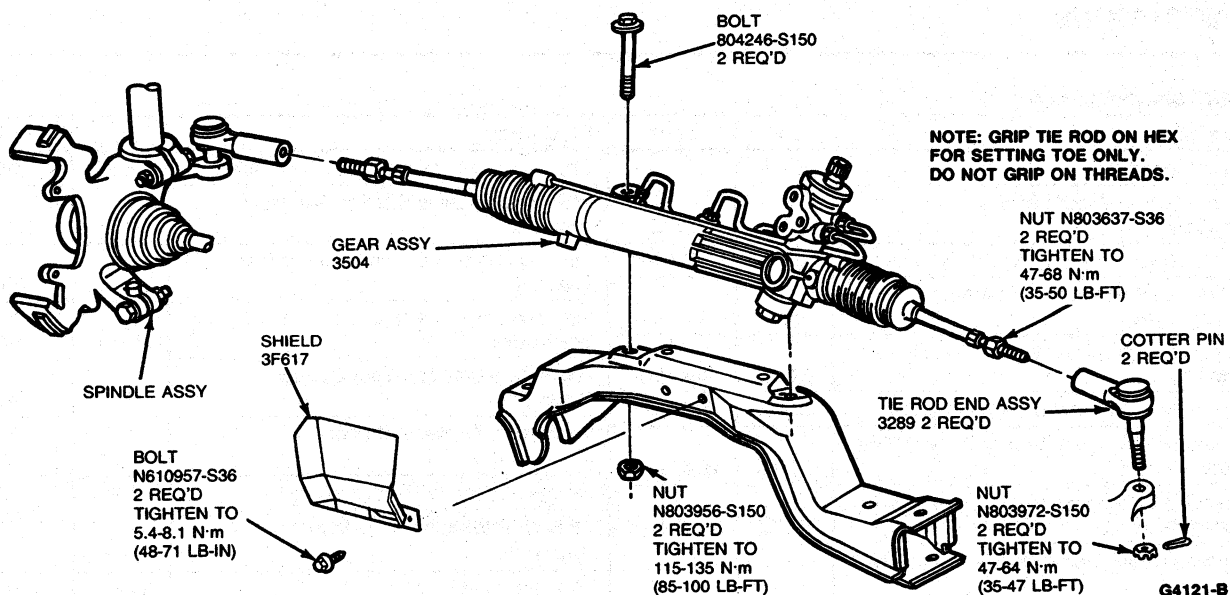
Taurus/Sable.

## DESCRIPTION

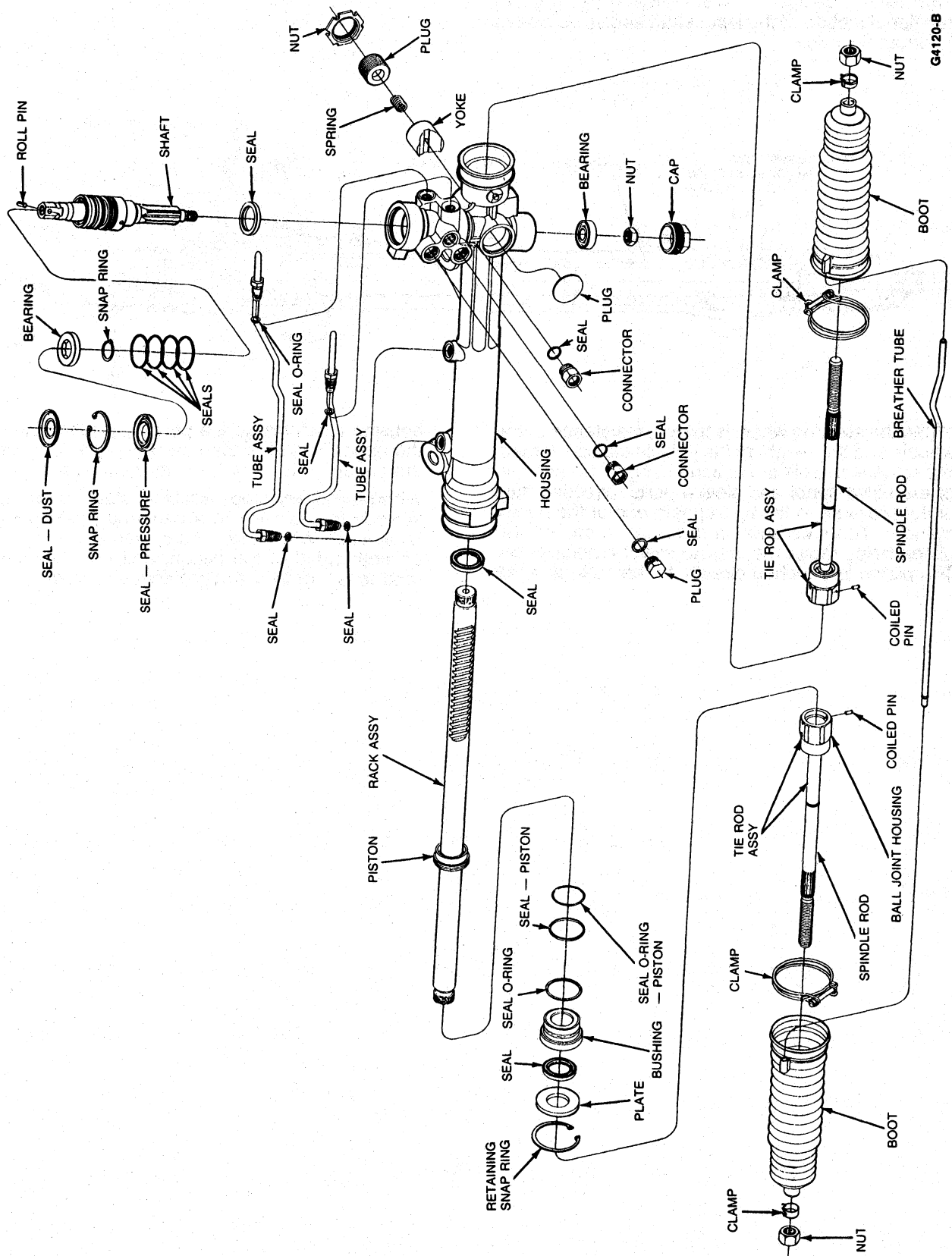
The power steering gear is a constant ratio power rack-and-pinion design.

The gear housing and valve housing are combined into a one-piece aluminum die casting. The gear design incorporates quick connect fittings for the pressure and return lines that allow the lines to swivel; this is normal and does not indicate loose fittings. If the fittings leak, check to ensure they are tightened to specification. (Do not over-tighten). If the leak is not corrected, replace the fitting seals.

The gear is a hydraulic-mechanical unit, which uses an integral piston and rack design to provide power-assisted vehicle steering control. Internal valving directs pump flow and controls pressure, as required, to reduce steering effort during operation. The unit contains a rotary hydraulic fluid control valve integrated to the input shaft and a boost cylinder integrated with the rack.

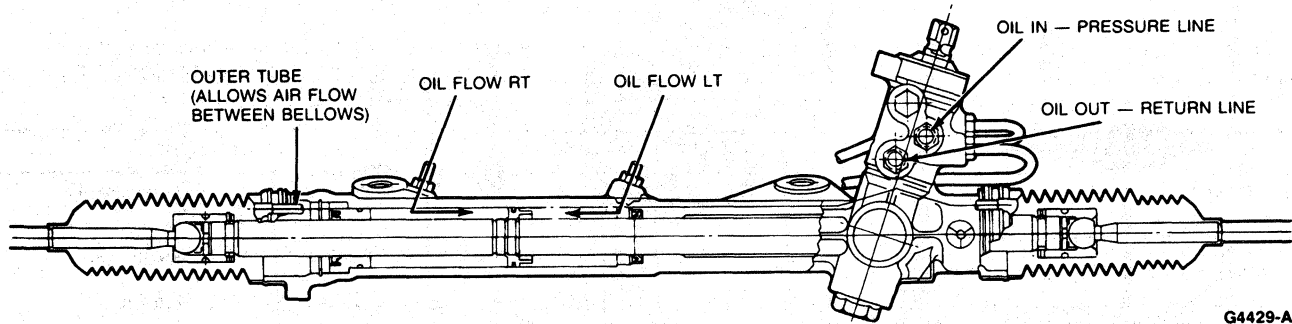


## DESCRIPTION (Continued)



**OPERATION****Rotary Valve**

The rotary design control valve uses relative rotational motion of the input shaft and valve sleeve to direct fluid flow.



When the steering wheel is turned, resistance of the wheels and the weight of the vehicle cause a torsion bar to deflect. This deflection changes the position of the valve spool and sleeve ports, directing fluid under pressure to the appropriate end of the power cylinder. The difference in pressure forces on the piston helps move the rack to assist turning effort. The piston is attached directly to the rack, and the

housing functions as the power cylinder. The oil in the opposite end of the power cylinder is forced to the control valve and back to pump reservoir.

When the driver stops applying steering effort, the valve is forced back to a centered position by the torsion bar. When this occurs, pressure is equalized on both sides of the piston, and the front wheels tend to return to a straight ahead position.



**DIAGNOSIS**

The diagnosis charts provide procedures to resolve typical customer complaints encountered with the power steering system.

Follow the sequence indicated to save time during condition identification and corrective action.

**POWER STEERING DIAGNOSIS**

Before any internal service is performed on the rack and pinion power steering, diagnosis of the condition must be performed. Make sure that the tire size is correct, with matched tires (front and rear), all inflated to specifications. The following conditions, possible sources and corrective action will assist in performing the proper service.

CONDITION	POSSIBLE SOURCE	ACTION
<ul style="list-style-type: none"> <li>● <b>WANDER</b> — Vehicle wander is a condition where the vehicle wanders side to side on the roadway when it is driven straight ahead while the steering wheel is held in a firm position. Evaluation should be conducted on a level road (little road crown).</li> </ul>	<ul style="list-style-type: none"> <li>● Loose tie rod ends.</li> <li>● Inner ball housing loose or worn.</li> <li>● Gear assembly mounting loose.</li> <li>● Loose suspension struts or ball joints.</li> <li>● Column intermediate shaft connecting bolts loose.</li> <li>● Column intermediate shaft joints loose or worn.</li> <li>● Improper wheel alignment.</li> </ul>	<ul style="list-style-type: none"> <li>● Replace tie rod end assemblies.</li> <li>● Replace tie rod assemblies.</li> <li>● Tighten mounting bolts to specification.</li> <li>● Adjust or replace as required.</li> <li>● Tighten bolts to specification.</li> <li>● Replace intermediate shaft.</li> <li>● Set alignment to specification.</li> </ul>
<ul style="list-style-type: none"> <li>● <b>FEEDBACK</b> — (Rattle, chuckle, knocking noises in the steering gear). Feedback is a condition where roughness is felt in the steering wheel by the driver when the vehicle is driven over rough pavement.</li> </ul>	<ul style="list-style-type: none"> <li>● Column U-joints loose.</li> <li>● Loose tie rod ends.</li> <li>● Loose/worn tie rod ball.</li> <li>● Gear assembly mounting loose.</li> <li>● Loose pinion bearing cap.</li> <li>● Loose pinion bearing locknut.</li> <li>● Piston disengaged or loose on rack.</li> <li>● Steering gear yoke worn.</li> <li>● Column intermediate shaft connecting bolts loose.</li> <li>● Loose suspension struts on ball joints.</li> </ul>	<ul style="list-style-type: none"> <li>● Replace if bad.</li> <li>● Replace tie rod end assemblies.</li> <li>● Replace tie rod assemblies.</li> <li>● Tighten mounting bolts to specification.</li> <li>● Tighten cap to specifications.</li> <li>● Tighten locknut to specification.</li> <li>● Replace rack assembly.</li> <li>● Replace yoke assembly.</li> <li>● Tighten bolts to specification.</li> <li>● Adjust or replace as necessary.</li> </ul>

CG3998-B

## DIAGNOSIS (Continued)

## POWER STEERING DIAGNOSIS — Continued

CONDITION	POSSIBLE SOURCE	ACTION
<ul style="list-style-type: none"> <li>● <b>POOR RETURNABILITY — Sticky Feel</b> — Poor returnability is noticed when the steering fails to return to center following a turn without manual effort from the driver. In addition, when the driver returns the steering to center, it may have a sticky or catchy feel.</li> </ul>	<ul style="list-style-type: none"> <li>● Misaligned steering column or column flange rubbing steering wheel and/or flange.</li> <li>● Check rotational torque of intermediate shaft joints.</li> <li>● Tight inner tie rod ball joints.</li> <li>● Binding in valve assembly.</li> <li>● Bent or damaged rack.</li> <li>● Bent or damaged sub-frame.</li> <li>● Column bearing binding.</li> <li>● Tight suspension struts or lower control arm ball joints.</li> <li>● Improper wheel alignment.</li> <li>● Contamination in system.</li> <li>● Deformed engine mounts.</li> </ul>	<ul style="list-style-type: none"> <li>● Align column.</li> <li>● If binding, replace intermediate shaft.</li> <li>● Replace tie rod as required.</li> <li>● Replace input shaft valve assembly.</li> <li>● Replace rack assembly.</li> <li>● Replace as necessary.</li> <li>● Replace bearing.</li> <li>● Adjust or replace as required.</li> <li>● Set to specification.</li> <li>● Flush power steering system.</li> <li>● Replace as required.</li> </ul>
<ul style="list-style-type: none"> <li>● <b>HEAVY STEERING EFFORTS (Poor or loss of assist)</b> — A heavy effort and poor assist condition is recognized by the driver while turning corners and especially while parking. A road test will verify this condition</li> </ul>	<ul style="list-style-type: none"> <li>● Leakage/loss of fluid.</li> <li>● Low pump fluid.</li> <li>● Valve plastic ring cut or twisted.</li> <li>● Damaged/worn plastic piston ring.</li> <li>● Loose/missing rubber backup piston O-ring.</li> <li>● Loose rack piston.</li> <li>● Gear assembly oil passages restricted.</li> <li>● Bent/damaged rack assembly.</li> <li>● Pump external leakage.</li> <li>● Improper drive belt tension.</li> <li>● Hose or cooler external leakage.</li> <li>● Improper engine idle speed.</li> <li>● Pulley loose or warped.</li> <li>● Pump/flow pressure not to specification.</li> <li>● Hose/cooler line restrictions.</li> </ul>	<ul style="list-style-type: none"> <li>● Refer to external leakage diagnosis for service.</li> <li>● Fill as necessary.</li> <li>● Replace ring.</li> <li>● Replace ring.</li> <li>● Replace/install O-ring.</li> <li>● Replace rack assembly.</li> <li>● Clear/service as required.</li> <li>● Replace rack assembly.</li> <li>● Service per Pump Diagnosis.</li> <li>● Readjust belt tension.</li> <li>● Replace as necessary.</li> <li>● Readjust idle.</li> <li>● Replace pulley.</li> <li>● Refer to Pump Service Diagnosis.</li> <li>● Clear or replace as required.</li> </ul>

CG3999-B

## DIAGNOSIS (Continued)

## FORD INTEGRAL POWER RACK AND PINION STEERING GEAR

CONDITION	POSSIBLE SOURCE	ACTION
<ul style="list-style-type: none"> <li>• <b>Hissing Sound</b> There is some noise in all power steering systems. One of the most common is a hissing sound most evident at standstill parking. There is no relationship between this noise and the performance of the steering gear.</li> </ul>	<ul style="list-style-type: none"> <li>• Hiss may be expected when the steering wheel is at the end of travel or when turning at standstill.</li> </ul>	<ul style="list-style-type: none"> <li>• Hiss is a normal characteristic of rotary steering gears and in no way affects steering. Do not replace the input shaft and valve assembly unless the hiss is extremely objectionable. A replacement valve will also exhibit a slight noise and is not always a cure for the condition. Investigate for a grounded column or a loose boot at the dash panel. Any metal to metal contact will transmit valve hiss into the passenger compartment through the steering column. Verify clearance between flexible coupling components. Be sure steering column shaft and gear are aligned so flexible coupling rotates in a flat plane and is not distorted as shaft rotates.</li> </ul>

CG3022-D

**External Leakage**

When looking for leaks, use this procedure to pinpoint the exact cause and location to avoid misdiagnosis:

1. Check for overfilled power steering pump reservoir.
2. Wipe suspected area dry.
3. Check for power steering pump overflow and aeration.
4. Check for exact source of oil. Example: Oil may be running down from another area (engine, etc.) and drip may not be leak point.
5. Some leaks are high pressure leaks and may require holding steering wheel against stops to seep out.

**CAUTION: Do not hold the steering wheel against a stop for more than three to five seconds at a time. Cycle the steering wheel from stop to stop ten times and check for leaks. The bellows may have to be moved back from the housing to see the leak.**

6. Power steering gear assembly leaks fall into several categories as listed in the Leakage Diagnosis chart. The category determines which seals or parts to replace. Refer to the corresponding illustrations for the leak category.

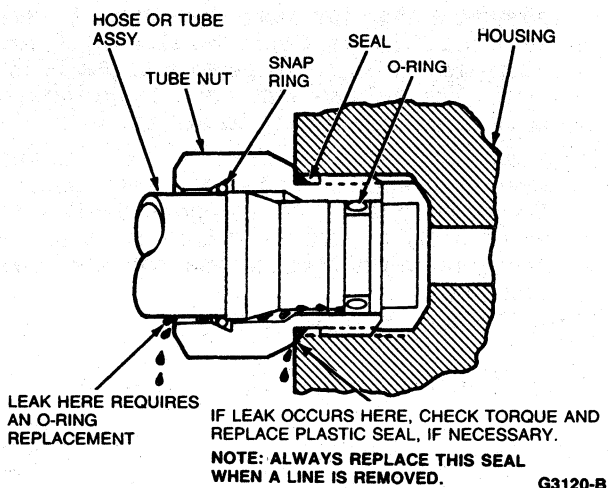
## DIAGNOSIS (Continued)

## LEAKAGE DIAGNOSIS

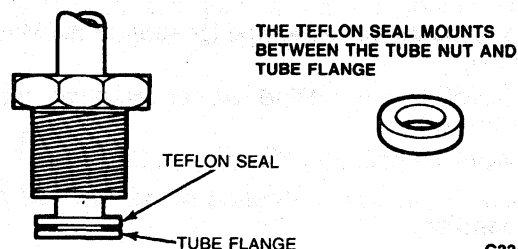
Leak Category	Part Required to Service
1. Hose fittings.	a. Loose — Tighten to specification — Do not over-tighten. b. Plastic seals at tube nut — Plastic seals should be replaced each time hose is disconnected. c. Inspect O-ring and replace as required.
2. Leak at (right or left) transfer line.	a. Loose — Tighten to specification — Do not over-tighten. b. Replace plastic seals. c. Replace line assembly as required.
3. Leak at input shaft seal.	a. Replace input shaft seal kit. Rack and tie-rod assembly removal is not required.
4. Leak at either or both bellows.	a. Replace all gear housing rack bushing and input shaft seals. Do not disturb transfer lines.
5. Leak at end of input shaft.	a. Replace input shaft valve assembly along with input shaft seal kit. Rack and tie rod assembly removal is not required.
6. Housing — porosity, cracked or stripped threads.	a. Replace the housing assembly.

**NOTE:** Whenever a gear assembly is disassembled for seal replacement, the gear seal contact surfaces should be checked for roughness and cleaned. Replace components such as input shaft/valve assembly or rack assembly only if the sealing surfaces cannot be cleaned satisfactorily with crocus cloth.

CG4430-A

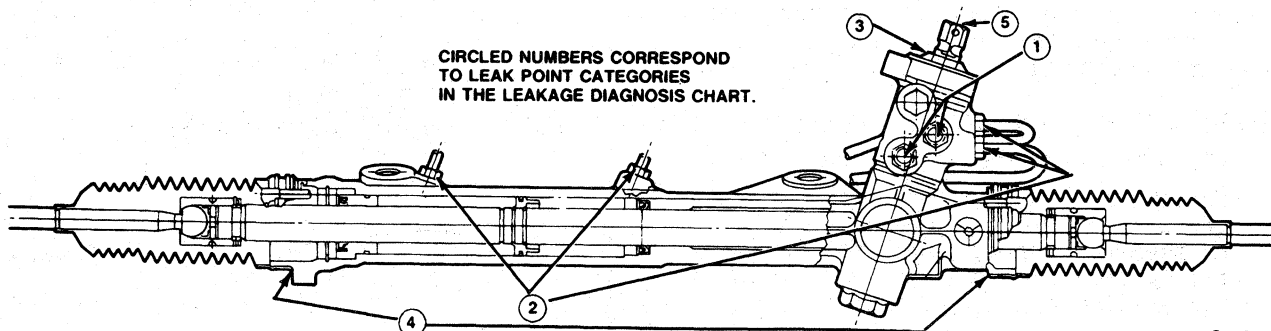


G3120-B



G3357-B

CIRCLED NUMBERS CORRESPOND TO LEAK POINT CATEGORIES IN THE LEAKAGE DIAGNOSIS CHART.



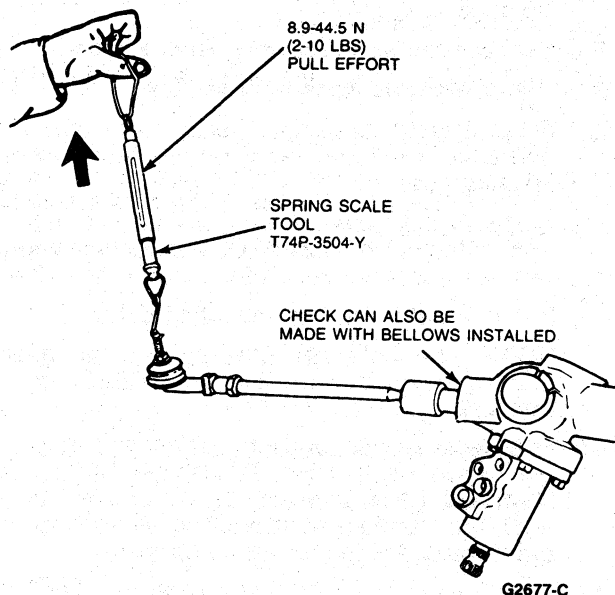
G4431-A

## DIAGNOSIS (Continued)

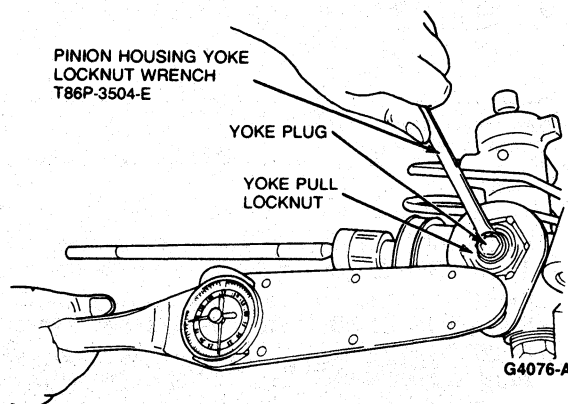
**Tie Rod Articulation Torque Check**

This check may be done with the gear on or off the vehicle.

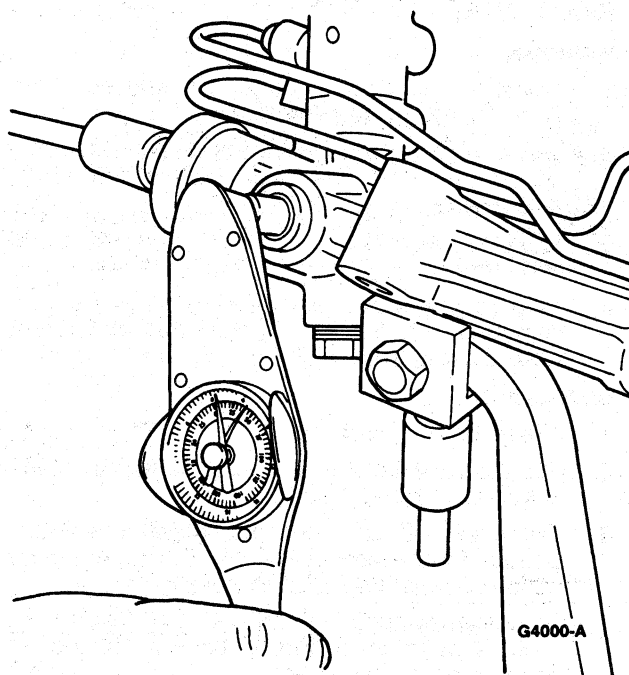
1. Disconnect tie rod end from spindle using Tie Rod End Remover TOOL-3290-C or equivalent.
2. Hook Pull Scale T74P-3504-Y or equivalent over tie rod end and measure the force required to move the tie rod.
3. If force required to move tie rods is not between 8.9N and 45N (2 lbs and 10 lbs) replace tie rod.



4. Drain power steering fluid by rotating input shaft lock to lock twice using Pinion Shaft Torque Adjuster T86P-3504-K or equivalent. Position adapter and wrench on input shaft.
5. Loosen yoke plug locknut with Pinion Housing Yoke Locknut Wrench T86P-3504-E or equivalent.



6. Loosen yoke plug.
7. With rack at center of travel, tighten yoke plug to 5-5.6 N·m (45-50 lb-in). Clean threads of yoke plug prior to tightening to prevent a false reading.

**ADJUSTMENTS**

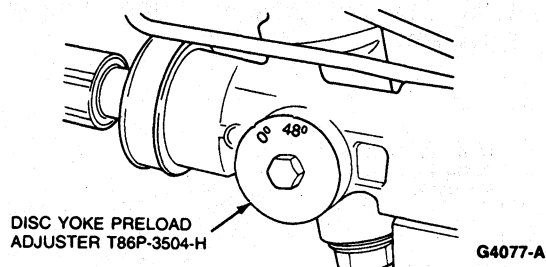
The power rack-and-pinion steering gear provides for only one service adjustment. **This adjustment can be performed only with the gear out of the vehicle. This adjustment is normally only required when the input shaft and valve assembly is removed.**

**Rack Yoke Plug Preload**

1. Clean exterior of steering gear thoroughly.
2. Mount steering gear in Holding Fixture T57L-500-B or equivalent. To avoid removing the pressed-in mounting bolts from the gear, enlarge the mounting holes in the hold fixture with a 9/16-inch diameter drill.
3. Do not remove external pressure lines, unless they are leaking or damaged. If these lines are removed, they must be replaced with new lines.

## ADJUSTMENTS (Continued)

8. Install Disc-Yoke Preload Adjuster T86P-3504-H or equivalent. Mark location of zero degree mark on housing. Back off adjuster so 48 degree mark lines up with zero degree mark.



9. Place Pinion Housing Yoke Locknut Wrench T86P-3504-E or equivalent on yoke plug locknut. While holding yoke plug, tighten locknut to 54-68 N·m (40-50 lb-ft). Refer to illustration following Step 5. **Do not allow yoke plug to move while tightening or preload will be affected.** Check input shaft torque after tightening locknut.
10. If external pressure lines were removed, they must be replaced with new service lines. Clean out Teflon® seal shreds from housing ports prior to installation of new lines.

## REMOVAL AND INSTALLATION

## Tie Rod End Replacement

## Gear In Vehicle

## Removal

1. Remove and discard cotter pin and nut from worn tie rod end ball stud.
2. Disconnect tie rod end from steering spindle, using Tie Rod Remover TOOL-3290-C or equivalent.
3. Hold tie rod end with a wrench and loosen tie rod jam nut.
4. Grip tie rod with a pair of suitable pliers, and remove rod end assembly from tie rod, but first note the depth to which tie rod was located.

## Installation

1. Clean tie rod threads.
2. Thread new tie rod end into tie rod to same depth as removed tie rod end.
3. Place tie rod end stud into steering spindle. Ensure front wheels are pointed straight ahead before connecting stud to spindle.
4. Install a new nut on tie rod end stud. Tighten nut to 48 N·m (35 lb-ft), and continue tightening nut to align next castellation of nut with cotter pin hole in stud. Install a new cotter pin.
5. Set toe to specification. Refer to Section 14-01. Tighten jam nut to 47-68 N·m (35-50 lb-ft).

## Steering Gear

## Removal

1. From inside vehicle, remove nuts retaining steering shaft weather boot to dash panel.
2. Remove two bolts retaining intermediate shaft to steering column shaft.
3. Set weather boot aside. Remove pinch bolt at steering gear input shaft and remove intermediate shaft.
4. Raise vehicle on a hoist. Refer to Pre-Delivery manual, Section 50-04.
5. Remove LH front wheel.
6. Remove heat shield.
7. Cut bundling strap retaining lines to gear.
8. Remove tie rod ends from spindles.
9. Place a drain pan under vehicle and remove hydraulic pressure and return lines from steering gear.

NOTE: The pressure and return lines are on the front of the valve housing. Do not confuse them with the transfer lines on the side of the valve.

10. Remove nut from gear mounting bolts.

NOTE: The bolts are pressed into the gear housing and should not be removed during gear removal.

11. Push weather boot end into vehicle and lift gear out of mounting holes. Rotate gear so input shaft will pass between brake booster and floorpan. Carefully start working steering gear out through LH fender apron opening.
12. Rotate input shaft so that it clears LH fender apron opening and complete removal of steering gear.

NOTE: If steering gear seems to be stuck, check RH rod to ensure the stud is not caught on any obstacle.

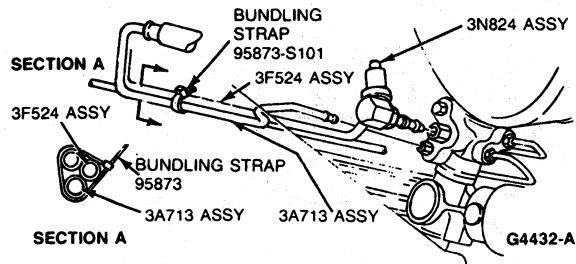
## Installation

1. Install new plastic seals on hydraulic line fittings as outlined.
2. Insert steering gear through LH fender apron. Rotate input shaft forward to completely clear fender apron opening. To allow gear to pass between brake booster and floorpan, rotate input shaft rearward.
3. Align steering gear bolts to bolt holes and install mounting nuts. Tighten to 115-135 N·m (85-100 lb-ft).
4. Lower vehicle.
5. From engine compartment, install hydraulic pressure and return lines. Tighten pressure line to 28-33 N·m (20-25 lb-ft), and return line to 20-28 N·m (15-20 lb-ft).

NOTE: Swivel movement of lines is normal when fittings are properly tightened.

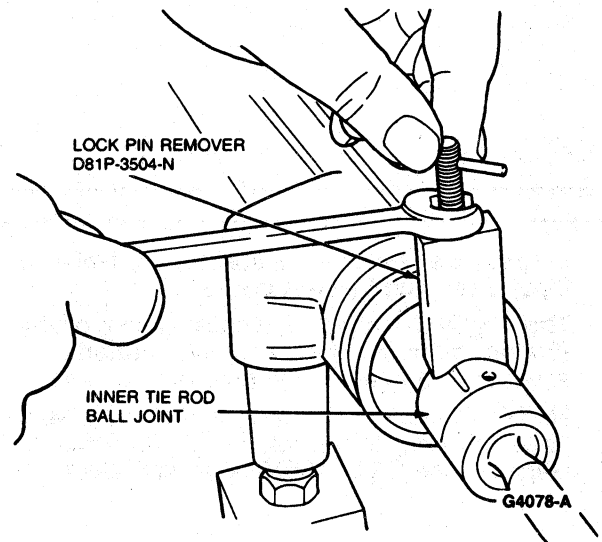
## REMOVAL AND INSTALLATION (Continued)

6. Raise vehicle.
7. Secure pressure and return lines to transfer tube with bundling strap as shown.



8. Install heat shield.
9. Install tie rod ends to spindles. Tighten castle nuts to minimum of 48 N·m (35 lb-ft). If necessary, tighten slightly more to align slot in nut for the cotter pin.
10. Install a new cotter pin.
11. Install LH front wheel and lower vehicle.
12. From inside vehicle, pull weather boot end out of vehicle and install over valve housing.
13. From inside vehicle, install intermediate shaft to steering gear input shaft.
14. Install inner weather boot to floorpan.
15. Install intermediate shaft to steering column shaft.
16. Fill power steering system with Motorcraft Type F automatic transmission fluid.
17. Check system for leaks and proper operation.
18. Adjust toe setting. Refer to Section 14-01.

4. Remove bellows along with breather tube.  
**CAUTION: Use care not to damage bellows.**
5. If pinion requires removal, remove pinion before proceeding. Refer to Input Shaft and Valve Disassembly.
6. Using Lock Pin Remover D81P-3504-N or equivalent remove coiled lock pins from inner tie rod ball joints.



7. Position rack so that several rack teeth are exposed. Hold rack with an adjustable wrench on end teeth only, while loosening ball joint nuts with Nut Wrench T74P-3504-U or equivalent.

## DISASSEMBLY AND ASSEMBLY

## Tie Rods, Bellows

## Disassembly

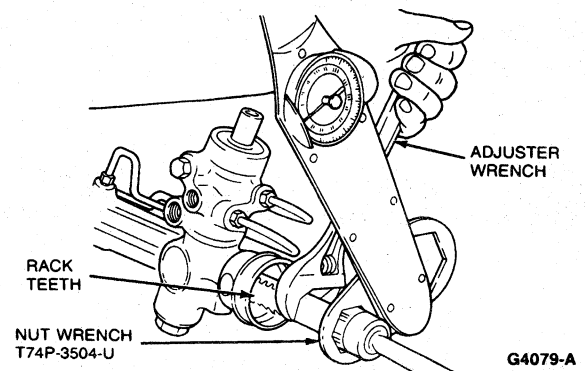
1. Mount gear assembly in Bench Mounted Holding Fixture T57L-500-B or equivalent.

NOTE: Drill out mounting holes in holding fixture with a 9/16-inch drill to allow the gear assembly mounting bolts to fit.

2. Remove tie rod ends.
3. Remove four clamps retaining bellows to gear housing and tie rods. Discard clamps if damaged or excessively corroded.

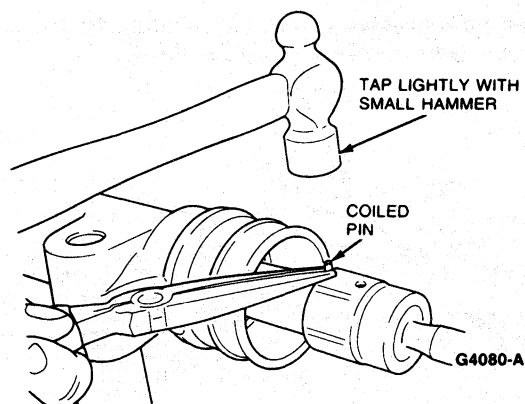
## Assembly

1. If pinion was not removed, expose several rack teeth and hold rack with adjustable wrench. Tighten each ball joint assembly separately to 75-88 N·m (55-65 lb-ft) using Nut Wrench T74P-3504-U or equivalent.



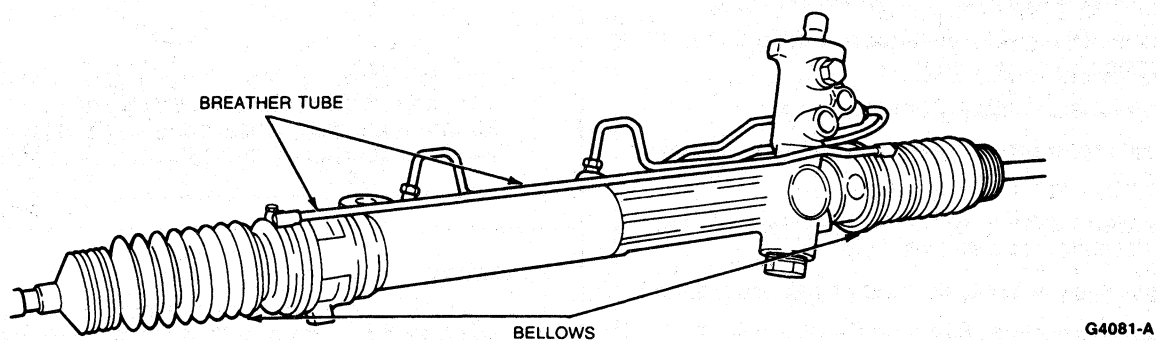
**DISASSEMBLY AND ASSEMBLY (Continued)**

2. If pinion was removed, hold one ball joint nut with a 1-5/16 inch open-end or box wrench while tightening other nut to 75-88 N·m (55-65 lb-ft) with Nut Wrench T74P-3504-U or equivalent. Both ends are tightened simultaneously by this method.
3. Install new coiled pins in tie rod ball housing by tapping lightly with small hammer.



4. If pinion was removed, install pinion. Refer to Input Shaft and Valve Assembly.
  5. Thoroughly clean rack and housing bore of any foreign material. Any abrasive material is extremely harmful to high pressure oil seals.
- NOTE: Replenish any grease that may have been removed from rack teeth with Steering Gear Grease C3AZ-19578-A or equivalent.

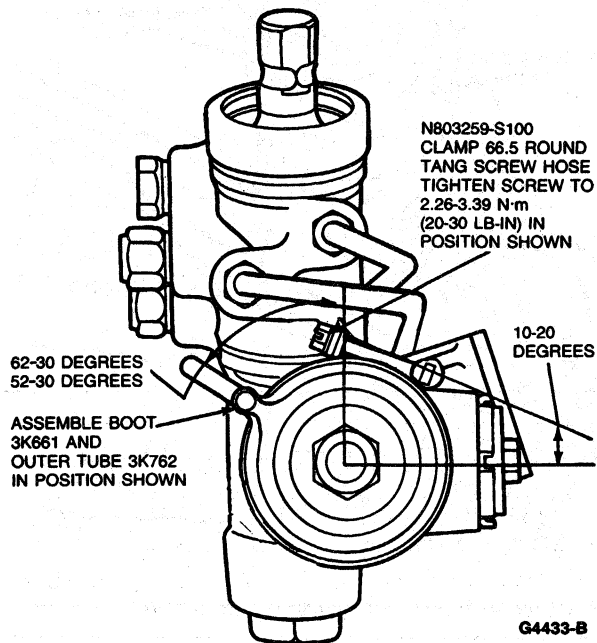
6. Apply Steering Gear Grease C3AZ-19578-A or equivalent to groove in rods where bellows clamp to tie rod. This allows for toe-in adjustment without twisting bellows.
7. Install bellows and breather tube. Ensure breather tube is positioned as shown.





**DISASSEMBLY AND ASSEMBLY (Continued)**

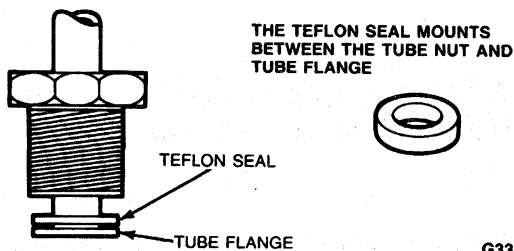
8. Install screw type clamps and position screw axis as shown.



9. Install new clamps retaining bellows to tie rods.
10. Apply Disc Brake Caliper Slide Grease D7AZ-19590-A or equivalent to tie rod threads.
11. Install tie rod outer ends.

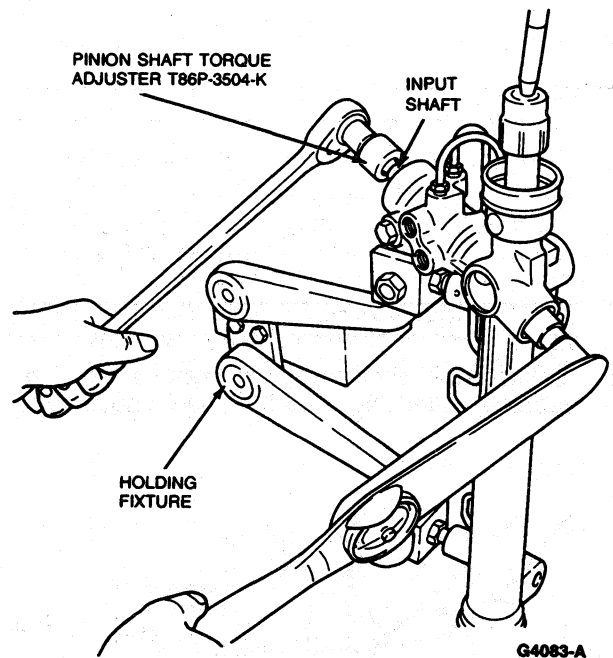
**Input Shaft and Valve Assembly****Disassembly**

1. Thoroughly clean areas of input shaft valve housing, yoke locknut and plug, and pinion bearing plug.
2. Mount gear in the Bench Mounted Holding Fixture T57L-500-B or equivalent. Drill out mounting holes in holding fixture with a 9/16-inch drill to allow gear assembly mounting bolts to fit.
3. Do not remove external pressure lines (RH and LH turn lines), unless they are leaking or damaged. If these lines are removed, new Teflon® seals must be installed.



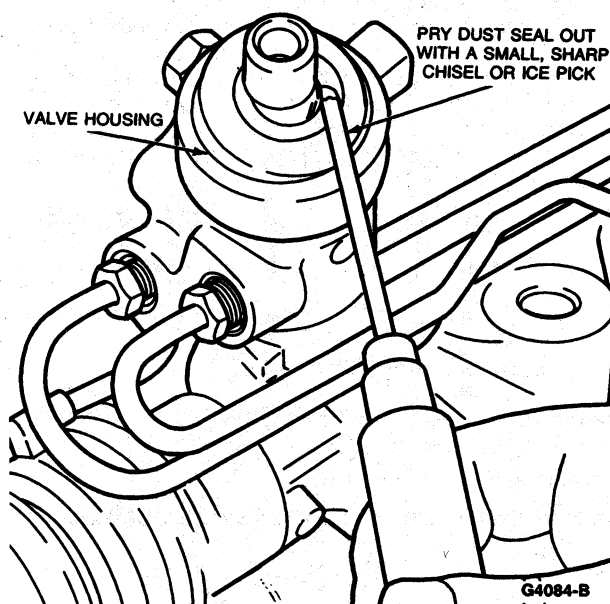
4. Loosen yoke plug locknut and yoke plug to relieve preload on rack.
5. Remove pinion bearing plug.
6. Install Pinion Shaft Torque Adjuster T86P-3504-K or equivalent on input shaft. Hold input shaft, and remove pinion bearing locknut with an 11/16-inch socket. Discard locknut.

**CAUTION:** Do not allow rack to reach full travel when loosening or tightening the locknut.

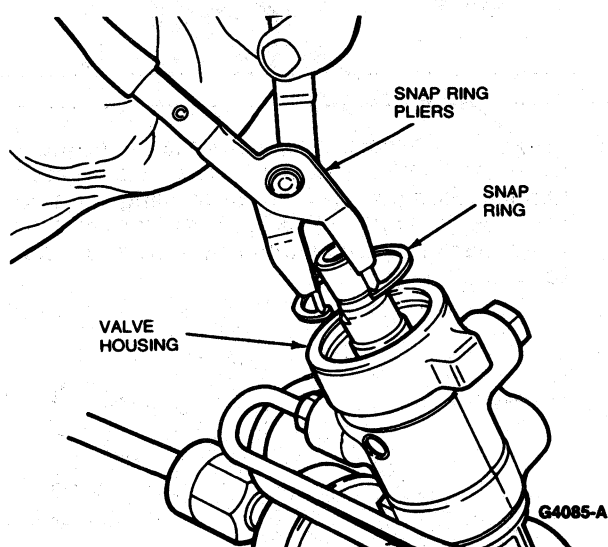


**DISASSEMBLY AND ASSEMBLY (Continued)**

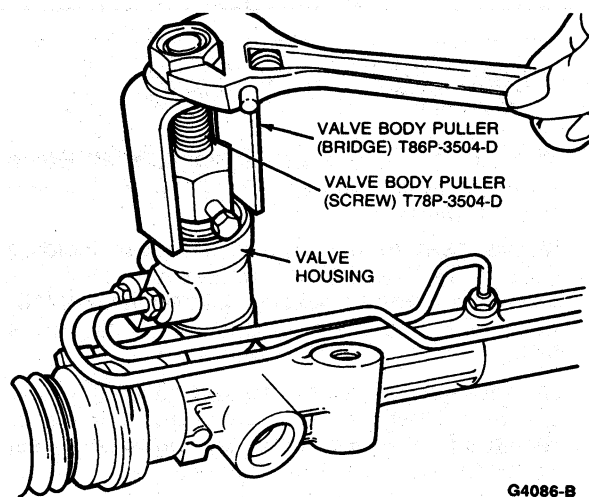
7. Pry input shaft dust seal out of valve housing with a small, sharp chisel or ice pick. **Use care not to damage any valve housing surfaces.**



8. Using snap ring pliers, remove snap ring, located under dust seal from valve housing.

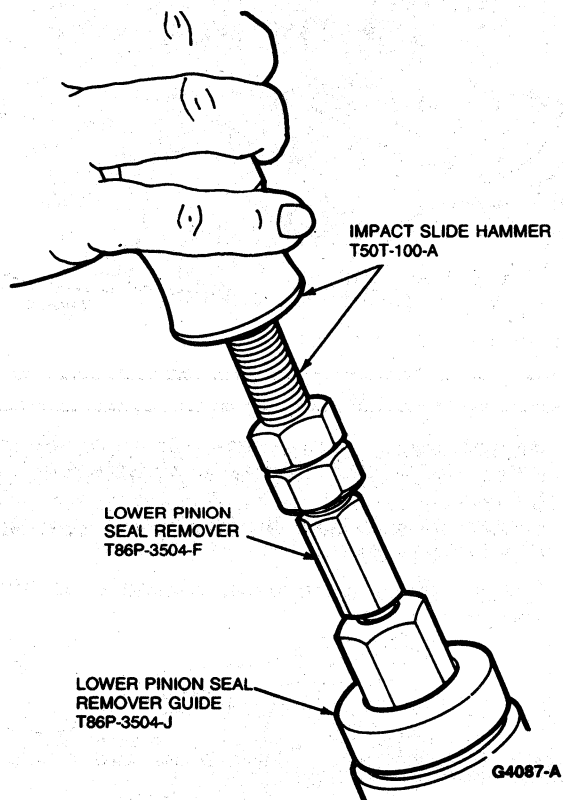


9. Attach Valve Body Puller (Bridge) T86P-3504-D and Valve Body Puller (Screw) T78P-3504-B or equivalent, to input shaft. Turn nut to remove valve. Input shaft seal and bearing will come out with valve body.

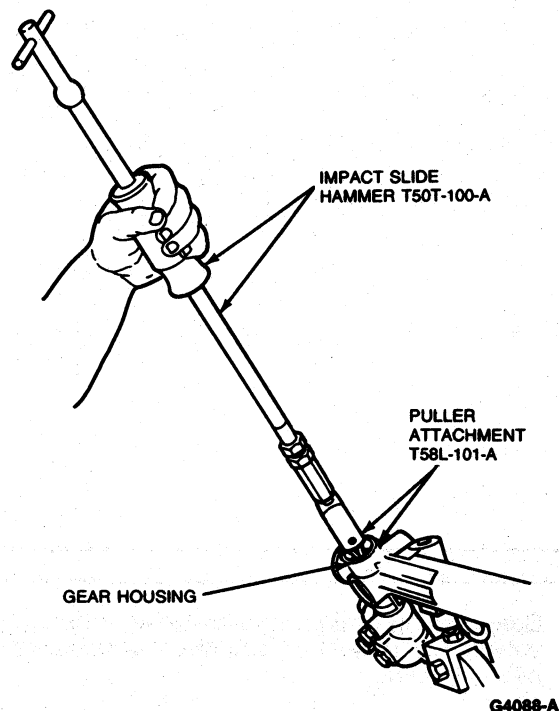


## DISASSEMBLY AND ASSEMBLY (Continued)

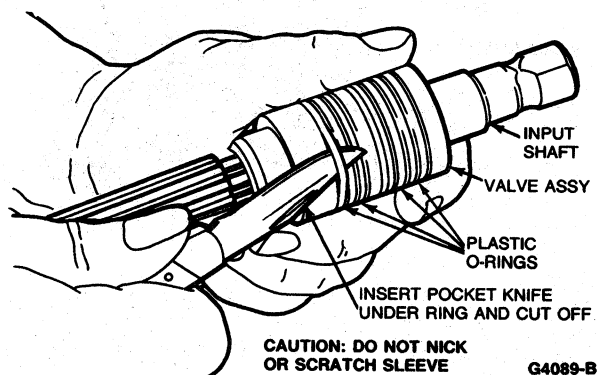
10. To remove lower pinion shaft seal, insert Lower Pinion Seal Remover T86P-3504-F or equivalent until it bottoms along with Lower Pinion Seal Remover Guide T86P-3504-J. Activate expander with a pair of wrenches by holding large nut and turning small nut until expander fully tightens. Pull tool and seal with Impact Slide Hammer T50T-100-A or equivalent.



11. Remove pinion bearing from gear housing with Impact Slide Hammer T50T-100-A and Puller Attachment T58L-101-A or equivalent.

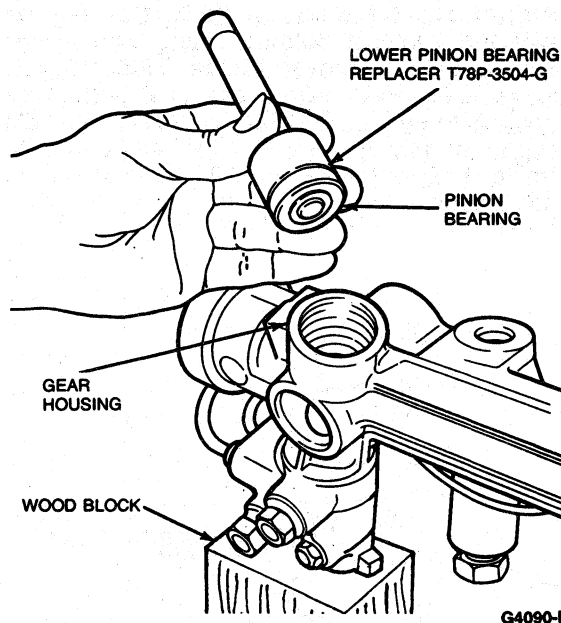


12. The only serviceable components of the input shaft and valve assembly are four plastic O-rings. Remove O-rings by pushing rings to one side, inserting a small pointed pocket knife under each ring, and cutting it off. Use care not to scratch valve sleeve.

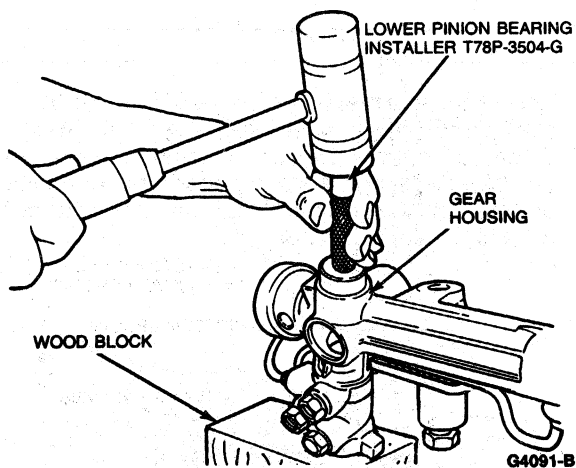


**DISASSEMBLY AND ASSEMBLY (Continued)****Assembly**

1. Install steering gear pinion bearing in gear housing using Lower Pinion Bearing Replacer T78P-3504-G or equivalent.

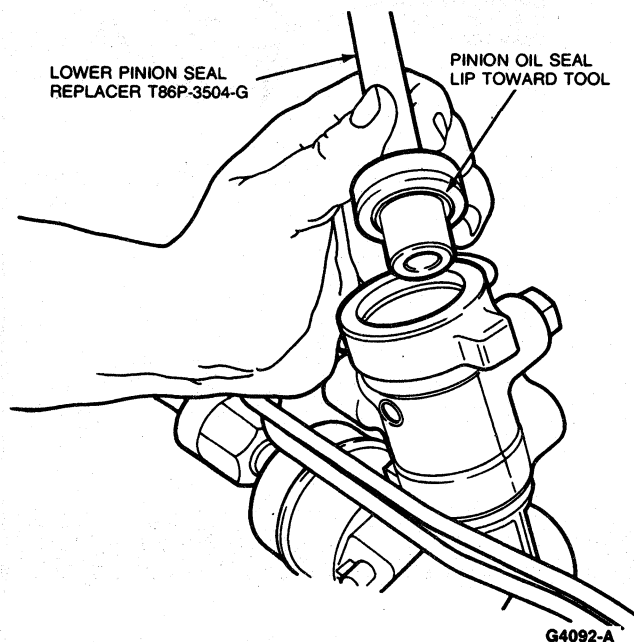


Seat bearing against shoulder in bore. Support valve housing with a wood block when seating pinion bearing.



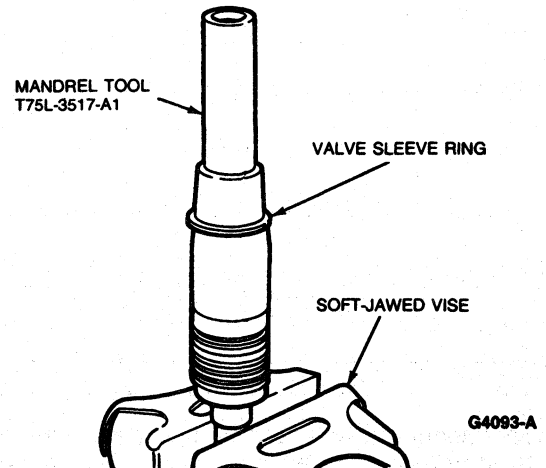
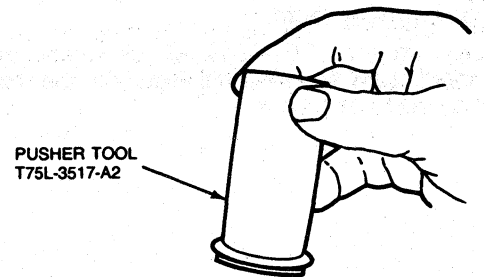
2. Apply Steering Gear Grease C3AZ-19578-A or equivalent to pinion oil seal, and place it on Lower Pinion Seal Replacer T86P-3504-G or equivalent with seal lip toward tool. Support pinion housing on a flat clean surface.

Install seal in valve bore, seating it against shoulder.

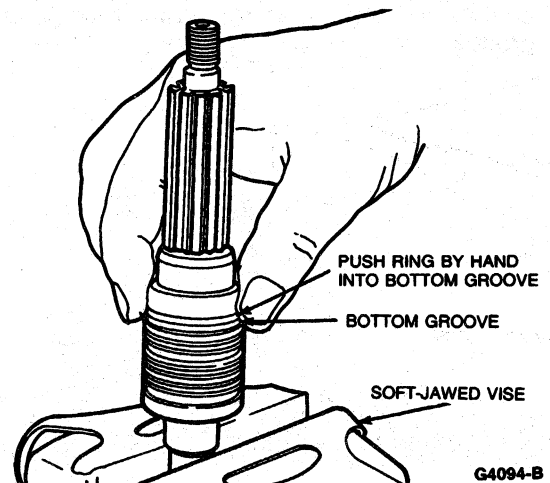


**DISASSEMBLY AND ASSEMBLY (Continued)**

3. Mount input shaft end of valve assembly in a soft-jawed vise. Clamp shaft outside bearing and seal surface.
4. Lubricate Mandrel T75L-3517-A1 or equivalent with power steering fluid and install over valve assembly. Slide one valve sleeve ring over tool.
5. Slide Pusher T75L-3517-A2 or equivalent over mandrel. Rapidly push down on pusher tool, forcing ring down ramp onto valve sleeve.

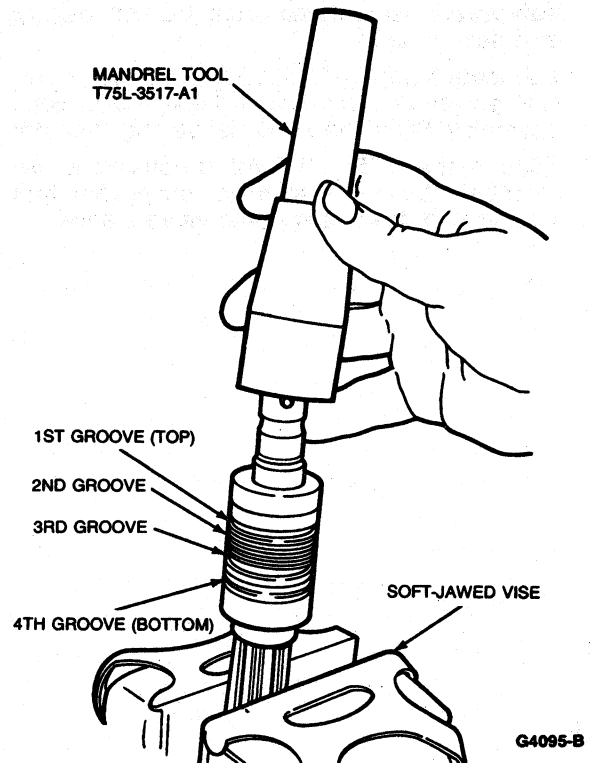


Complete installation by pushing ring into bottom groove.

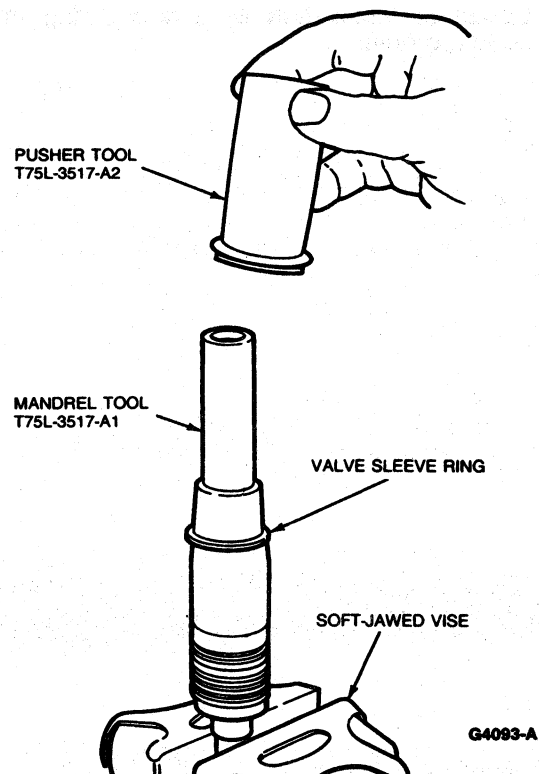


**DISASSEMBLY AND ASSEMBLY (Continued)**

6. Remove valve assembly from vise and regrip it with pinion gear teeth.
7. Install Mandrel T75L-3517-A1 or equivalent over input shaft. Mandrel will align with the third (next to bottom) groove.



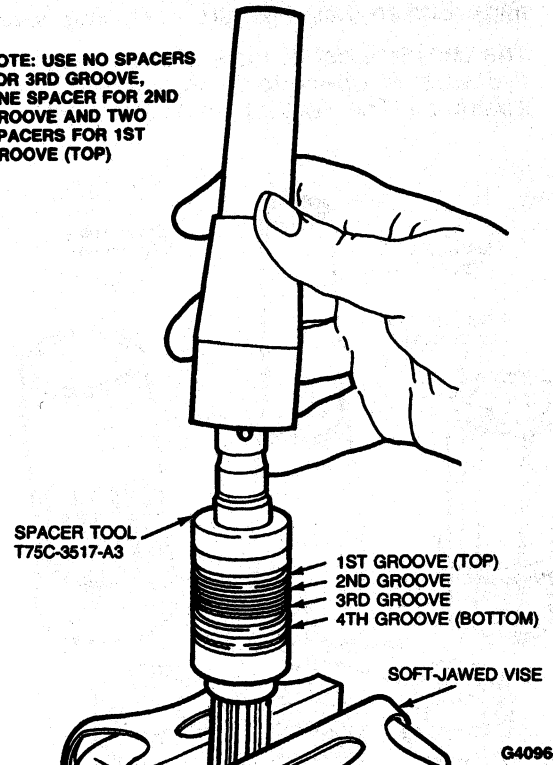
Install third valve sleeve ring by pushing on it rapidly with Pusher T75L-3517-A2 or equivalent. The ring will snap into proper groove.



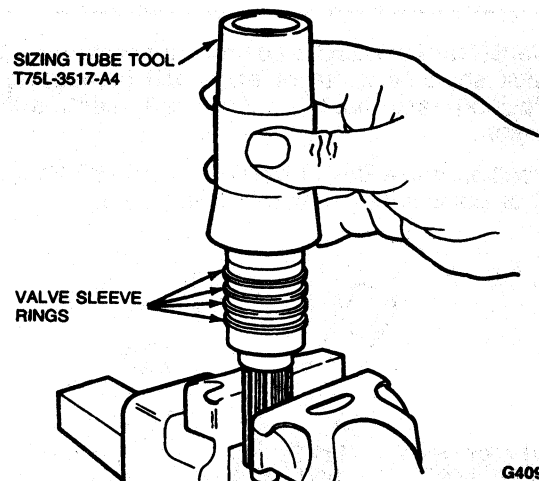
**DISASSEMBLY AND ASSEMBLY (Continued)**

8. Repeat Step 7 using one spacer for second valve sleeve ring (Spacer T75L-3517-A3 or equivalent).

**NOTE: USE NO SPACERS FOR 3RD GROOVE, ONE SPACER FOR 2ND GROOVE AND TWO SPACERS FOR 1ST GROOVE (TOP)**



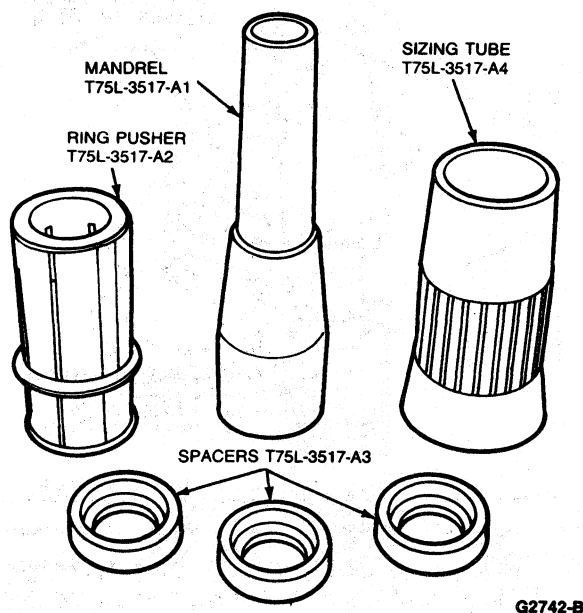
9. Repeat Step 7 using two spacers for the first (top) valve sleeve ring (Spacer T75L-3517-A3 or equivalent).
10. After installing four valve sleeve rings, apply a light coat of Steering Grease C3AZ-19578-A or equivalent to sleeve and rings.
11. Slowly install Sizing Tube T75L-3517-A4 or equivalent over sleeve valve end of input shaft onto valve sleeve rings. Ensure that rings are not being bent over as tube is slid over them.



**DISASSEMBLY AND ASSEMBLY (Continued)**

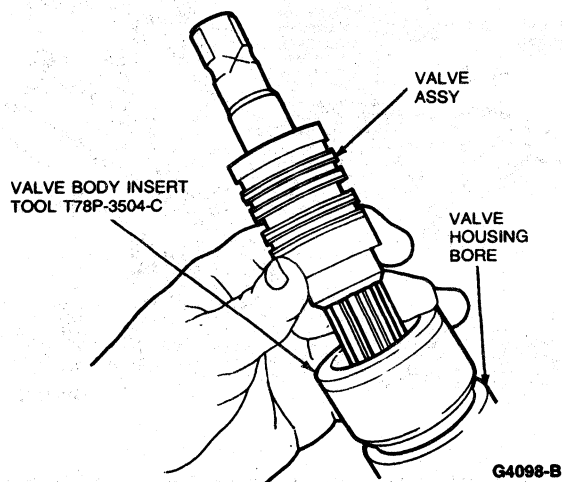
Remove sizing tube, and check condition of rings. Ensure that rings turn freely in grooves.

The complete set of tools needed to perform the above operations is shown in the illustration. The Tool Kit No. is T75L-3517-A.



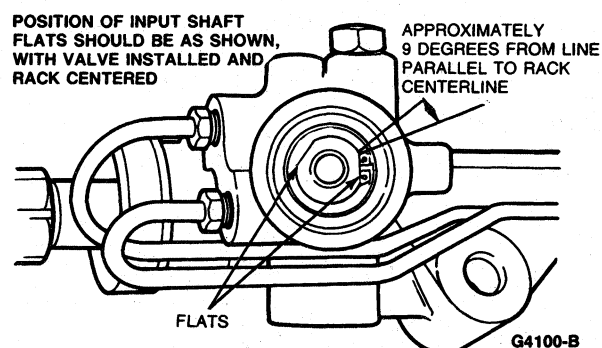
12. Center rack in housing so that equal amounts of rack shaft stick out of each end of housing. Position rack teeth so they will mesh with pinion.

13. Position Valve Body Insertion Tool T78P-3504-C or equivalent in valve housing bore.



14. Insert valve assembly with flats on input shaft in position shown.

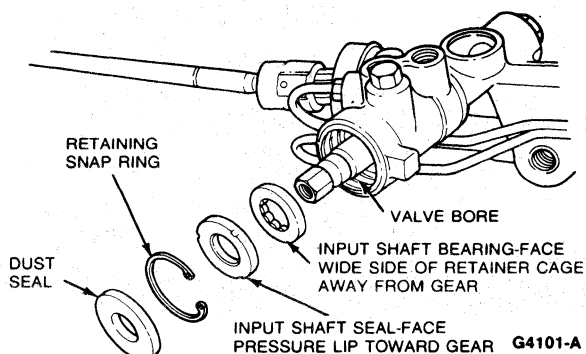
NOTE: If pinion is off one tooth, it will be obvious, since one tooth equals 45 degrees.



15. Using Pinion Shaft Torque Adjuster T86P-3504-K or equivalent count total turns, stop to stop (2.5 turns). From one stop, back off half the total (1 1/4 turns). The position should be as shown in illustration under Step 14. If it is approximately 45 degrees (one tooth) away from position, pull valve assembly out far enough to disengage pinion teeth and install to obtain proper position.

16. Install bearing assembly in valve bore and seat with Upper Pinion Bearing Seal Replacer T78P-3504-D or equivalent.

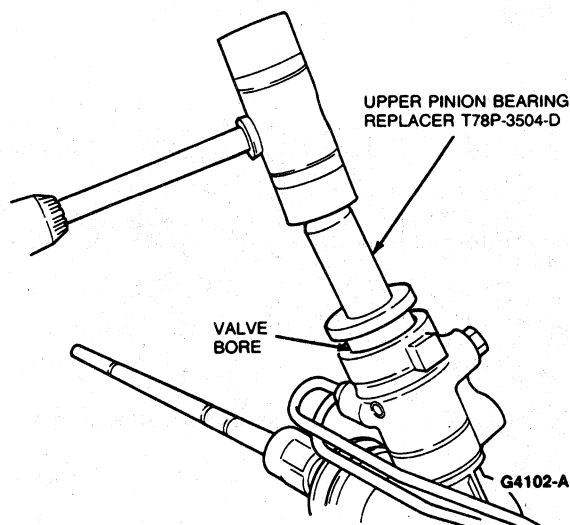
17. Apply a film of Steering Grease C3AZ-19578-A or equivalent to input shaft seal, and install with lip toward valve.



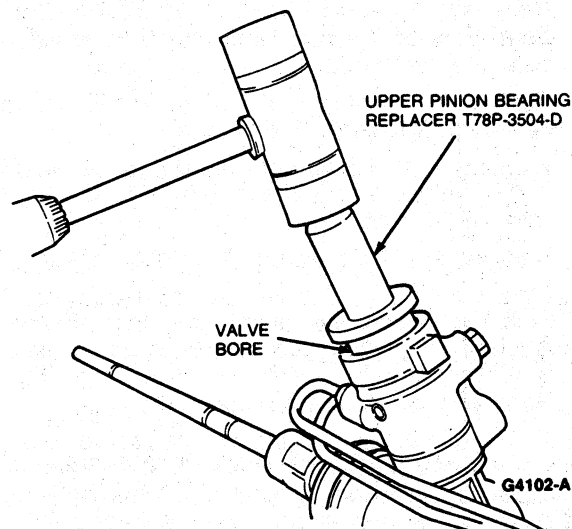


**DISASSEMBLY AND ASSEMBLY (Continued)**

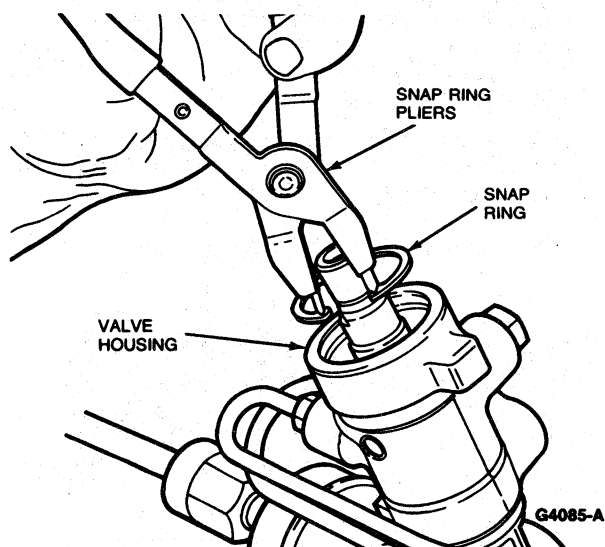
18. Seat seal with Upper Pinion Bearing Seal Replacer T78P-3504-D or equivalent.



21. Install dust seal with Upper Pinion Bearing Seal Replacer T78P-3504-D or equivalent.

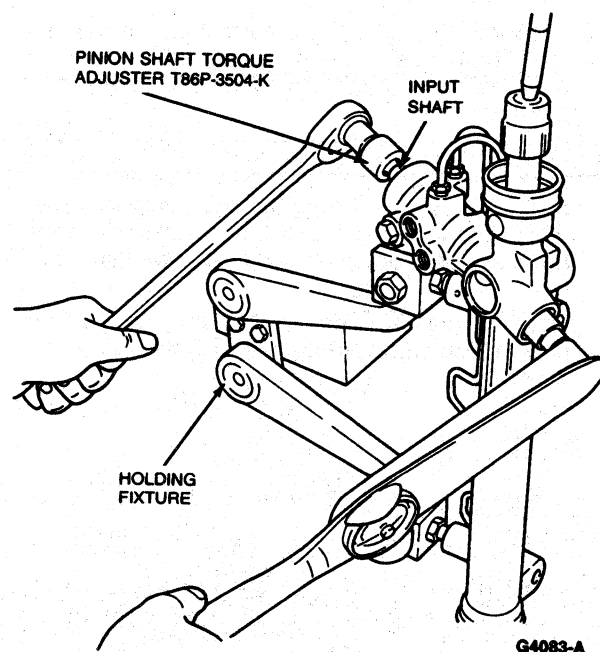


19. Install retaining snap ring in valve bore using snap ring pliers.



20. Coat ID and OD of dust seal and input shaft with Polyethylene Grease D0AZ-19584-A or equivalent.

22. Install nut on pinion end of valve assembly. Holding input shaft with Pinion Shaft Torque Adjuster T86P-3504-K or equivalent, tighten nut to 40-55 N·m (30-40 lb-ft). Rack must be away from stops during this operation.

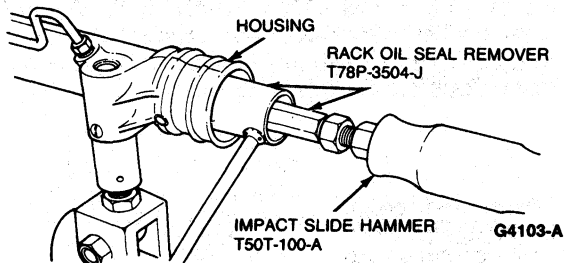


23. Install steering gear pinion bearing cap. Tighten to 55-81 N·m (40-60 lb-ft).
24. Set rack yoke preload as outlined.

## DISASSEMBLY AND ASSEMBLY (Continued)

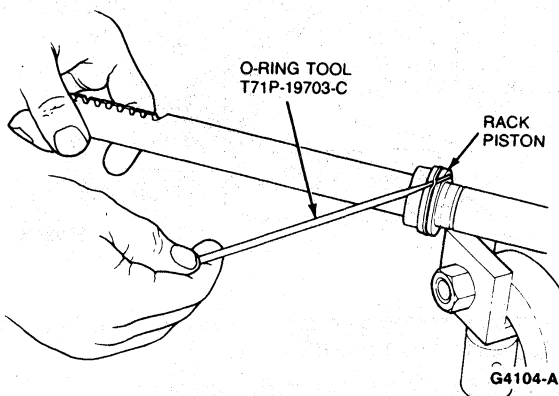
**Gear Housing, Rack Yoke Plug, Rack Assembly, Rack Bushing, and Oil Seals****Disassembly**

1. Remove tie rod and socket assemblies from both ends of the rack, input shaft, and valve assembly from gear housing as outlined.
2. Remove yoke plug and spring. **NOTE:** Yoke cannot be removed at this time.
3. Working from RH side of gear (opposite pinion end), push rack in just far enough to facilitate removal of snap ring.
4. Remove snap ring from right end of housing.
5. Slowly pull rack out of RH side of housing until rack piston contacts aluminum rack bushing. Apply pulling effort. **Do not hammer** on rack until bushing is withdrawn from housing. Remove rack from the housing.
6. To remove internal high-pressure rack oil seal, insert Rack Oil Seal Remover T78P-3504-J or equivalent into housing until it bottoms. Activate expander with a wrench until expander fully tightens. Remove tool with oil seal from housing using Impact Slide Hammer T50T-100-A or equivalent, threaded into expander end. Discard seal.

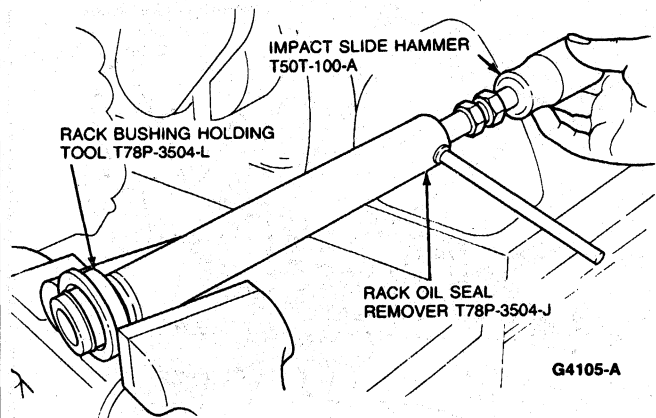


**NOTE:** On the first attempt, the nylon ring may pull out of the seal, leaving the seal in the gear. Repeat the procedure, and the seal will come out.

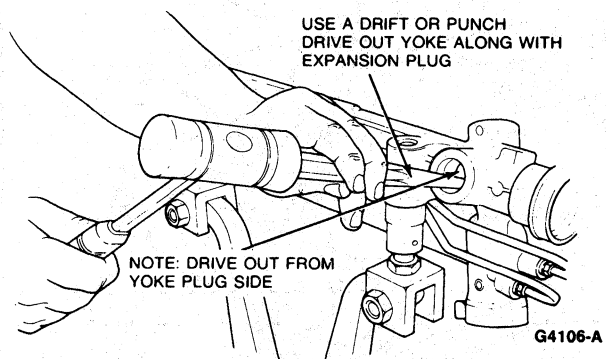
7. Remove plastic O-ring and rubber O-ring from rack piston with O-Ring Tool T71P-19703-C or equivalent.



8. Insert rack bushing into Rack Bushing Holding Tool T78P-3504-L or equivalent, seal end first. Place tool and bushing in vise. With Rack Oil Seal Remover T78P-3504-J and Impact Slide Hammer T50T-100-A or equivalent, remove seal.



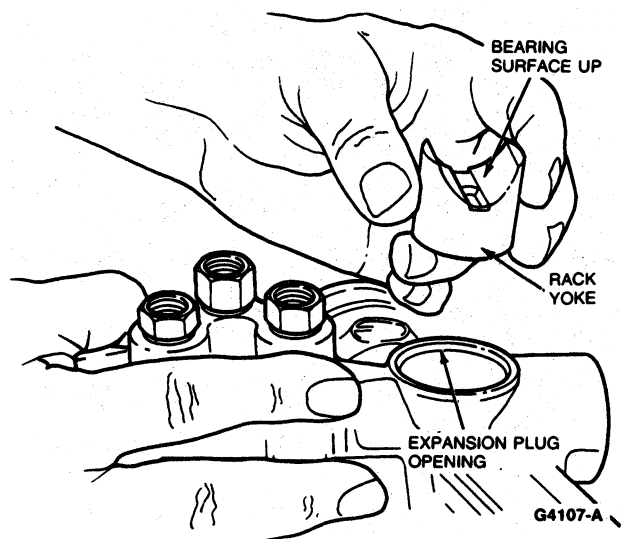
9. Remove rubber O-rings from rack bushing.
10. Inspect rack yoke while still in gear housing. If it is in good condition, do not remove it.
11. If yoke needs replacing, use a drift or punch to knock it out, along with expansion plug.



## DISASSEMBLY AND ASSEMBLY (Continued)

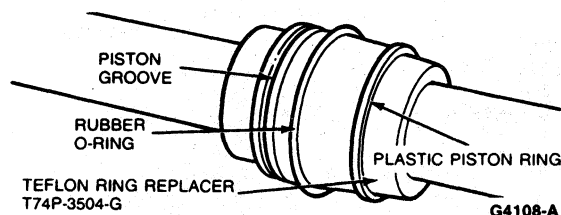
**Assembly**

1. If yoke was removed during disassembly, a new yoke is required. Coat new yoke with Steering Grease C3AZ-19578-A or equivalent and install through expansion plug opening, rack bearing surface up.

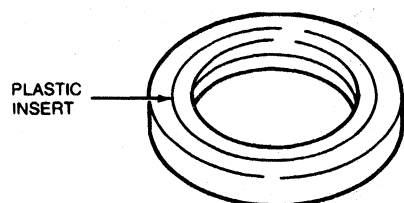


2. Slide Teflon® Ring Replacer T74P-3504-G or equivalent over plain end (without teeth) of rack up to piston.

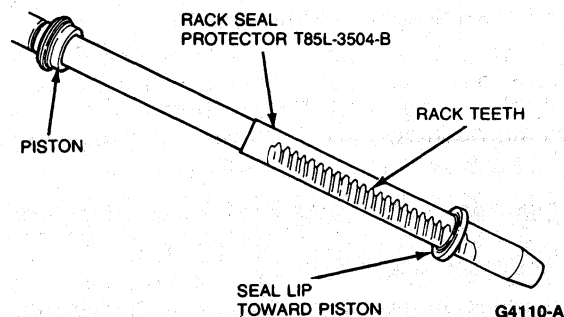
Roll rubber O-ring into piston groove, then slide plastic piston ring into piston groove over O-ring.



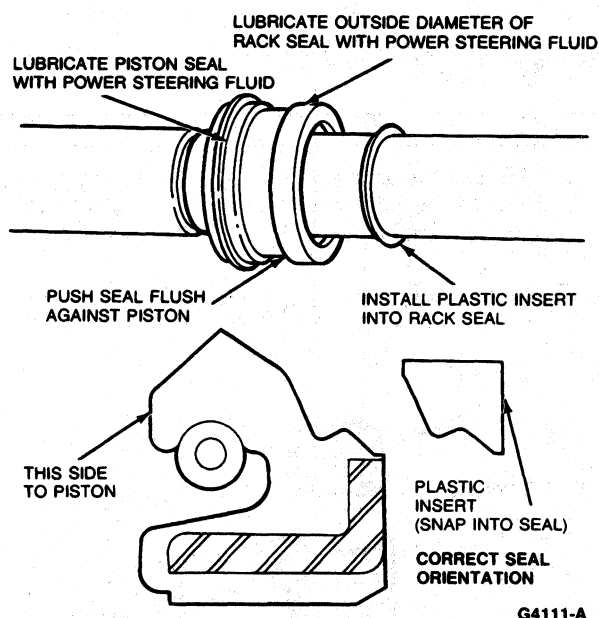
3. Remove plastic insert from rack seal. Save insert for installation.



4. Install Rack Seal Protector T85L-3504-B or equivalent over rack teeth.
5. Lubricate rack seal protector and rack with power steering fluid.
6. Install seal with lip toward piston. Push seal all the way against piston. Remove rack seal protector.

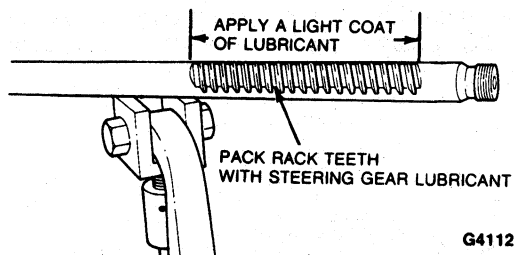


7. Install plastic insert in rack seal.



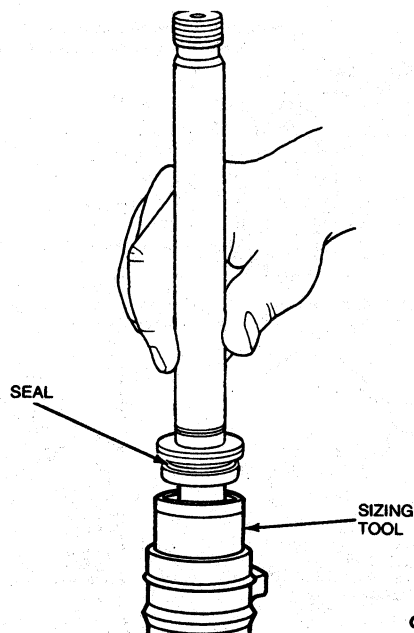
## DISASSEMBLY AND ASSEMBLY (Continued)

8. Pack rack teeth with steering gear lubricant. Apply a light coat of steering gear lubricant to yoke contact area on back of rack teeth.



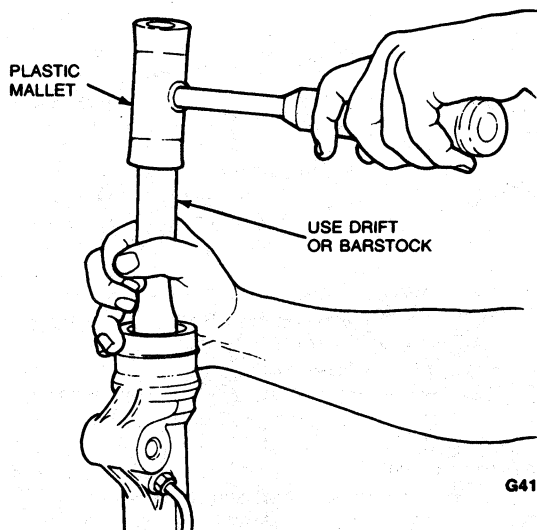
G4112-A

9. Lubricate piston seal and rack seal outside diameter with power steering fluid. Refer to the illustration under Step 7.
10. Install Teflon® Ring Sizing Tool T78P-3504-M or equivalent into end of gear housing.
11. Ensure yoke is all the way in when installing rack.
12. Install rack, taking care **NOT** to scratch housing piston bore.
13. Carefully push piston through sizing tool. Continue pushing on rack until it bottoms. Remove sizing tool.



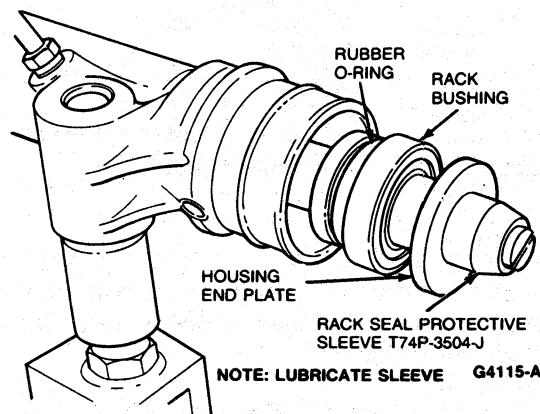
G4113-C

14. Seat rack seal with rack by driving end of rack with a drift or bar stock and plastic mallet. **DO NOT** remove rack.



G4114-A

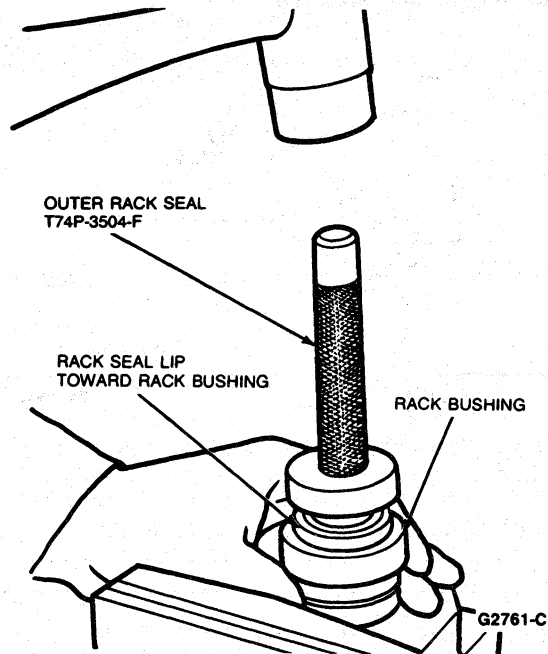
15. Move rack so it is centered in housing.
16. Thread Rack Seal Protective Sleeve T74P-3504-J or equivalent over threads on RH side of rack. Apply power steering fluid to protective sleeve.



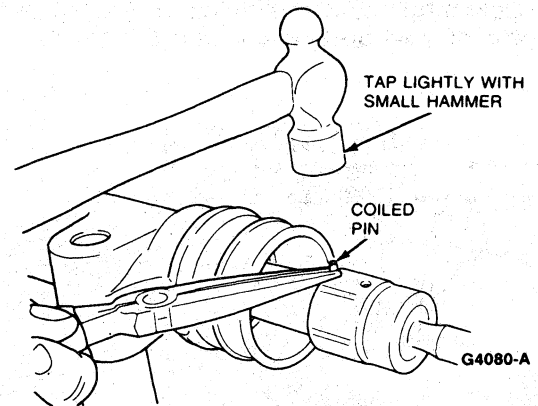
G4115-A

**DISASSEMBLY AND ASSEMBLY (Continued)**

17. Install rubber O-ring on aluminum rack bushing.
18. Apply specified gear lubricant to the outer rack oil seal. With Outer Rack Seal Replacer T74P-3504-F or equivalent, install high-pressure oil seal in rack bushing. Lip spring must face the inside of the bushing.



19. Lubricate short Rack Seal Protective Sleeve T74P-3504-J or equivalent on rack end and rubber O-rings on rack bushing with specified gear lubricant. Refer to illustration under Step 16.
20. Start bushing, seal facing out, on rack. Pass bushing and seal over protecting sleeve and into housing bore. Place end plate against rack bushing. With Teflon® Ring Sizing Tool-T78P-3504-M or equivalent apply hand pressure to end plate and rack bushing until bushing seats in gear housing. If rack bushing will not seat with hand pressure, a 1-1/8-inch deep socket (or larger) and a plastic mallet may be used to tap bushing in place. Install retaining ring (snap ring). Remove protective sleeve.
21. Install rod assemblies. Tighten both tie rod ball joint nuts simultaneously to 75-88 N·m (55-65 lb-ft) by holding one and turning the other.
22. Install coiled pins in ball joint nuts by lightly tapping with hammer until seated.

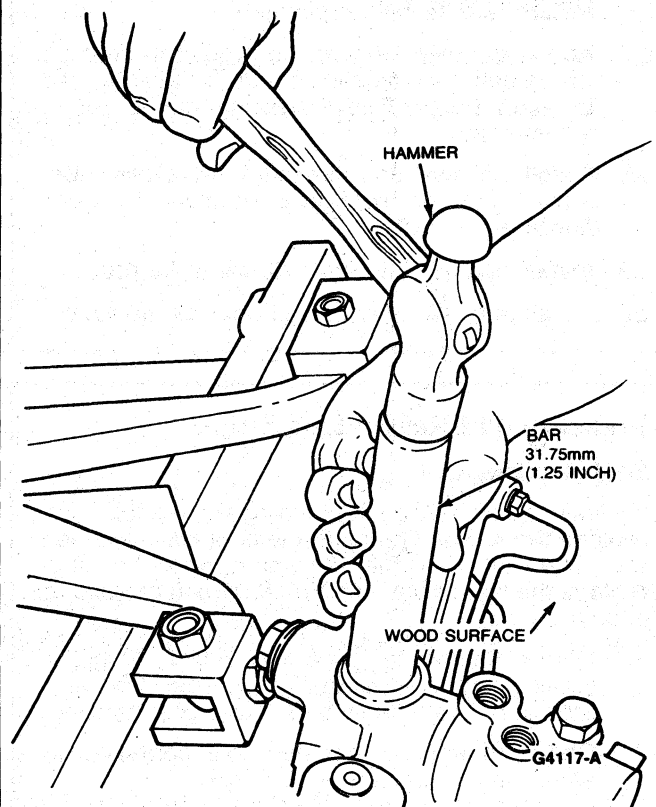


23. Install input shaft and valve assembly.

**NOTE:** Do not perform Step 24 if yoke was not removed.

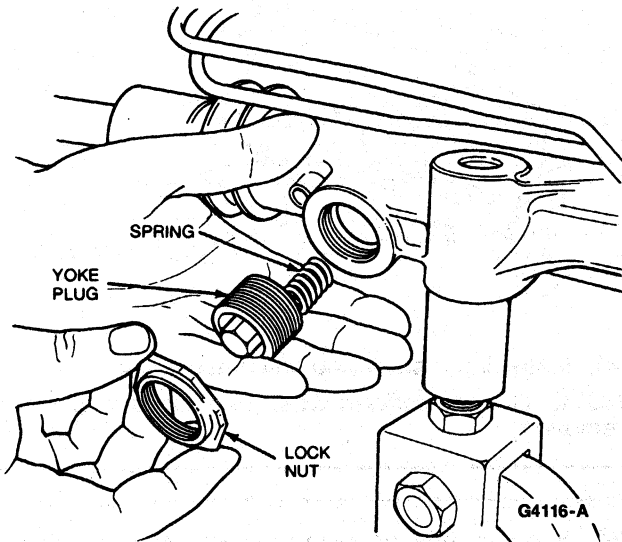
24. Support gear on wood surface at yoke plug opening. Using a 31.75mm (1.25-inch) bar with a flat end and a hammer, flatten expansion plug until flat portion is approximately 1/2 to 3/4 of the total plug diameter.

**NOTE:** Do not flatten plug completely or it will fall out.



**DISASSEMBLY AND ASSEMBLY (Continued)**

25. Install spring, plug, and locknut. Adjust yoke plug preload as outlined.



26. Fully extend left end of rack, so rack teeth are exposed. Using 59ml (2 ounces) of specified gear lubricant, pack rack teeth and pack any remaining grease into left end of gear housing. Return rack to center position.
27. Apply specified lubricant to groove in tie rods where bellows clamp to tie rods. This is required to keep bellows from twisting during toe-in adjustment.
28. Install bellows and pressure equalizer tube. Install clamps retaining bellows to gear housing.
29. Install clamps retaining bellows to tie rods.
30. Install jam nuts and tie rod ends on tie rods.

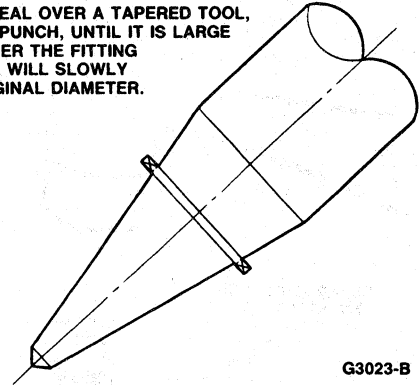
**Pressure and Return Line Fitting****Seal Replacement**

If a leak occurs between the tubing and the tube nut, replace the rubber O-ring. If a leak occurs between the tube nut and the aluminum gear housing, replace the plastic washer. The following procedure should be used:

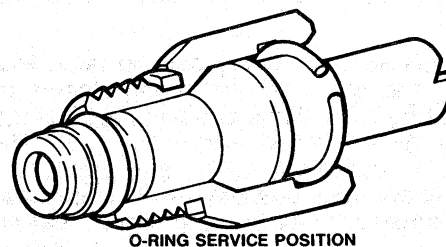
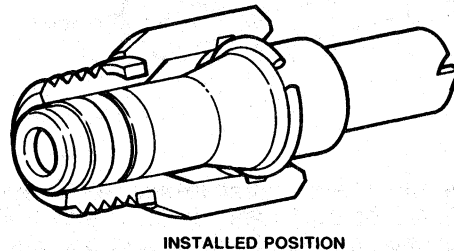
1. Check fittings to determine which fitting is leaking and whether leak is between tube and tube nut or between tube nut and gear housing.
2. Check to ensure that nuts are tightened to specification. Do not over-tighten.

3. Unscrew tube nut, and replace plastic seal washer. To facilitate assembly of new TFE seal, a tapered shaft may be required to stretch the washer, so it may be slipped over tube nut threads.

STRETCH PLASTIC SEAL OVER A TAPERED TOOL, SUCH AS A CENTER PUNCH, UNTIL IT IS LARGE ENOUGH TO SLIP OVER THE FITTING THREADS. THE SEAL WILL SLOWLY RETURN TO ITS ORIGINAL DIAMETER.



4. To replace rubber O-ring, push tubing into nut until O-ring is exposed. Replace O-ring (3/8-inch O-ring 388749-S for return line and 5/16-inch O-ring 388748-S for pressure line).



5. Lubricate new O-ring with Type F Automatic Transmission Fluid E4AZ-19582-C or equivalent. Grasp tube nut, and pull tubing until O-ring slips back into tube nut.

NOTE: On 5/16-inch pressure line, ensure snap ring is positioned in internal groove of tube nut before pulling tube.

6. Reconnect tube nuts and tighten to specification.

## SPECIFICATIONS

Gear Ratio	15:1
Number of Turns	2.5
Pinion, Rack Lubricant Capacity	23-27 Grams
Power Steering Fluid Capacity (Including Steering Pump)	2.5 Pints
Pinion, Rack and Pinion Bearing Lubricant	ESW-M1C87-A (C3AZ-19578-A)
Seal Lubricant (Cavity under Dust Seal)	ESB-M1C93-A (D0AZ-19584-A)
Power Steering Fluid (ATF)	Motorcraft Type F ATF
Effort Required to Initiate Proper Input Shaft Rotation (Power Cylinder drained and gear removed from Vehicle)	.78-2.03 N•m (7-18 lb-in)
Tie Rod Articulation Effort (On Pull Scale)	2-10 lbs.
Tie Rod Outer End Lubricant	None (Bonded Rubber Design)

CG4434-A

## TORQUE SPECIFICATIONS

Description	N•m	Lb-Ft	Description	N•m	Lb-Ft
Pressure Line Fitting (Pump-to-Gear 1/2 Hex)	14-20	10-15	Yoke Plug	5-5.6	45-50 (Lb-In)
Return Line Fitting	14-20	10-15	Yoke Plug Locknut	55-67	40-50
Gear-to-Crossmember Mounting Bolt Nut	115-135	85-100	Pressure Line Fitting at Valve	28-33	20-25
Tie Rod End-to-Spindle Arm Nut	48-63	35-47	Return Line Fitting at Valve	20-28	15-20
Tie Rod End-to-Tie Rod Jam Nut	48-68	35-50	Pressure Line Fittings at Power Cylinder (Gear Housing)	26-38	22-28
Intermediate Shaft-to-Steering Gear Bolt	41-51	30-38			
Intermediate Shaft-to-Steering Column (2 Nuts)	21-33	15-25			
Weather Boot-to-Dash Panel	5.5-6.7	4-5	Pinion Bearing Locknut	41-54	30-40
Bellows Clamp Screw	2.26-3.39	20-30 (Lb-In)	Pinion Bearing Cap	55-81	40-60
			Tie Rod Ball Socket Assembly to Rack	75-81	55-65

CG4119-A

## SPECIAL SERVICE TOOLS

Tool Number	Description	Tool Number	Description
T50T-100-A	Impact Slide Hammer	T86P-3504-H	Disc-Yoke Pre-Load Adjusting
T58L-101-A	Puller Attachment	T74P-3504-J	Rack Seal Protector Sleeve
T57L-500-B	Bench Mounted Holding Fixture	T78P-3504-J	Rack Oil Seal Remover
TOOL-3290-C	Tie Rod End Remover	T86P-3504-K	Pinion Shaft Torque Adjuster
T78P-3504-B	Valve Body Puller (Screw)	T78P-3504-L	Rack Bushing Holding Tool
T85L-3504-B	Rack Seal Protector	T78P-3504-M	Teflon Ring Sizing Tool
T78P-3504-C	Valve Body Insert	D81P-3504-N	Lock Pin Remover
T78P-3504-D	Upper Pinion Bearing Seal Replacer	T74P-3504-U	Nut Wrench
T86P-3504-D	Valve Body Puller (Bridge)	T74P-3504-Y	Spring Scale
T86P-3504-E	Pinion Housing Yoke Locknut Wrench	T75L-3517-A	Seal Installation Set
T74P-3504-F	Outer Rack Seal Replacer	D79L-7000-A	Retaining Ring Pliers
T86P-3504-F	Lower Pinion Seal Remover (Small OD)	T71P-19703-C	O-Ring Tool
T74P-3504-G	Teflon Ring Replacer	D79L-33610-A	Power Steering Analyzer
T78P-3504-G	Lower Pinion Bearing Replacer	T86P-3504-J	Part of Lower Pinion Seal Remover (Large OD)
T86P-3504-G	Lower Pinion Seal Replacer		

CG4118-B

# SECTION 13-51 Steering Pump, Power—Ford Model CII

SUBJECT	PAGE	SUBJECT	PAGE
ADJUSTMENTS		REMOVAL AND INSTALLATION	
Pump Belt Tension .....	13-51-3	Pump Reservoir .....	13-51-5
Quick Connect Power Steering Fitting .....	13-51-4	Steering Pump and Pulley Hub .....	13-51-4
DESCRIPTION .....	13-51-1	SPECIAL SERVICE TOOLS .....	13-51-14
DIAGNOSIS AND TESTING		SPECIFICATIONS .....	13-51-14
Pump Noise .....	13-51-3	VEHICLE APPLICATION .....	13-51-1
Test Procedure .....	13-51-3		
DISASSEMBLY AND ASSEMBLY			
Steering Pump, Power .....	13-51-8		

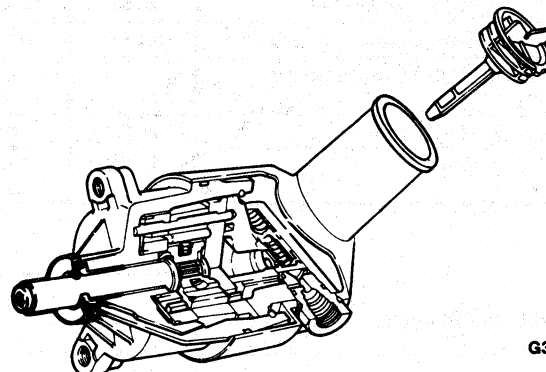
## VEHICLE APPLICATION

Taurus/Sable.

## DESCRIPTION

The Ford Model CII power steering pump is a belt-driven, ten slipper type pump with a fiberglass-filled nylon reservoir. The reservoir is attached to the rear side of the aluminum pump housing, and the pump body is encased within the housing and reservoir. The pump design incorporates a pump pressure fitting which allows the pump pressure line to swivel. This is normal and does not indicate a loose fitting.

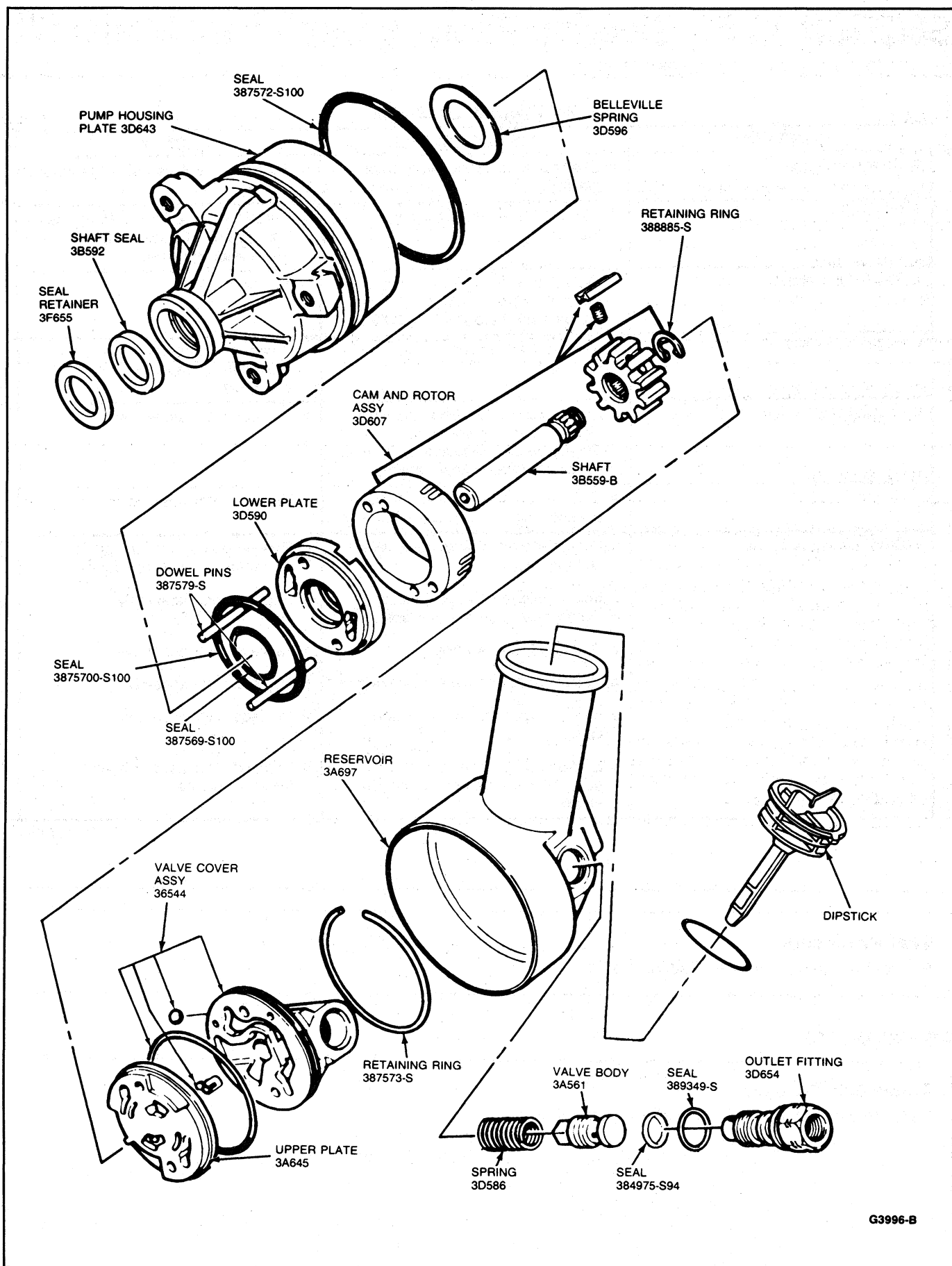
A pressure-sensitive identification tag is attached to the reservoir body. This tag indicates the basic model number and the suffix. **Always use the model codes on the tag when requesting service parts in case of differences in internal components. Refer to Section 13-01 for an example of this tag.**



G3618-B



## DESCRIPTION (Continued)



**DIAGNOSIS AND TESTING****Pump Noise**

Refer to the pump noise diagnosis chart.

**PUMP NOISE DIAGNOSIS**

CONDITION	POSSIBLE SOURCE	ACTION
• Power Steering	• Check belt for proper tension or glazing.	• Tighten or replace belt as required.
• Pump Noisy	• Low fluid level and possible leakage.	• Refill to specified level. Purge air from system. Check for leaks. Service as required.
• Swish Type Noise	• Fluid flow into the bypass valve of the pump valve housing with fluid temperature below 54°C (130°F).	• Normal noise.
• Whine Type Noise	• Aerated fluid, or cam countour damaged.	• Purge system of air. If condition not resolved, replace rotor assembly.
• Clicking Mechanical Type Noise	• Pump slippers too long, excessive wear of pumping elements. Excessive slipper to slot clearance, or out of square slipper springs.	• Replace rotor assembly.
• Chatter Type Noise	• Chipped corners on rotor outside diameter or distorted slipper spring.	• Replace rotor assembly.
• Other Cause of Noise	<ul style="list-style-type: none"> <li>• Improper assembly of components such as slippers.</li> <li>• Imperfections on rotor outside diameter or rotor end surface.</li> <li>• Damaged rotor splines.</li> <li>• Hairline crack on cam inner surface.</li> <li>• Interference between rotor and cam.</li> <li>• Excessively worn or scored pumping elements and pressure plates.</li> </ul>	<ul style="list-style-type: none"> <li>• Rebuild pump and replace components as required.</li> <li>• Replace rotor assembly.</li> <li>• Replace rotor assembly.</li> <li>• Replace rotor assembly.</li> <li>• Replace rotor assembly.</li> <li>• Replace rotor assembly and pressure plates.</li> </ul>

CG4058-B

**Test Procedure**

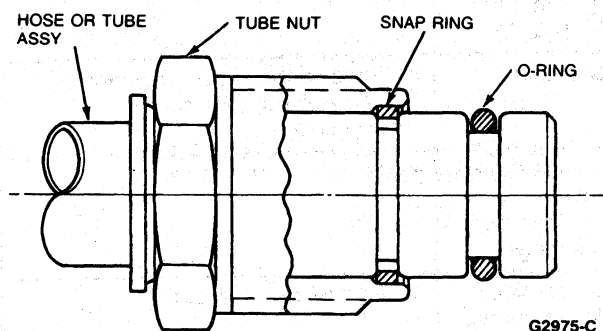
For test procedure refer to Section 13-01.

**ADJUSTMENTS****Pump Belt Tension**

Refer to Section 27-02 for adjustment procedures.

**ADJUSTMENTS (Continued)****Quick Connect Power Steering Fitting****Service**

The quick connect power steering fitting, under certain conditions, may leak and/or result in improper engagement. The leak can be caused by a cut O-ring, imperfections in the outlet fitting ID, or improperly machined O-ring groove. Improper engagement can be caused by an improperly machined tube end, tube nut, snap ring, outlet fitting or gear port.



G2975-C

If a leak occurs, the O-ring should be replaced with quick connect O-rings. The O-rings that are used on the tube-O power steering fitting should not be used on the quick connect fitting because of dimensional and material changes. If O-ring replacement does not solve leak problem, outlet fitting replacement and/or hose replacement should be made.

If improper engagement occurs, refer to Section 13-55 for service procedure.

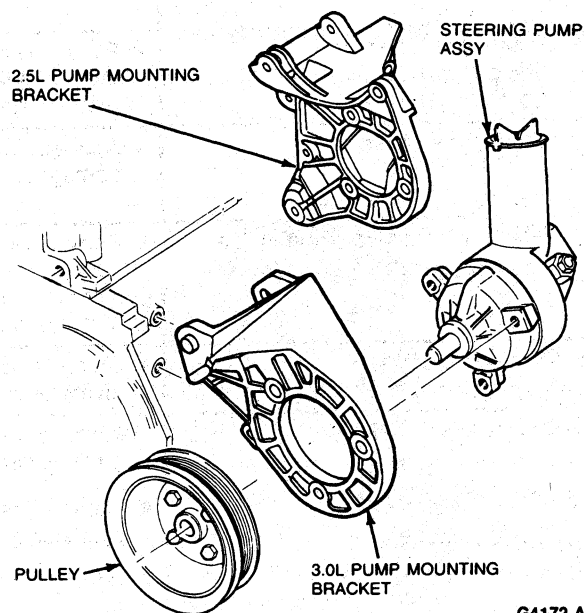
When the quick connect tube nut is tightened or loosened, a tube nut wrench should be used. Care must be taken not to over-tighten tube nut. Tighten to 14-20 N·m (10-15 lb-ft). Swivel and/or end play of the quick connect fittings is normal, and does not indicate a loose fitting.

**REMOVAL AND INSTALLATION****Removal**

1. Remove radiator overflow bottle to gain access to three bolts attaching pulleys to pulley hub.
2. Mark both pulley-to-hub positions with grease pencil or paint daub for reassembly to maintain balance.
3. Remove the three bolts and two pulleys from pulley hub.

**Installation**

1. Install two pulleys on hub, aligning marks put on hub and pulleys during removal.
2. Install the three bolts and tighten to 21-32 N·m (15-25 lb-ft).
3. Install radiator overflow bottle.



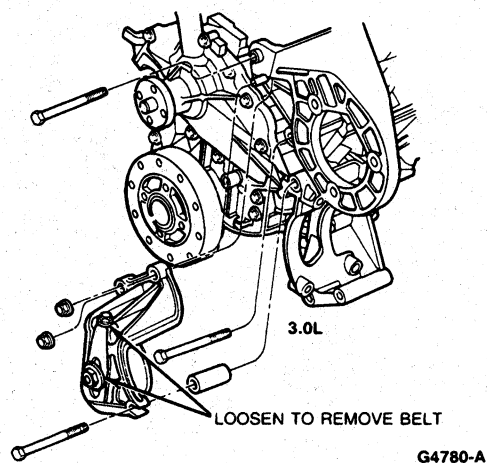
G4172-A

**Steering Pump and Pulley Hub****3.0L Engine****Removal**

1. Disconnect battery ground cable.
2. Loosen idler pulley and remove power steering belt.
3. Remove pulley from hub.
4. Remove return line from pump.
5. Completely back off pressure line nut. Line will separate when pump is removed from bracket.
6. Remove three pump mounting bolts and remove pump.

**REMOVAL AND INSTALLATION (Continued)****Installation**

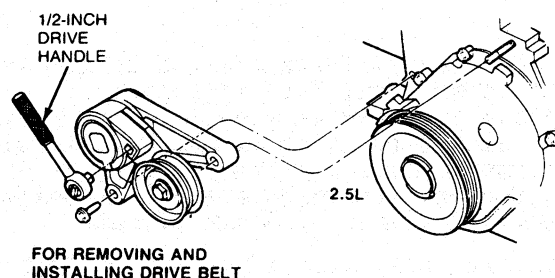
1. Install pump on mounting bracket. Guide pressure line into pump outlet fitting while installing pump.
2. Install pressure and return lines.
3. Install pulley on hub.
4. Install steering pump drive belt and adjust tension. Refer to the Powertrain manual, Section 27-02.
5. Connect battery ground cable.
6. Fill pump with fluid and check operation. Refer to Section 13-01.

**Installation**

1. Install pump on mounting bracket and install three bolts retaining pump to bracket.
2. Install pulley on pump shaft using Steering Pump Pulley Replacer T65P-3A733-C or equivalent.

NOTE: The small diameter threads must be fully engaged in pump shaft before pressing on pulley. Hold screw head and turn nut to install pulley. Install pulley face flush with pump shaft within  $\pm 0.25\text{mm}$  ( $\pm 0.10$  inch).

3. Connect hydraulic pressure and return lines.
4. Install drive belt using auto-tensioner as outlined in Removal, Step 2.
5. Connect battery ground cable.
6. Fill pump with fluid and check operation. Refer to Section 13-01.
7. Remove drain pan.

**2.5L Engine****Removal**

1. Disconnect battery ground cable.
2. Using 1/2-inch drive hole provided, rotate tensioner pulley clockwise and remove belt from alternator and power steering pulley.
3. Position drain pan and disconnect hydraulic pressure and return lines.
4. Remove pulley from shaft using Hub Puller T69L-10300-B or equivalent.
5. Remove three bolts retaining pump to bracket and remove pump.

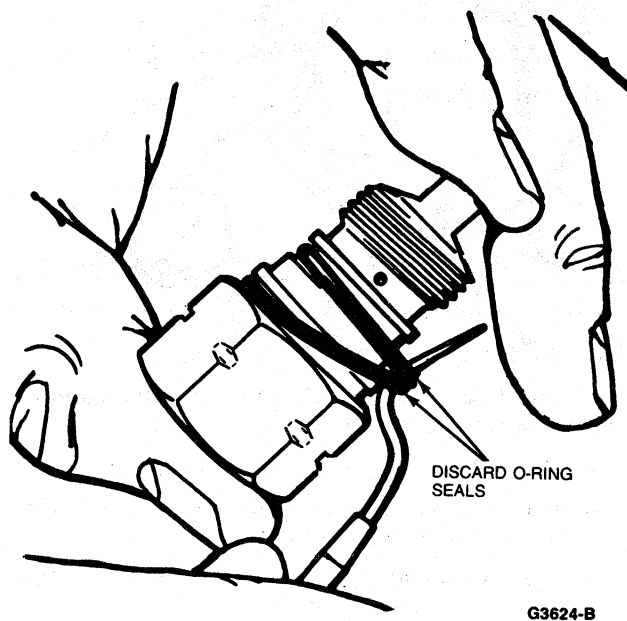
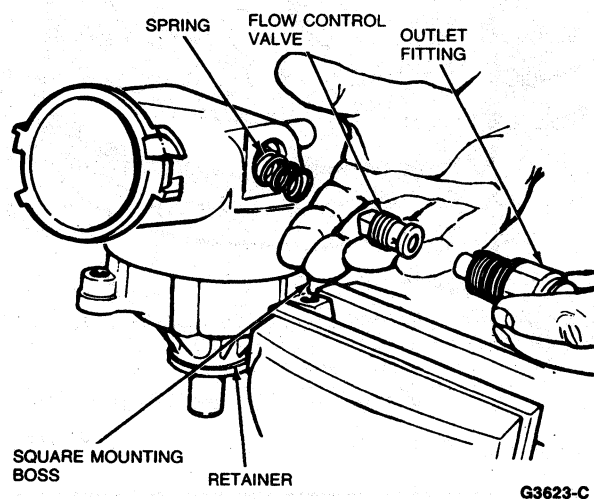
**Pump Reservoir**

Take the following precautions when servicing the power steering pump reservoir:

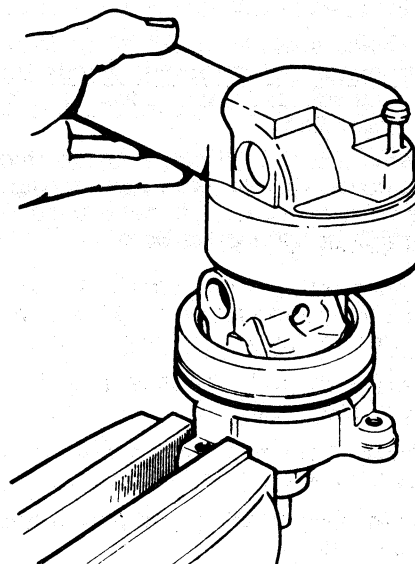
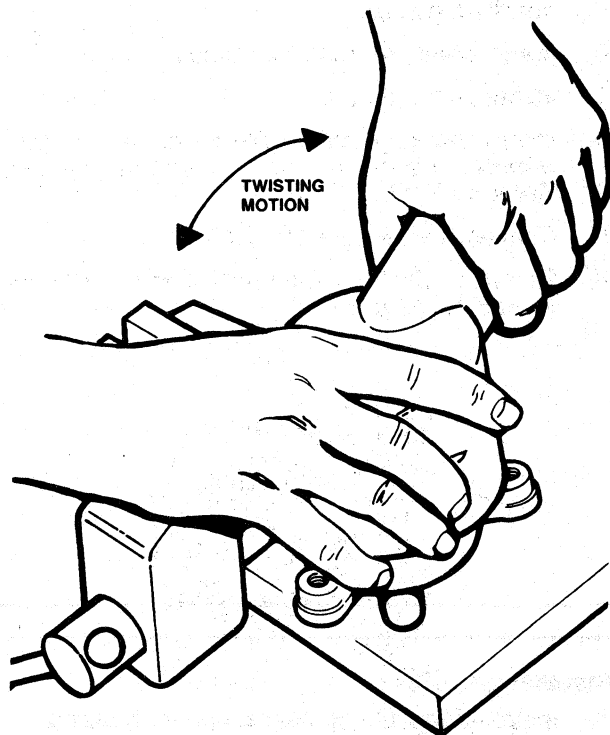
- Use clean work bench and tools.
- Plug inlet and outlet openings of pump with plugs or masking tape.
- Thoroughly clean exterior of pump with solvent.

**REMOVAL AND INSTALLATION (Continued)****Removal**

1. Place pump assembly in a bench vise with soft jaws and remove outlet fitting, flow control valve, and spring. Discard all seals.

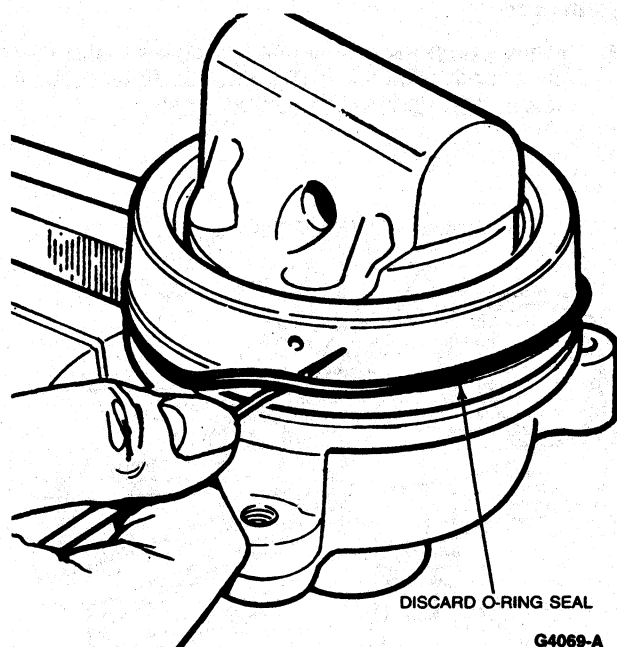


2. Remove fiberglass reservoir by twisting side-to-side and lifting.



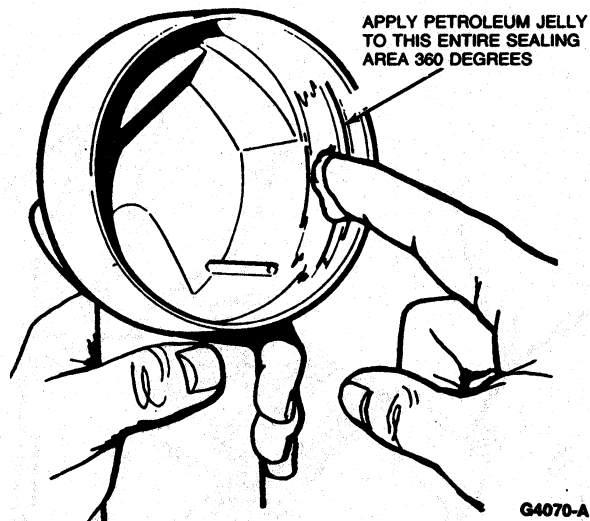
**REMOVAL AND INSTALLATION (Continued)**

3. Discard O-ring seal on pump housing.  
NOTE: Do not hammer on the reservoir.

**Installation**

1. Install a new O-ring seal on pump housing.
2. Apply petroleum jelly to reservoir O-ring seal and inside edge of reservoir. Do not twist O-ring seal.
3. Install reservoir over pump and align outlet fitting hole in reservoir with hole in valve cover.
4. Place new O-ring seals on outlet fitting. Install flow control spring, flow control valve and outlet fitting into reservoir and valve cover. Tighten fitting to specification.

NOTE: If valve is cocked, it may become stuck in the valve cover. Do not force valve forward. Forcing the valve may shear off metal and carry the metal chips into the valve bore.



## DISASSEMBLY AND ASSEMBLY

**Steering Pump, Power**

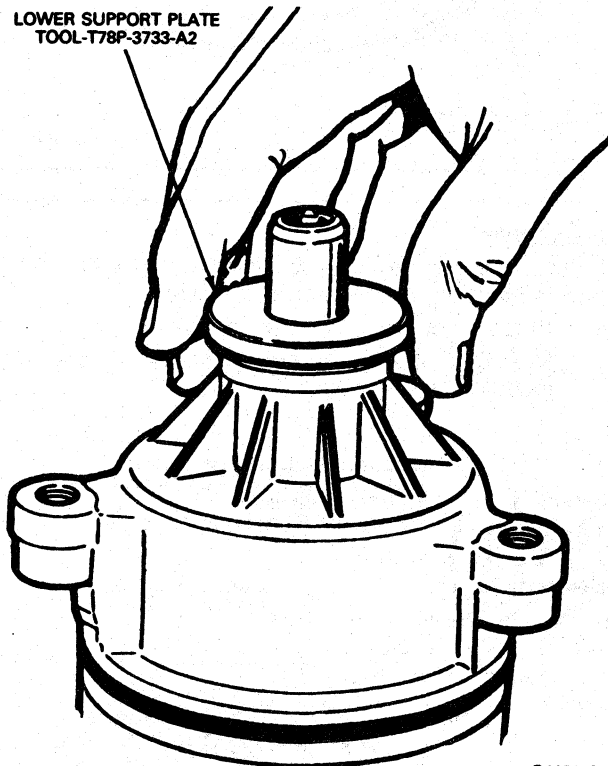
The following precautions must be observed when servicing the power steering pump:

1. Use clean work bench and tools.
2. Thoroughly clean exterior of unit with solvent. Drain as much fluid from pump as possible.
3. If only the reservoir is to be removed, clean as outlined under Reservoir Removal.
4. Do not use cleaning solvents on seal.

**Disassembly**

1. Remove pump pulley as outlined.
2. Remove outlet fitting, flow control valve, and flow control spring from pump. Remove pump reservoir as outlined.
3. Place C-Frame and Clamp Assembly T74P-3044-A1 or equivalent in a bench vise.
4. Place Lower Support Plate T78P-3733-A2 or equivalent over pump rotor shaft.

LOWER SUPPORT PLATE  
TOOL-T78P-3733-A2

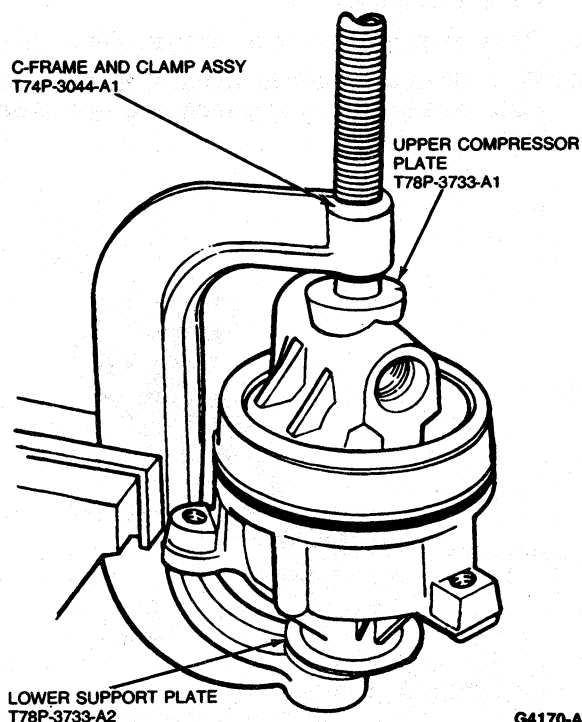


G4055-A

5. Install Upper Support Plate T78P-3733-A1 or equivalent into upper portion of C-clamp.
6. Holding upper support plate, place pump assembly into C-clamp with rotor shaft facing down.

C-FRAME AND CLAMP ASSY  
T74P-3044-A1

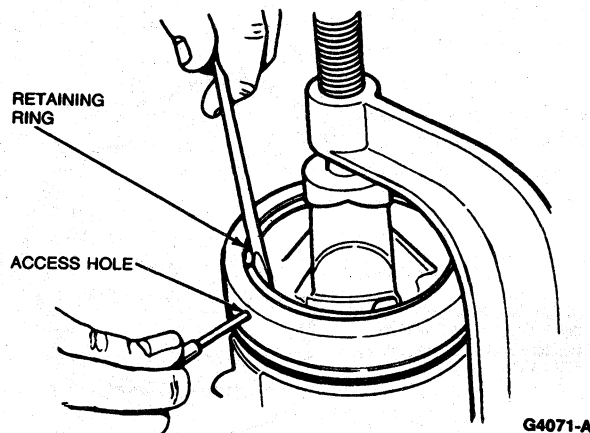
UPPER COMPRESSOR  
PLATE  
T78P-3733-A1



LOWER SUPPORT PLATE  
T78P-3733-A2

G4170-A

7. Tighten C-clamp until slight bottoming of valve cover is felt.
8. In the side of the pump housing is a small hole. Through this hole, insert a small drift or suitable tool, and push inward on valve cover retaining ring. While applying inward pressure on retaining ring, place screwdriver under edge of retaining ring. Remove the ring.



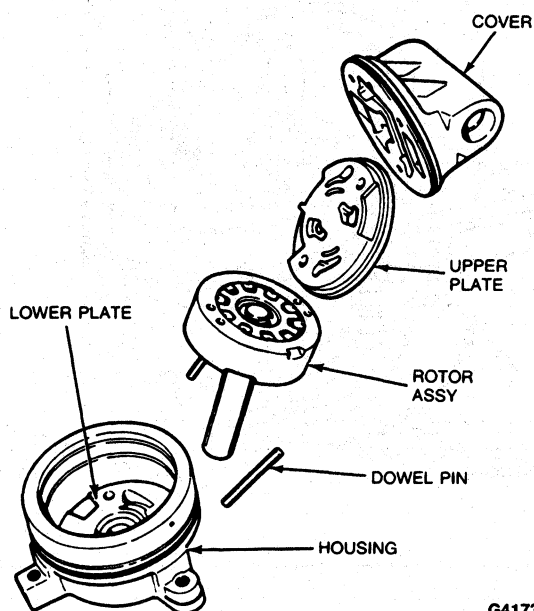
RETAINING  
RING

ACCESS HOLE

G4071-A

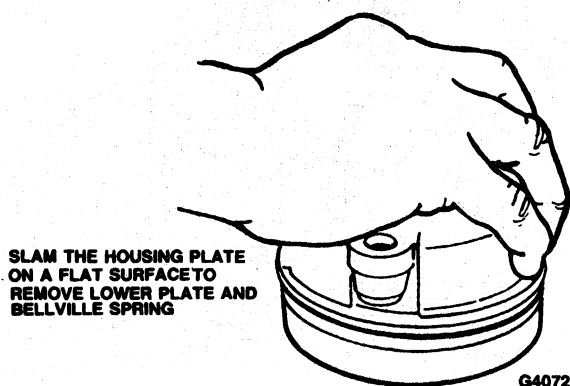
**DISASSEMBLY AND ASSEMBLY (Continued)**

9. Loosen C-clamp, upper compressor plate and pump assembly.
10. Remove pump valve cover. Discard O-ring seal.
11. Push on rotor shaft to remove shaft, upper plate, rotating group assembly and two dowel pins.



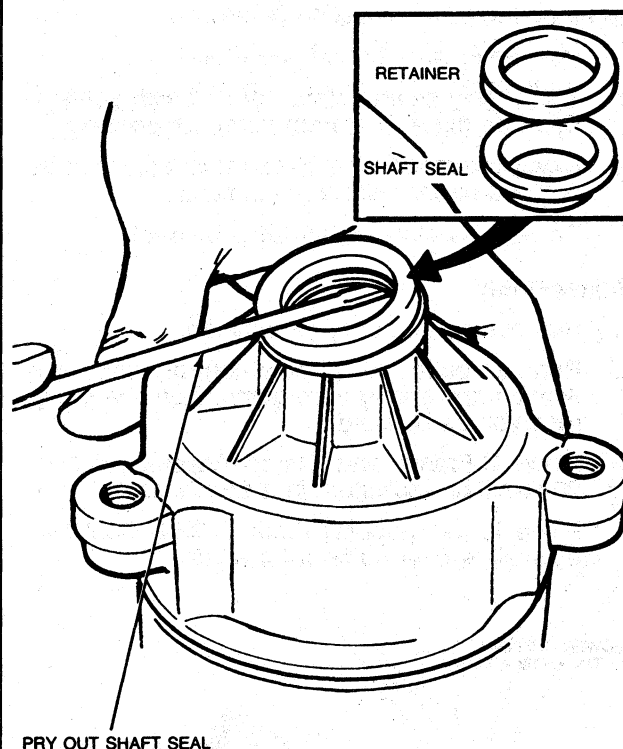
G4173-A

12. The lower plate and Belleville spring will remain in pump housing. To remove, place pump housing on a flat surface. Raise slightly and slam housing down flat until lower plate and Belleville spring fall out. Discard O-ring seals.



G4072-A

13. Remove rotor shaft seal and seal retainer simultaneously by prying out with a screwdriver.



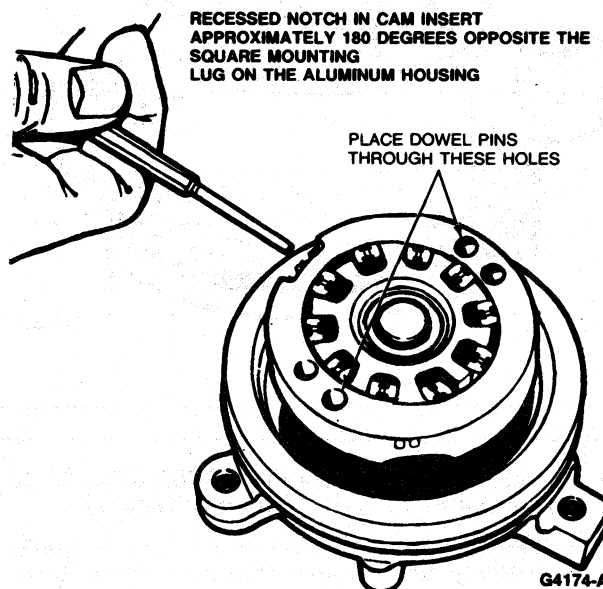
G2578-E

**Assembly**

If the rotating group was disassembled for cleaning and inspection, assemble as follows:

1. Place rotor on rotor shaft splines.

NOTE: Rotor is symmetrical, so it can be installed either way.

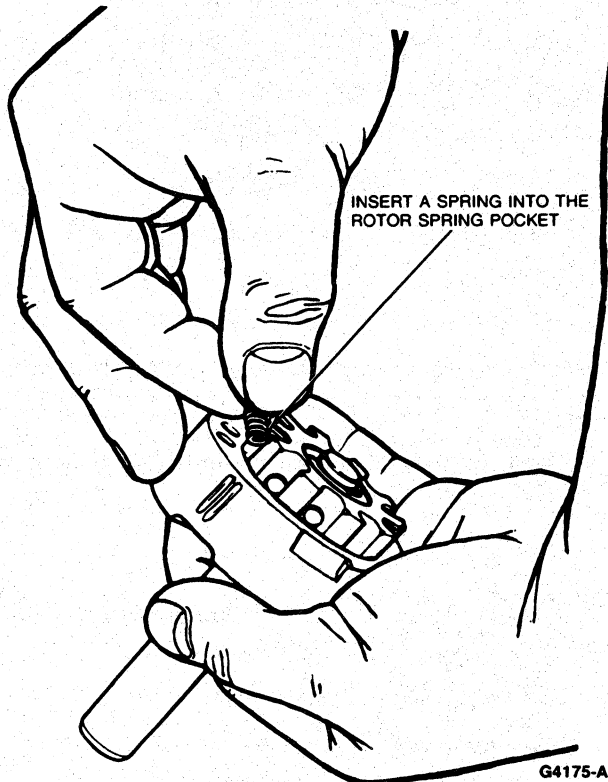


G4174-A



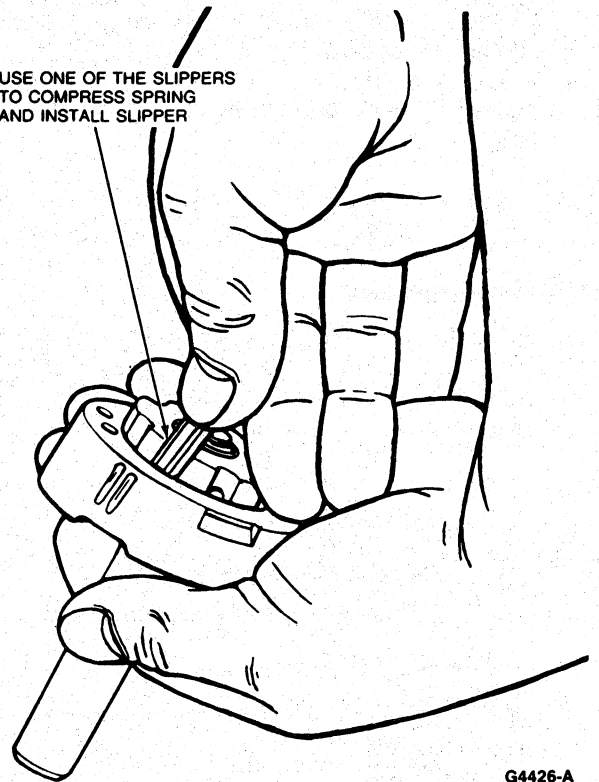
**DISASSEMBLY AND ASSEMBLY (Continued)**

2. Install retaining ring in groove at end of rotor shaft.
3. Place insert cam over rotor. Ensure recessed notch on insert cam faces up.
4. With rotor extended upward approximately half way out of the cam, insert a spring into a rotor spring pocket. Work in rotor cavity directly beneath recessed flats on cam.

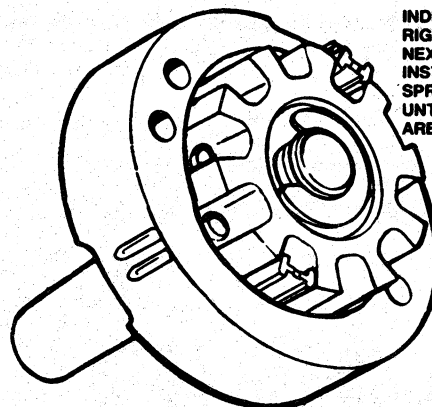


5. Use one of the slippers to compress spring, and install slipper with groove facing cam profile. Repeat Steps 4 and 5 on slipper cavity beneath opposite inlet recess.

USE ONE OF THE SLIPPERS TO COMPRESS SPRING AND INSTALL SLIPPER

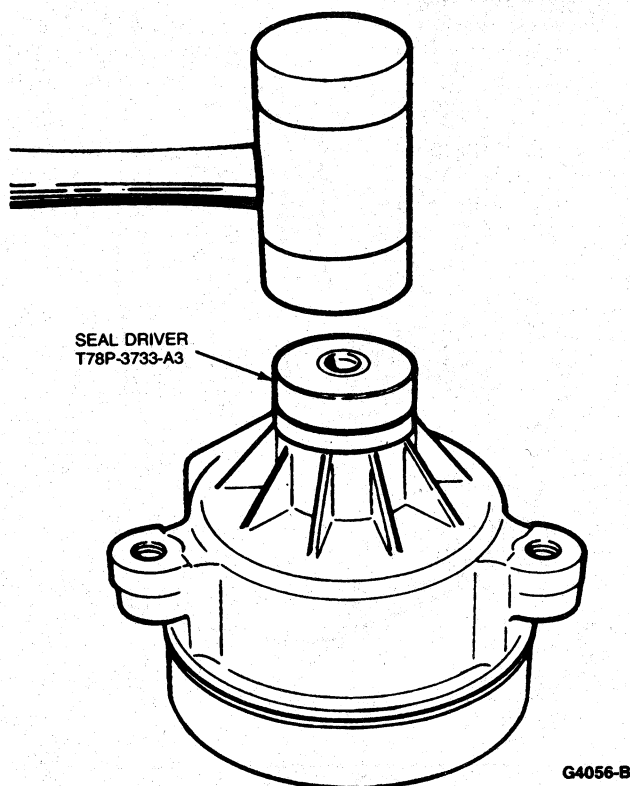


6. Holding cam stationary, index rotor either right or left one space and install another spring and slipper until all ten rotor cavities have been filled. Turn rotor carefully so that springs and slippers already installed do not fall out.

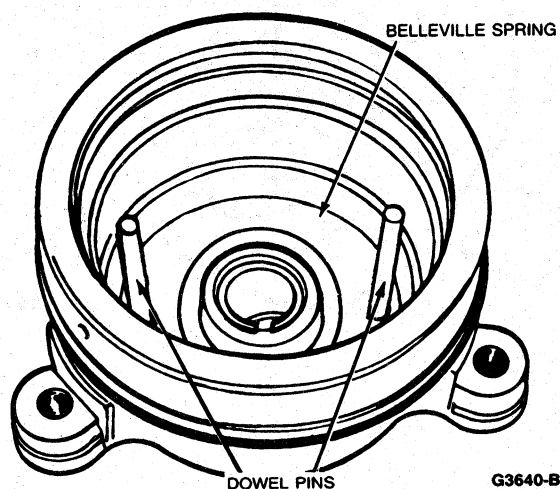


## DISASSEMBLY AND ASSEMBLY (Continued)

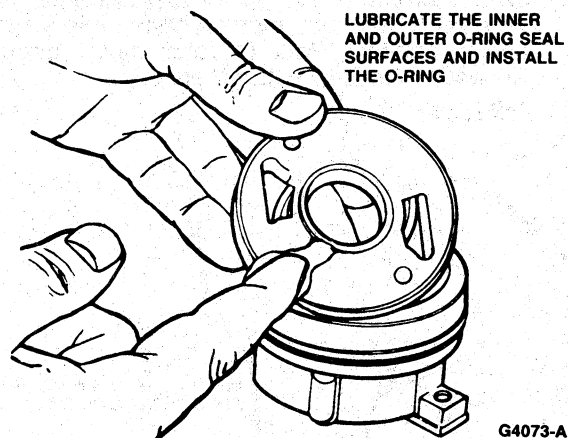
7. Install a rotor shaft seal using Seal Driver T78P-3733-A3 or equivalent. Using a plastic mallet, drive seal into bore until it bottoms. Install seal retainer in same manner.



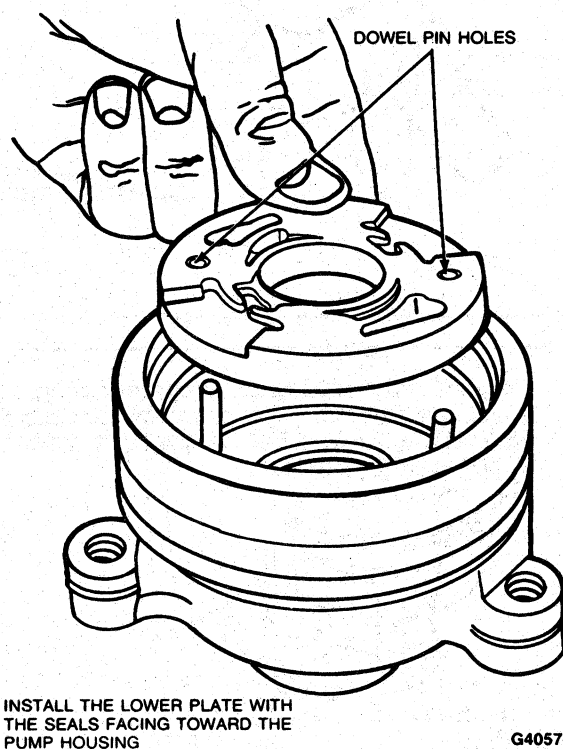
8. Place pump housing plate on flat surface with pulley side facing down.
9. Insert two dowel pins and Belleville spring into housing.
- NOTE: The Belleville spring must be inserted with the dished surface upward.



10. Lubricate inner and outer O-ring seals with specified power steering fluid, and install these seals on lower pressure plate.

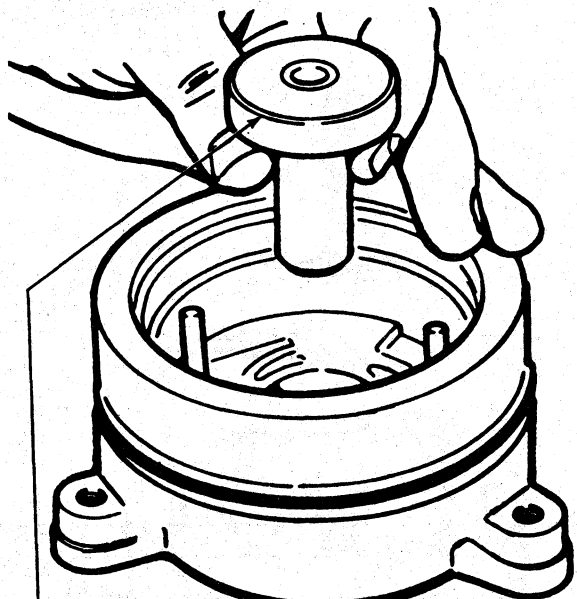


11. Insert lower pressure plate with O-ring seals toward front of pump into housing and over dowel pins.



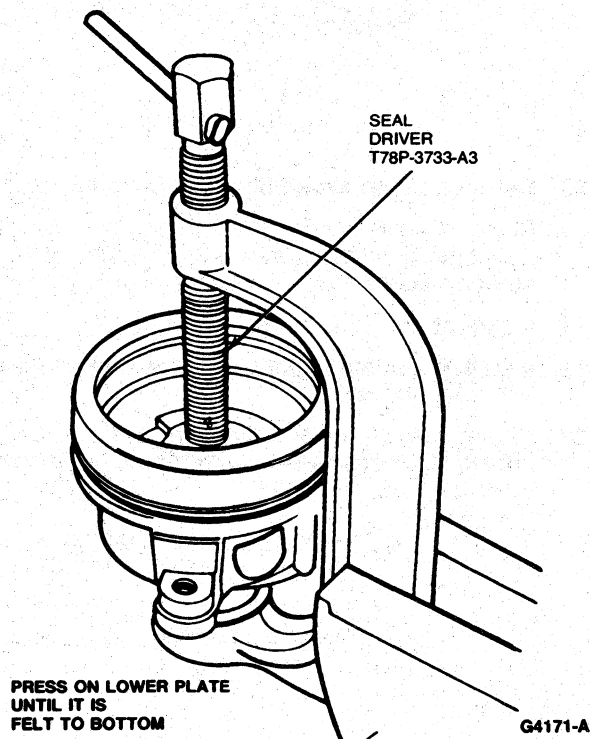
**DISASSEMBLY AND ASSEMBLY (Continued)**

12. Place entire assembly on C-clamp. Place Seal Driver T78P-3733-A3 or equivalent into rotor shaft hole. Press on lower plate lightly until it is felt to bottom into pump housing. This operation will seat outer O-ring seal.



PLACE SEAL DRIVER T78P-3733-A3  
INTO ROTOR SHAFT HOLE

G2583-C



PRESS ON LOWER PLATE  
UNTIL IT IS  
FELT TO BOTTOM

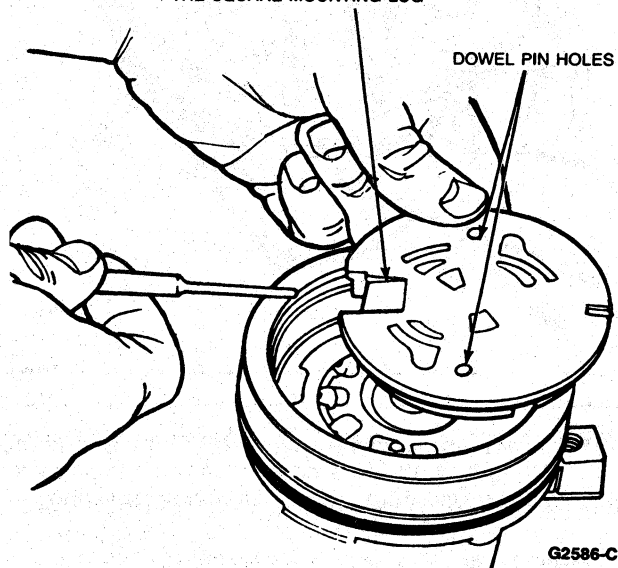
G4171-A

13. Install cam, rotor and slippers, and rotor shaft assembly into pump housing over dowel pins.

NOTE: When installing this assembly into pump housing, stepped holes must be used for dowel pins, and the recessed notch in cam insert must face toward reservoir and approximately 180 degrees opposite the square mounting lug on aluminum housing. Refer to the illustration under Assembly, Step 1.

14. Place upper pressure plate over dowel pins with recess directly over recessed notch on cam insert and approximately 180 degrees opposite square mounting lug.

UPPER PLATES RECESS MOUNTS DIRECTLY OVER  
THE RECESSED NOTCH IN THE CAM AND  
APPROXIMATELY 180 DEGREES OPPOSITE  
THE SQUARE MOUNTING LUG

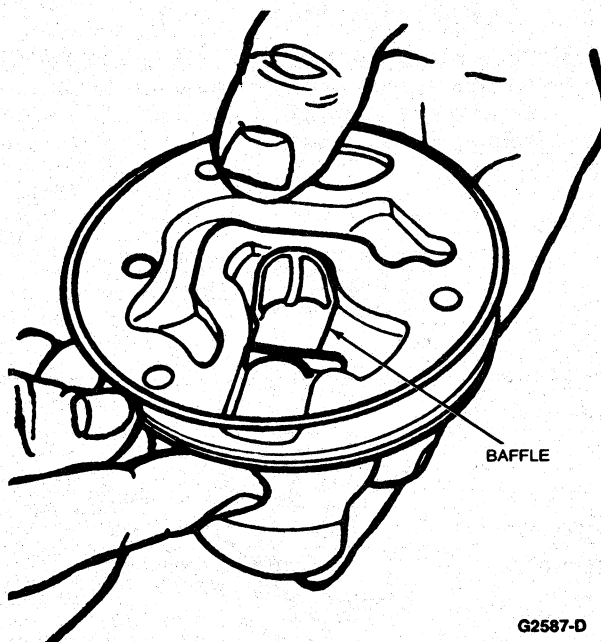


G2586-C

**DISASSEMBLY AND ASSEMBLY (Continued)**

15. Place a new O-ring seal on valve cover. Lubricate this seal with specified power steering fluid.

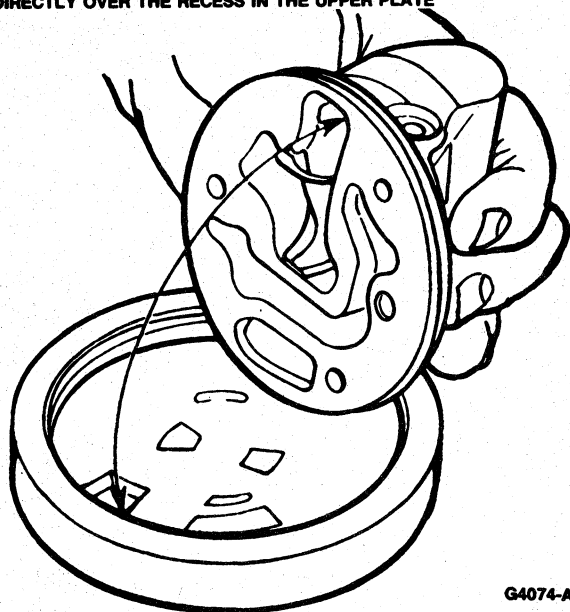
NOTE: Ensure the plastic baffle is securely in place in valve cover. If baffle is loose, apply a coating of petroleum jelly on the baffle, and install it into location on the valve cover.



G2587-D

16. Insert valve cover over dowel pins. Ensure fitting hole in valve cover is directly in line with square mounting lug of aluminum housing.

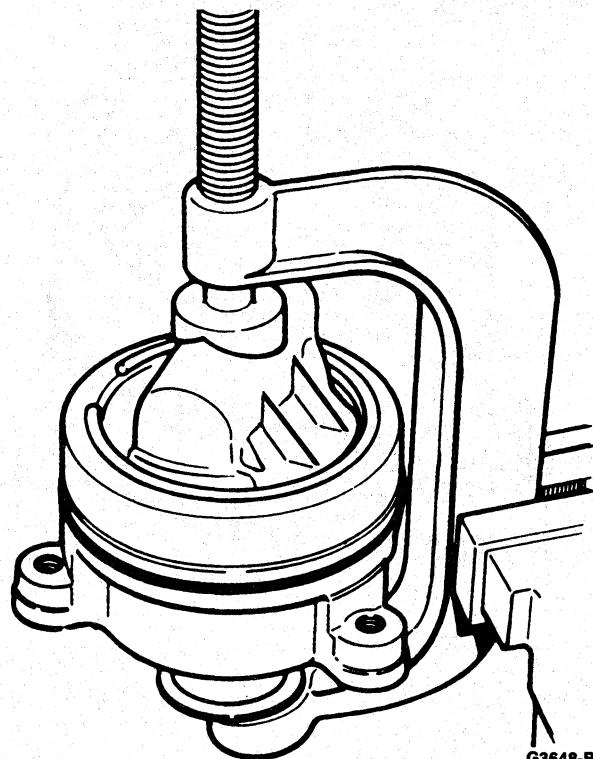
**PRESSURE CHANNEL IN THE VALVE COVER FITS DIRECTLY OVER THE RECESS IN THE UPPER PLATE**



G4074-A

17. Place entire assembly in C-clamp tool and compress valve cover into pump housing, until retaining ring groove is exposed in pump housing.

18. Install valve cover retaining ring with ends near access hole in pump housing.



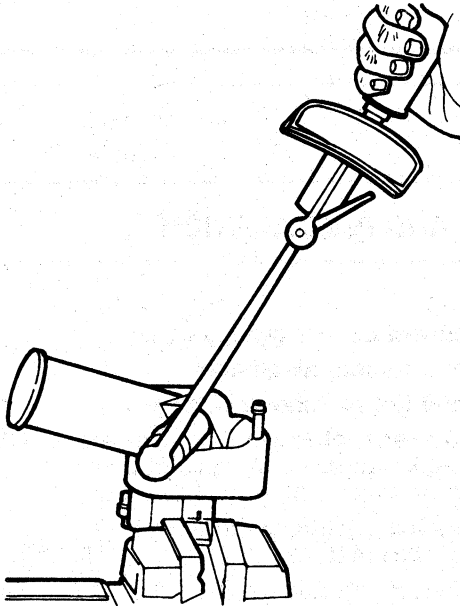
G3648-B

19. Remove pump assembly from C-clamp tool.
20. Place a new O-ring seal on pump housing. Lubricate this O-ring seal with specified power steering fluid.
21. Install power steering reservoir.
22. Install flow control spring and flow control valve into valve cover.
23. Place new O-ring seals on outlet fitting. Lubricate these seals with specified power steering fluid.

**DISASSEMBLY AND ASSEMBLY (Continued)**

24. Install outlet fitting into valve cover. Tighten to 34-46 N·m (25-34 lb-ft).

NOTE: If the flow control valve is cocked, it may become stuck in the valve cover. Do not force the valve forward. Forcing the valve may shear off metal and carry the metal chips into the valve bore.



G3649-B

**SPECIFICATIONS****TORQUE SPECIFICATIONS**

Description	N·m	Lb·Ft
Pivot Bolt — 2.5L/3.0L Engine	41-61	30-45
Front Bolts to Support Bracket — 2.5L/3.0L Engine	41-61	30-45
Support Bracket to Engine	40-62	30-45
Pump to Bracket	40-62	30-45
Pressure Hose Tube Nut to Pump Pressure Fitting	13-20	10-15
Return Hose to Pump (Hose Clamp)	.9-2.7	8-24 Lb-In
Support Bracket to Cylinder Head — 2.5L Engine	21-32	15-25
Pulley to Pulley Hub — 2.5L/3.0L Engine	21-32	15-25

CG4428-B

**SPECIAL SERVICE TOOLS**

Tool Number	Description
T74P-3044-A1	C-Frame and Clamp Assembly
T69L-10300-B	Steering Pump Pulley Tool
T78P-3733-A	Power Steering Pump Tools — Use with T74P-3044-A1
T78P-3733-A1	Upper Support Plate
T78P-3733-A2	Lower Support Plate
T78P-3733-A3	Seal Driver
T65P-3A733-C	Steering Pump Pulley Replacer
T71P-19703-B	Hub Puller
Rotunda 021-00028	Belt Tension Gauge
Rotunda 014-00207	Power Steering Analyzer

CG3940-C

# SECTION 13-55 Steering, Power—Hoses

SUBJECT	PAGE	SUBJECT	PAGE
DESCRIPTION .....	13-55-1	REMOVAL AND INSTALLATION (Cont'd.)	
REMOVAL AND INSTALLATION		Pressure Switch .....	13-55-5
Pump Seal Replacement and		VEHICLE APPLICATION .....	13-55-1
Inspection .....	13-55-3		
Pressure and Return Line Fitting at			
Steering Gear .....	13-55-4		

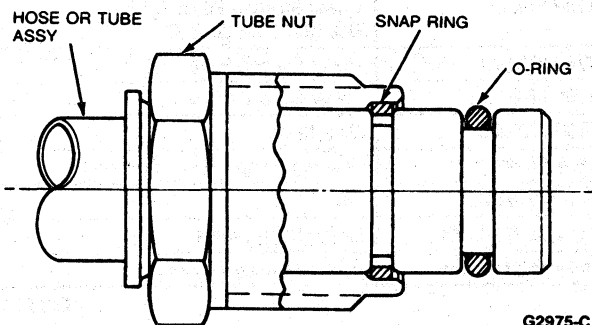
## VEHICLE APPLICATION

Taurus/Sable.

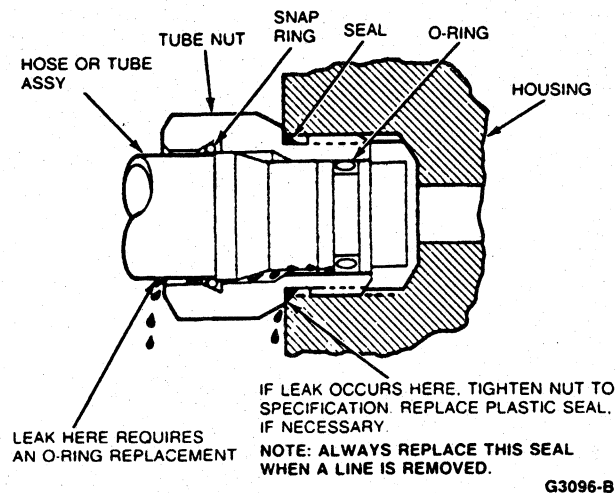
## DESCRIPTION

The power steering hoses use O-ring seals at the quick connect fittings. Note that there are two possible leak points at the gear fittings.

### Pump



### Gear Connection



## REMOVAL AND INSTALLATION

### Removal

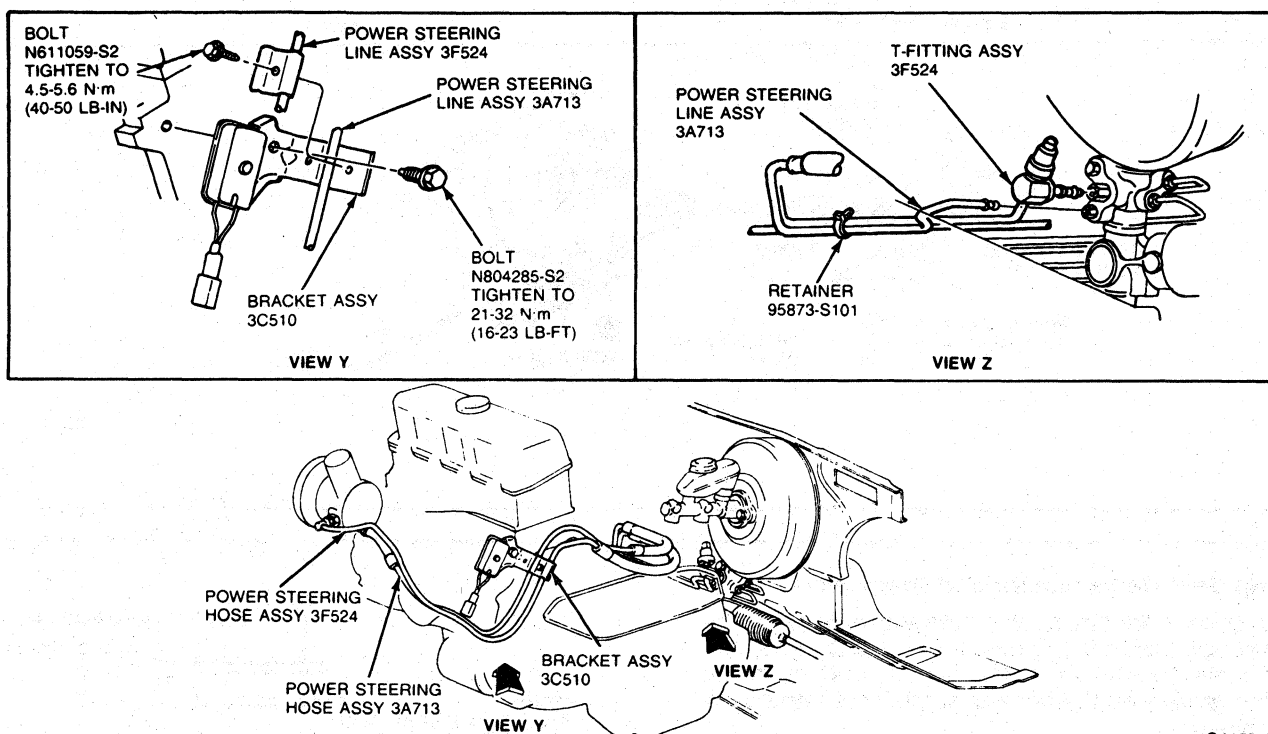
1. Disconnect battery ground cable.
2. Remove remote air cleaner.
3. Remove hot air tube (2.5L only).
4. Disconnect electrical connectors from distributor, ignition coil, radio capacitor and oil switch and move harness (2.5L only).
5. Disconnect electrical connector in back of radiator fan motor.
6. Disconnect electrical connector from purge valve.
7. Remove radiator fan shroud.
8. Disconnect integrated module harness from headlamp harness and place module on top of engine to provide accessibility to power steering lines.
9. Remove screw at pressure and return line bracket.
10. Remove anti-rattle clip.
11. Disconnect electrical connector on power steering pressure switch at steering gear.
12. Remove plastic strap attaching tubes to steering gear.
13. Remove pressure line fitting at power steering pump using a 5/8-inch open-end wrench.
14. Loosen clamp and remove return line at pump.
15. Remove return line fitting as described in Step 13.
16. Remove pressure line fitting at steering gear, using an 11/16-inch open-end wrench.

### Installation

1. Position power steering lines in vehicle and connect lines at power steering pump and steering gear.
2. Install screw at pressure and return line bracket.
3. Install anti-rattle clip.

**REMOVAL AND INSTALLATION (Continued)**

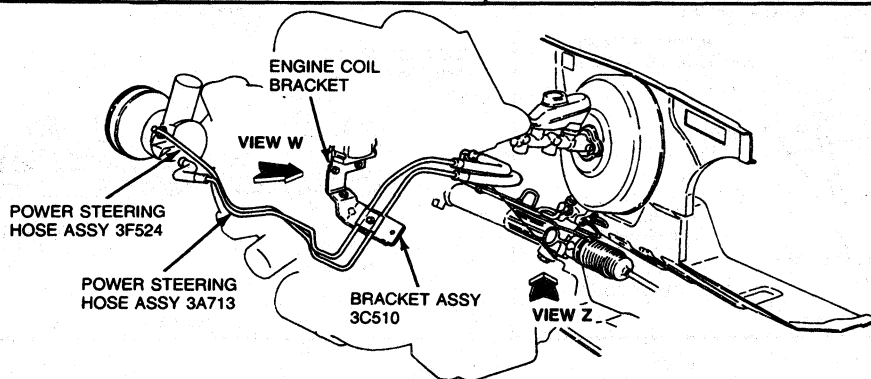
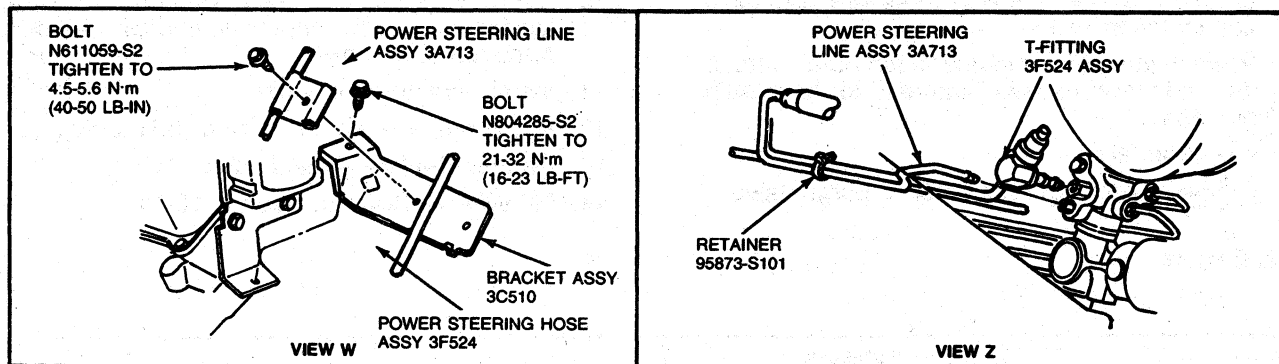
4. Install plastic strap attaching lines to transfer tube on steering gear.
5. Connect power steering pressure electrical connector to switch.
6. Position integrated module to top of fan shroud and connect module harness to headlamp harness.
7. Install fan shroud.
8. Connect electrical connector to purge valve.
9. Connect electrical connector to radiator fan motor.
10. Connect electrical connectors to distributor, ignition coil, radio capacitor and oil switch if removed (2.5L only).
11. Install remote air cleaner.
12. Install hot air tube if removed (2.5L only).
13. Connect battery ground cable.
14. Fill system. Refer to Section 13-01.

**2.5L Engine**

G4157-A

## REMOVAL AND INSTALLATION (Continued)

## 3.0L Engine



G4158-B

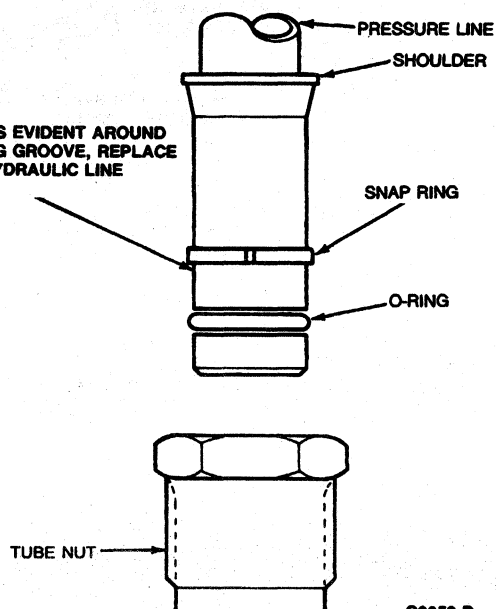
## Pump Seal Replacement and Inspection

The quick connect power steering fittings at the pump may leak if the O-ring is cut or damaged, or if the sealing surfaces in the female port or in the O-ring groove on the hose assembly are improperly machined.

If a leak occurs, the O-ring should be replaced with quick connect O-ring 388749-S. NOTE: The O-rings that are used on the tube of the power steering fitting should not be used on the quick connect fittings because of dimensional and material differences. If O-ring replacement does not solve the leak problem, replace the female port (pump outlet fitting) first, and then the hose assembly.

The quick connect fittings at the pump may disengage if the snap ring is damaged or if the tube nut is not properly machined. If disengagement occurs, the tube end may be serviced with a tube nut service kit containing a new tube nut, snap ring, and O-ring.

**CAUTION:**  
IF WEAR IS EVIDENT AROUND  
SNAP RING GROOVE, REPLACE  
ENTIRE HYDRAULIC LINE  
ASSY.



G3953-B



## REMOVAL AND INSTALLATION (Continued)

**CAUTION:** If wear is evident around snap ring groove, replace entire hose assembly.

The service snap ring must be installed with a minimum amount of deformation to the snap ring. After installation, the snap ring must not be distorted or bent, and must rotate freely in the snap ring groove. If the hose assembly still does not engage, replace the hose assembly.

The system should then be properly filled, the engine started, and the steering wheel cycled from lock to lock to test for positive connector engagement.

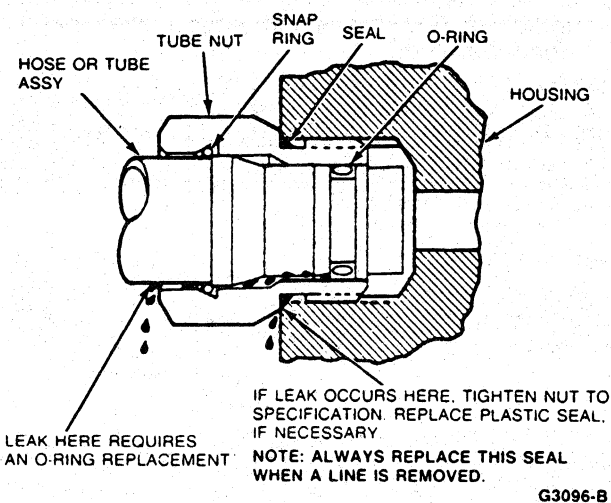
Care must be taken not to over-tighten the tube nut. Tighten to 14-20 N·m (10-15 lb-ft). Swivel and/or end play of the quick connect fittings is normal, and does not indicate an under-tightened fitting.

Quick connect hose assemblies for service have tube nuts, snap rings, and O-rings already attached.

### Pressure and Return Line Fitting at Steering Gear

#### Seal Replacement (Gear)

If a leak occurs between the tubing and tube nut, replace the rubber O-ring. If a leak occurs between the tube nut and the aluminum gear housing, replace the plastic washer.



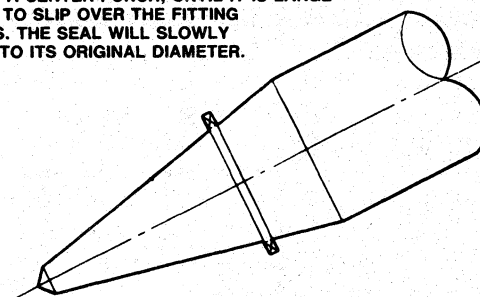
The following procedure should be used:

1. Check fittings to determine which fitting is leaking and whether leak is between tube and tube nut or between tube nut and gear housing.
2. If leak is between tube nut and gear housing, check to ensure nut is tightened to 14-20 N·m (10-15 lb-ft).

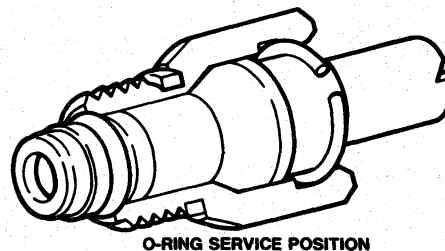
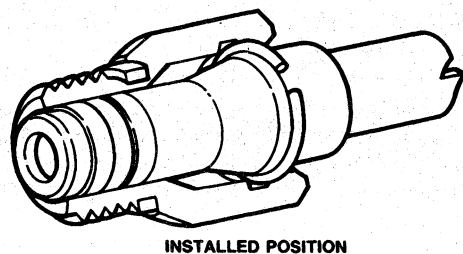
**CAUTION:** DO NOT over-tighten.

3. If leak continues or if leak is between tube and tube nut, remove line.
4. Unscrew tube nut, and inspect plastic seal washer. Always replace plastic seal washer (pressure line plastic washer, 388897-S, and return line plastic washer, 388898-S) when line is removed. To facilitate assembly of new plastic seal washer, a tapered shaft may be required to stretch washer, so it may be slipped over tube nut threads.

STRETCH PLASTIC SEAL OVER A TAPERED TOOL, SUCH AS A CENTER PUNCH, UNTIL IT IS LARGE ENOUGH TO SLIP OVER THE FITTING THREADS. THE SEAL WILL SLOWLY RETURN TO ITS ORIGINAL DIAMETER.



5. To replace rubber O-ring, push tubing into nut until O-ring is exposed.



Replace the O-ring (3/8-inch O-ring 388749-S for the return line and 5/16-inch O-ring 388748-S for the pressure line).

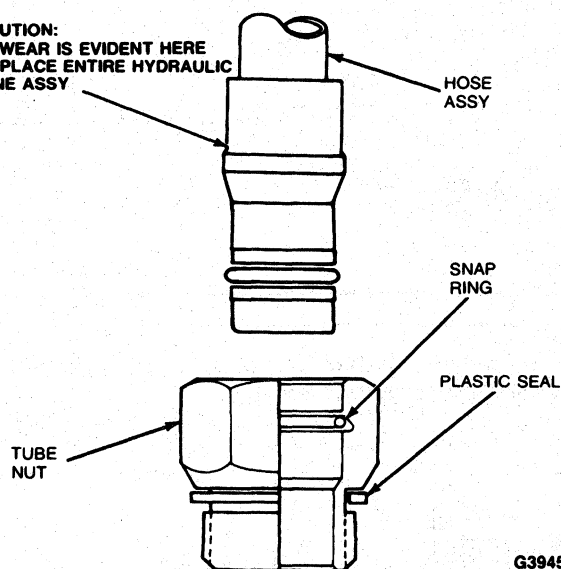
6. Lubricate new O-ring with power steering fluid. Grasp tube nut, and pull tubing until O-ring slips back into tube nut.
7. Connect tube nuts and tighten to 14-20 N·m (10-15 lb-ft). Install plastic strap to attach pressure and return lines to left turn transfer line.

**REMOVAL AND INSTALLATION (Continued)**

The quick connect fittings at the steering gear may disengage if not fully assembled, if the snap ring is missing, or if the female port in the gear, the tube nut, or the hose end is not machined properly.

If the fitting disengages, check for a snap ring in the tube nut before assembling the fitting. The fitting is fully engaged only when the hose bottoms in the port and will not pull out. To test for positive engagement, the system should be properly filled, the engine started, and the steering wheel cycled from lock to lock. If the snap ring is missing or if the hose will not engage, the hose may be serviced with a tube nut service kit. If hose assembly still does not engage, replace the hose assembly. Service hose assemblies have tube nuts, snap rings and O-rings already attached.

**CAUTION:**  
IF WEAR IS EVIDENT HERE  
REPLACE ENTIRE HYDRAULIC  
LINE ASSY



G3945-B

**Pressure Switch**

The pressure switch uses an O-ring seal. If a leak occurs, check that the switch is properly tightened to 7-14 N·m (5-10 lb-ft). If the leak continues, replace the O-rings, then the pressure tube, and finally the pressure switch.

**Pressure Switch Functional Check**

Check operation of the switch if either or both of the following problems are noted:

- Engine stalls during parking maneuvers.
- Engine idles at high speed.

The following test is based on the fact that the switch is normally closed. As power steering load increases, the switch opens and increases the idle speed.

1. Disconnect the electrical connector at the pressure switch.
2. Connect a continuity tester (ohmmeter) across the pressure switch terminals.
3. Start engine and let idle.
4. Switch should be normally closed (zero ohms) with steering wheel straight ahead.
5. Turn steering toward either stop while watching continuity tester. Switch should open near the stops (no continuity or infinite reading on ohmmeter).
6. If switch fails either test, replace the switch. If switch is OK, check the engine idle speed control system.

# SUSPENSION

# GROUP 14

(3000 & 5000)

SECTION TITLE	PAGE	SECTION TITLE	PAGE
SUBFRAME .....	14-07-1	SUSPENSION—REAR, COIL SPRINGS—	
SUSPENSION—FRONT .....	14-10-1	STATION WAGON .....	14-35-1
SUSPENSION—REAR, COIL SPRINGS—		SUSPENSION—SERVICE .....	14-01-1
SEDAN .....	14-32-1		

## SECTION 14-01 Suspension—Service

SUBJECT	PAGE	SUBJECT	PAGE
<b>ADJUSTMENTS</b>		<b>CLEANING AND INSPECTION (Cont'd.)</b>	
Caster and Camber .....	14-01-2	Shock Absorber Checks (Cont'd.)	
Reference Definitions .....	14-01-4	On Vehicle Tests .....	14-01-6
Toe .....	14-01-5	Strut Noise Check .....	14-01-6
Wheel Turning Angle, Front .....	14-01-5	<b>SPECIFICATIONS</b> .....	14-01-7
<b>CLEANING AND INSPECTION</b>		<b>TESTING</b>	
Ball Joint, Lower .....	14-01-6	Equipment Installation .....	14-01-1
Front End .....	14-01-6	<b>VEHICLE APPLICATION</b> .....	14-01-1
Shock Absorber Checks .....	14-01-6		
Bench Test .....	14-01-6		

### VEHICLE APPLICATION

Taurus/Sable.

### TESTING

#### Equipment Installation

All wheel alignment readings must be performed on an alignment rack leveled to within 1.59mm (1/16-inch) side-to-side and front-to-rear. The instrumentation used must have a means of compensating for wheel runout and must be capable of reading individual (LH and RH) toe measurements.

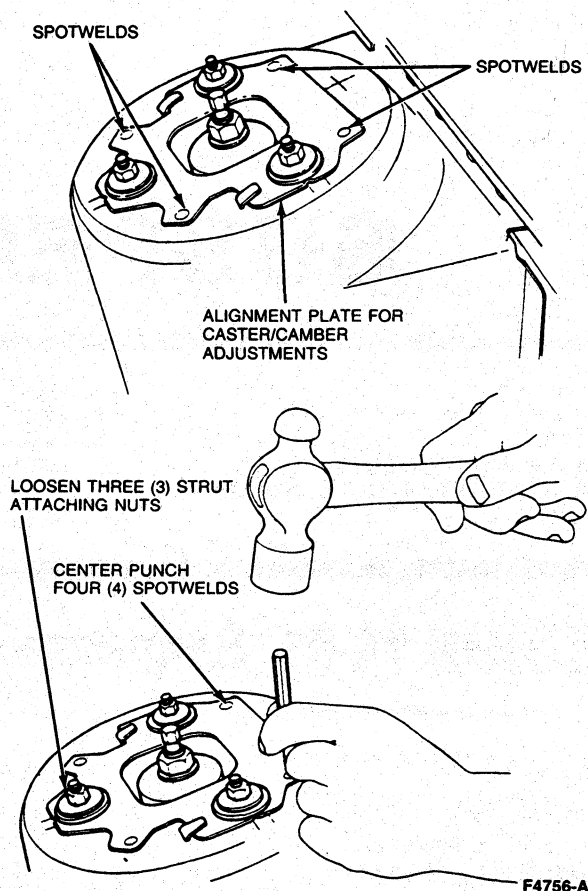
## ADJUSTMENTS

### Caster and Camber

NOTE: Refer to Section 14-07 to check sub-frame alignment before caster/camber adjustments are performed.

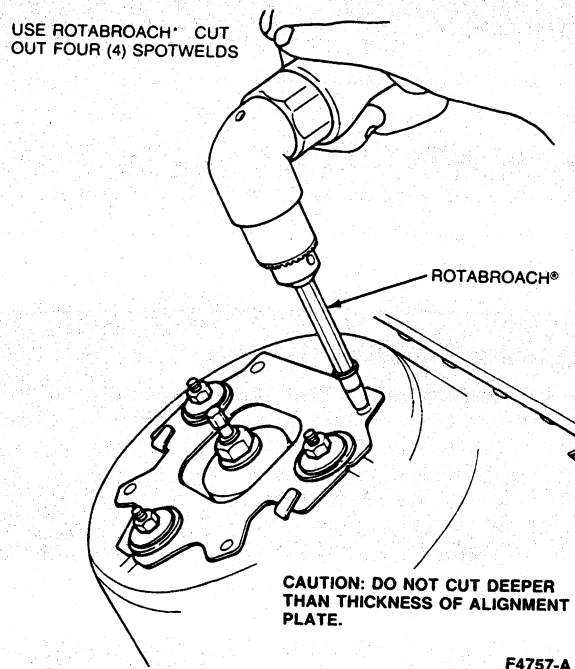
NOTE: Vehicles that require camber/caster adjustment can be corrected by loosening the sub-frame attaching bolts and shifting the sub-frame as required. If further adjustment is required, use the following procedure:

1. Center punch four spot welds on alignment plate(s).



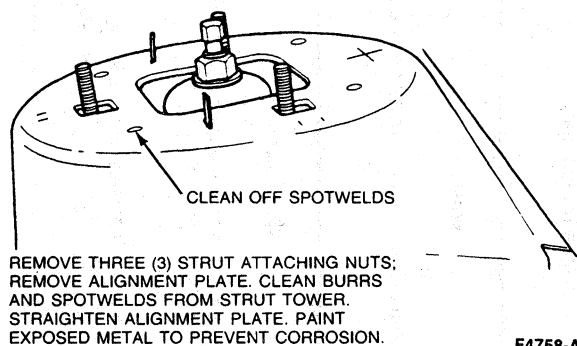
2. Loosen three nuts attaching strut to vehicle.
3. Use Rotabroach® or an equivalent to remove four welds.

**CAUTION: Do not cut deeper than necessary to remove alignment plate.**



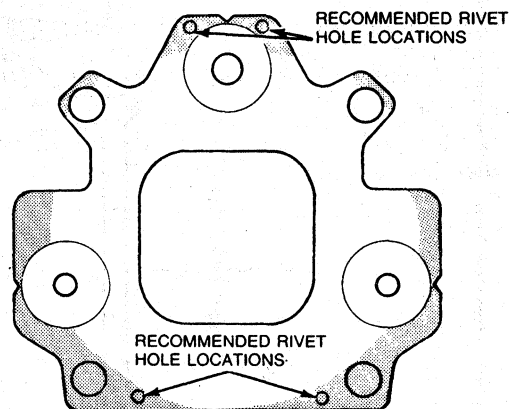
**ADJUSTMENTS (Continued)**

4. Remove three nuts attaching strut mount to tower.
5. Remove alignment plate.
6. Clean burrs from tower and alignment plate and paint exposed metal on strut tower and plate.



F4758-A

**CAUTION: Do not drill deeper than 9.6mm (3/8 inch) into shock tower.**

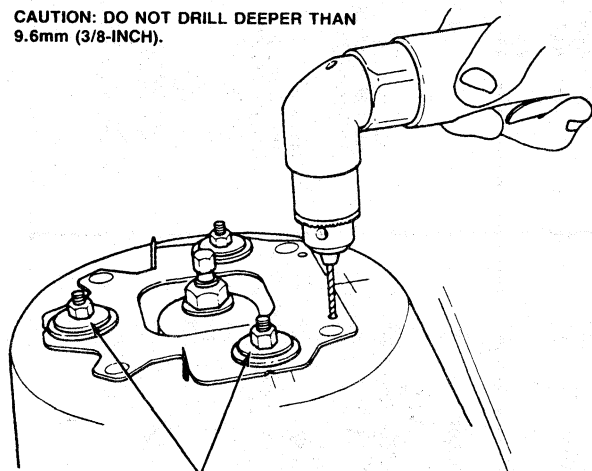


DRILL THREE (3) HOLES IN ALIGNMENT PLATE FOR 3.2mm (1/8-INCH)  
DRILL IN SHADED AREA ONLY

F4760-A

7. Install alignment plate.
8. Install three strut mount nuts, loosely.
9. Make alignment-camber/caster adjustments.
10. Tighten three strut mount nuts to 27-40 N·m (20-30 lb-ft).
11. Drill three 3.2mm (1/8 inch) holes through alignment plate and strut tower and paint exposed metal.

**CAUTION: DO NOT DRILL DEEPER THAN 9.6mm (3/8-INCH).**

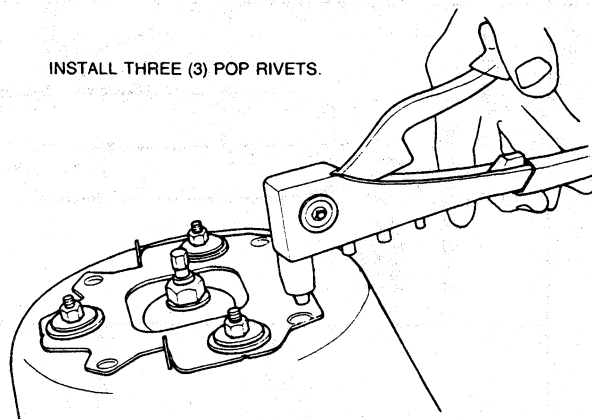


INSTALL ALIGNMENT PLATE.  
INSTALL THREE (3) STRUT ATTACHING NUTS, LOOSELY.  
MAKE ALIGNMENT ADJUSTMENTS.  
TIGHTEN STRUT ATTACHING NUTS.  
DRILL THREE (3) HOLES FOR RIVETS.  
SEE FIGURE 5 FOR HOLE LOCATION.

F4759-A

12. Install three pop rivets 3.2mm (1/8 inch) diameter x 6.4mm (1/4 inch) grip range.

INSTALL THREE (3) POP RIVETS.



F4761-A

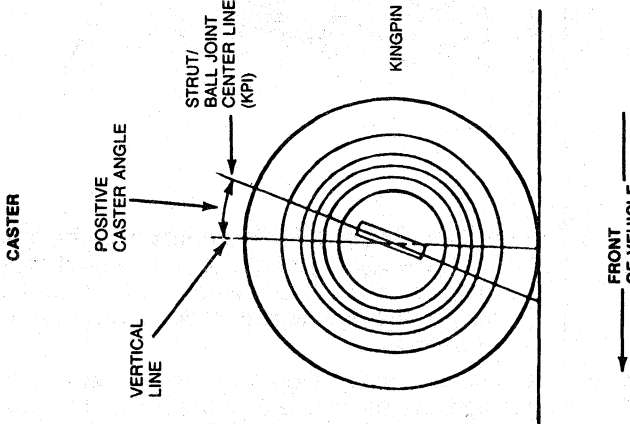
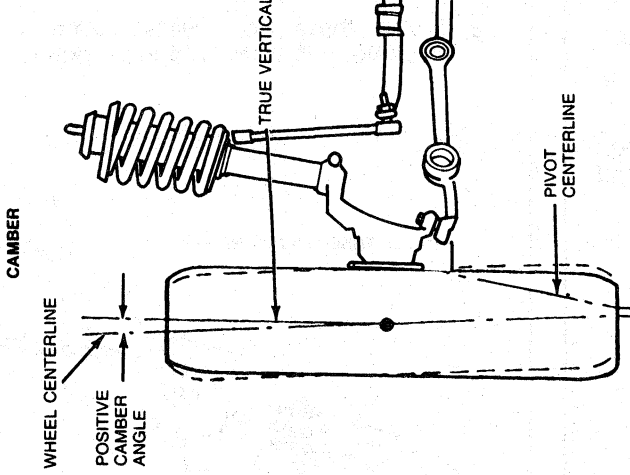
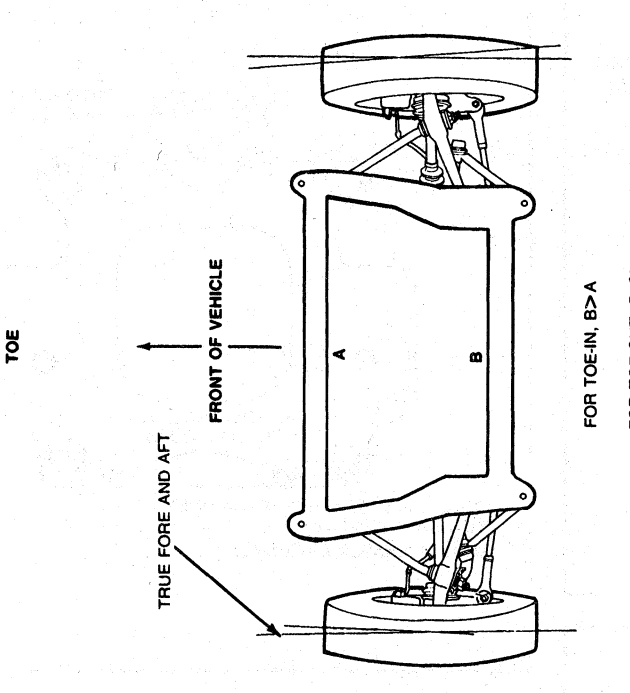
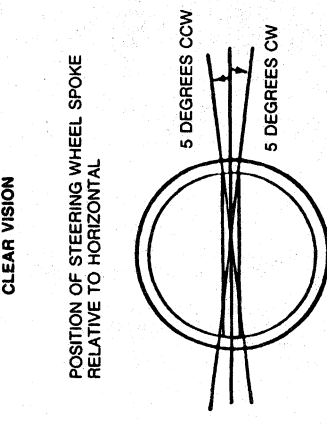
**NOTE:** Caster measurements must be made on the LH side by turning the left wheel through the prescribed angle of sweep and on the RH side by turning the right wheel through the prescribed angle of sweep.

When using alignment equipment designed to measure caster on both the RH and LH side, turning only one wheel will result in a significant error in the caster angle for the opposite side.

## ADJUSTMENTS (Continued)

## Reference Definitions

## REFERENCE DEFINITIONS

<p><b>CASTER</b></p>  <p>POSITIVE CASTER ANGLE</p> <p>STRUT/BALL JOINT CENTER LINE (KPI)</p> <p>KINGPIN</p> <p>FRONT OF VEHICLE</p>	<p><b>CAMBER</b></p>  <p>WHEEL CENTERLINE</p> <p>POSITIVE CAMBER ANGLE</p> <p>TRUE VERTICAL</p> <p>PIVOT CENTERLINE</p> <p>SCRUB RADIUS</p>	<p><b>TOE</b></p>  <p>TRUE FORE AND AFT</p> <p>FRONT OF VEHICLE</p> <p>A</p> <p>B</p> <p>FOR TOE-IN, <math>B &gt; A</math></p> <p>FOR TOE-CUT, <math>B &lt; A</math></p>	<p><b>NOMINAL</b></p> <p>THE NOMINAL VALUE IS THE PREFERRED VALUE</p> <p><b>TOLERANCE</b></p> <p>THE TOLERANCE IS THE RANGE OF ACCEPTABLE VALUES AROUND THE NOMINAL VALUE.</p> <p><b>EXAMPLE:</b> SIDE-TO-SIDE CAMBER = <math>+1/2</math> DEGREES (NOM.) <math>\pm 3/4</math> DEGREES (TOL.) MEANS THAT VALUES BETWEEN <math>+1-1/4</math> DEGREES AND <math>-1/4</math> DEGREES ARE ACCEPTABLE.</p>
<p><b>CLEAR VISION</b></p>  <p>5 DEGREES CCW</p> <p>5 DEGREES CW</p>	<p><b>SIDE-TO-SIDE</b></p> <p>SIDE TO SIDE MEANS THE VALUE OF THE LEFT SIDE MINUS THE VALUE OF THE RIGHT SIDE</p> <p><b>EXAMPLE:</b> LEFT CAMBER = <math>+3/4</math> DEGREES RIGHT CAMBER = <math>+1/4</math> DEGREES SIDE TO SIDE = <math>+3/4</math> DEGREES <math>- 1/4</math> DEGREES = <math>1/2</math> DEGREES</p> <p><b>EXAMPLE:</b> LEFT CAMBER = <math>1/4</math> DEGREES RIGHT CAMBER = <math>+3/4</math> DEGREES SIDE TO SIDE = <math>1/4</math> DEGREES <math>-3/4</math> DEGREES = <math>-1/2</math> DEGREES</p>	<p><b>NOMINAL</b></p> <p>THE NOMINAL VALUE IS THE PREFERRED VALUE</p> <p><b>TOLERANCE</b></p> <p>THE TOLERANCE IS THE RANGE OF ACCEPTABLE VALUES AROUND THE NOMINAL VALUE.</p> <p><b>EXAMPLE:</b> SIDE-TO-SIDE CAMBER = <math>+1/2</math> DEGREES (NOM.) <math>\pm 3/4</math> DEGREES (TOL.) MEANS THAT VALUES BETWEEN <math>+1-1/4</math> DEGREES AND <math>-1/4</math> DEGREES ARE ACCEPTABLE.</p>	

F4356-A

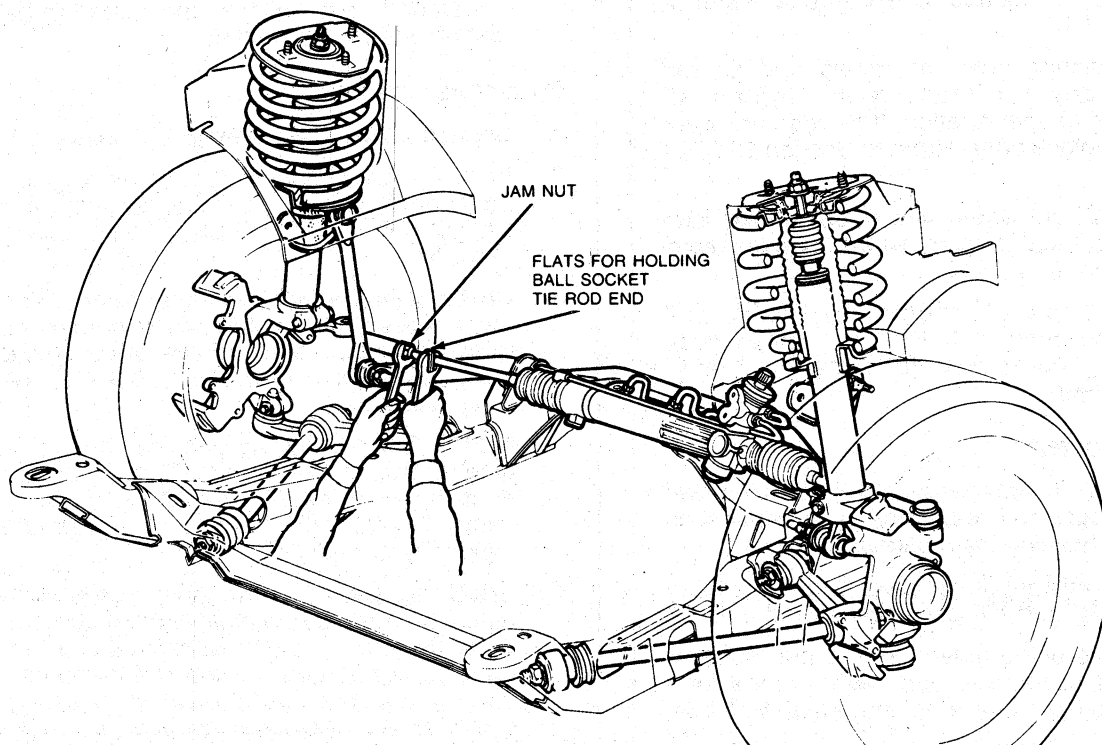
**ADJUSTMENTS (Continued)****Toe**

1. Ensure alignment equipment is calibrated and in good working condition to obtain accurate results.
2. Start engine (power steering only) and move steering wheel back and forth several times until it is in straight ahead or centered position.
3. Turn engine off (power steering only) and lock steering wheel in place using a steering wheel holder. Loosen and slide off small outer clamp

from steering gear boot prior to starting toe adjustment to prevent boot from twisting.

4. Adjust LH and RH tie rods until each wheel has one-half of desired total toe specification. Correct toe setting is given in Specifications.

NOTE: When jam nuts are loosened for toe adjustment, the nuts must be tightened to specification. Attach boot clamp after setting is completed and ensure boot is not twisted.



F4229-A

**Wheel Turning Angle, Front**

The turning angle cannot be adjusted directly because it is a result of the combination of caster, camber and toe adjustments and should, therefore, be measured only after the toe adjustment has been made. When the inside wheel is turned 20 degrees, turning angle of outside wheel should be as specified in Specifications.

NOTE: If the turning angle does not measure to specification, check the steering knuckle or other suspension or steering parts for a bent or loose condition.

**CLEANING AND INSPECTION****Front End****Inspection**

Do not check alignment without first making the following inspection for front-end damage or wear:

1. Check for specified air pressure in all four tires.
2. Raise front of vehicle off floor. Grasping upper and lower surfaces of tire, move each front wheel in and out to check front suspension ball joints and mounts for looseness, wear and damage. Tighten all loose nuts and bolts to specification. Replace all worn parts. Refer to Section 14-10.
3. Check steering gear mountings and tie rod connections for looseness. Tighten all mountings to specification. If tie rods are worn or bent, replace parts. Refer to Section 13-32 or 13-46.
4. Spin each front wheel with wheel spinner and check and balance each wheel as necessary. Refer to Section 11-12.
5. Check action of shock absorbers and suspension springs. If they are not in good condition, vehicle may not settle in normal/level position.

**Ball Joint, Lower**

1. Raise vehicle until wheels fall to full down position. Refer to Pre-Delivery manual, Section 50-04 for hoisting instructions.
2. Have an assistant grasp lower edge of tire and move wheel and tire assembly in and out.
3. As wheel is being moved in and out, observe lower end of knuckle and lower control arm. Any movement indicates abnormal ball joint wear.
4. If any movement is observed, install new lower control arm assembly.

**Shock Absorber Checks**

All vehicles are equipped with low pressure gas-filled hydraulic shock absorber struts of the direct acting type. They are non-adjustable and non-refillable. They cannot be serviced as a cartridge and must be serviced as an assembly.

**On Vehicle Tests**

1. Check all tire pressures.
2. Check for loose spare tire, wrench, jack, cargo lid and/or objects in cargo department.
3. Check for witness (wear) marks and loose attachments by performing a visual inspection on a body hoist with shock struts in full rebound.
4. Check torqued joints such as shock rod, shock mount, stabilizer bar, spindle, knuckle, control arms and tie rods. Tighten to specification.

5. Check shock strut for external damage.
6. Check shock strut to ensure it is securely and properly installed.
7. Inspect shock absorber for evidence of fluid leakage. A light film of fluid is permissible. Ensure that any fluid present is not from sources other than shock absorber. Replace shock absorber if leakage is severe and fluid is dripping from strut body onto the ground.
8. Check damping effect of shock absorber by bouncing vehicle by hand. If damping effect is not smooth and uniform, the following bench test should be conducted.

**Strut Noise Check**

1. Bounce vehicle and attempt to isolate noise.
2. If noise is caused by excessive rubbing of dust cover on strut, spray contact area with silicone. Check noise level. Replace dust cover as required.
3. Check spindle-to-strut fastener torque. Torque must exceed 75 N·m (55 lb-ft) on both rear strut lower mounting bolts. Front strut-to-knuckle torque must exceed 95 N·m (70 lb-ft). Tighten as required.

NOTE: These attaching bolts contain a locking type material in the threads. They could appear to have correct torque when the joint is actually loose. Replace the fastener if equipped with locking type material.

4. Check torque of strut upper mount-to-body nuts. The front torque must exceed 30 N·m (22 lb-ft). The rear torque must exceed 26 N·m (19 lb-ft). Check torque of strut rod-to-mount nut. The torque must exceed 48 N·m (35 lb-ft). Check to see that rubber insulators are in place. Correct as required.
5. Inspect connecting joints for damaged threads. Replace damaged components.
6. If noise persists after Steps 1 through 5 check out OK, remove strut and perform bench test as outlined.

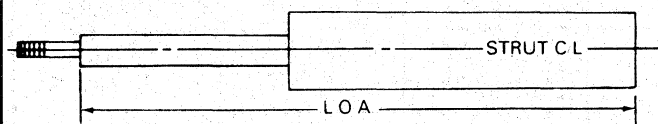
**Bench Test**

The shock absorbers/struts are gas-pressurized, which results in the struts being fully extended when not restrained. If a strut does not fully extend, it is damaged and should be replaced. Check length overall (LOA). If the strut does not meet the length overall requirement, there is a good indication something internal is not to specification and the strut should be replaced.



**CLEANING AND INSPECTION (Continued)**

With the shock in the normal upright position, compress it and allow it to extend three times to purge the pressure chamber of any gas that may have been introduced during handling.

**STRUTS LOA SPECIFICATION — TAURUS/SABLE**

Front	Rear
541-533mm (21.30-20.98 in.)	646-636mm (25.4-25 in.)

CF4230-B

Place the shock absorber right side up in a vise. Hand stroke the shock absorber as fast as possible using as much travel as possible. Action should become smooth and uniform throughout each

stroke. Higher resistance on extension than on compression is normal. If the combination dust shield/jounce bumper has been removed from the shock absorber, care must be taken to avoid excessive bottoming of the rod during the compression stroke to avoid internal damage.

The following conditions are abnormal:

- A lag or skip at reversal of travel near mid-stroke when shock is properly primed and in the installed position.
- Seizing.
- Noise, other than a faint "swish," such as a clicking upon fast stroke reversal.
- Excessive fluid leakage.
- With rod fully extended, any lateral motion of rod in relation to outer can.

If shock absorber action remains erratic after purging air, install a new shock absorber, replace only the damaged unit. Shock absorbers are not to be replaced as sets.

**SPECIFICATIONS****FRONT WHEEL TURNING ANGLE**

Vehicle	Turning Angle at Outside Wheel with Inside Wheel Turned 20 Degrees	
Taurus/Sable	Left Wheel and Right Wheel	18.25°

CF4763-A

**WHEELBASE AND TREAD WIDTH**

Vehicle Taurus/Sable	Wheelbase		Tread Width			
	mm	Inches	Front		Rear	
			mm	Inches	mm	Inches
Sedan	2694	106.1	1565.6	61.6	1520.8	59.9
Wagon	2694	106.1	1565.6	61.6	1518	59.8

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## SPECIFICATIONS (Continued)

## FRONT WHEEL ALIGNMENT (CURB HEIGHT WITH 1/2 TANK OF FUEL)

Vehicle	Alignment Factors	Units	Nominals	Minimum	Maximum
Taurus/Sable Sedan (front alignment)	Caster <sup>①</sup> (Taurus)	Decimal Fractional Minutes	+ 4.00 + 4 + 4 0'	+ 3.00 + 3 + 3 0'	+ 6.00 + 6 + 6 0'
	Caster <sup>①</sup> (Sable)	Decimal Fractional Minutes	+ 3.88 + 3-7/8 + 3 52'	+ 2.88 + 2-7/8 + 2 52'	+ 5.88 + 5-7/8 + 5 52'
	Caster difference side-to-side (left minus right)	Decimal Fractional Minutes	0 0 0	- 0.85 - 27/32 - 0 51'	+ 0.85 + 27/32 + 0 51'
	Camber	Decimal Fractional Minutes	- 0.50 - 1/2 - 0 30'	- 1.10 - 1-1/10 - 1 6'	+ 0.10 + 1/10 + 0 6'
	Camber difference side-to-side (left minus right)	Decimal Fractional Minutes	0 0 0	- 0.70 - 11/16 - 0 42'	+ 0.70 + 11/16 + 0 42'
	Total toe (left plus right)	Decimal inches Fractional inches Millimeters Decimal degrees	- 0.100" - 3/32" - 2.54mm - 0.200	- 0.225" - 7/32" - 5.71mm - 0.450	+ 0.025" + 1/32" + 0.63mm + 0.050
Taurus/Sable Station Wagon (front alignment)	Caster <sup>①</sup>	Decimal Fractional Minutes	+ 3.81 + 3-13/16 + 3 49'	+ 2.81 + 2-13/16 + 2 49'	+ 5.81 + 5-13/16 + 5 49'
	Caster difference side-to-side (left minus right)	Decimal Fractional Minutes	0 0 0	- 0.85 - 27/32 - 0 51'	+ 0.85 + 27/32 + 0 51'
	Camber	Decimal Fractional Minutes	- 0.44 - 7/16 - 0 26'	- 1.04 - 1-1/32 - 1 2'	+ 0.16 + 5/32 + 0 10'
	Camber difference side-to-side (left minus right)	Decimal Fractional Minutes	0 0 0	- 0.70 - 11/16 - 0 42'	+ 0.70 + 11/16 + 0 42'
	Total toe (left plus right)	Decimal inches Fractional inches Millimeters Decimal degrees	- 0.100" - 3/32" - 2.54mm - 0.200	- 0.225" - 7/32" - 5.71mm - 0.450	+ 0.025" + 1/32" + 0.63mm + 0.050

① Caster measurements must be made on the left side by turning left wheel through the prescribed angle of sweep and on the right side by turning the right wheel through the prescribed angle of sweep for the equipment being used. When using alignment equipment designed to measure caster on both the right and left side, turning only one wheel will result in a significant error in caster angle for the other wheel.

CF4704-A

# SECTION 14-07 Sub-frame

SUBJECT	PAGE	SUBJECT	PAGE
REMOVAL AND INSTALLATION .....	14-07-1	SPECIFICATIONS .....	14-07-2
SPECIAL SERVICE TOOLS .....	14-07-2	VEHICLE APPLICATION .....	14-07-1

## VEHICLE APPLICATION

Taurus/Sable.

## REMOVAL AND INSTALLATION

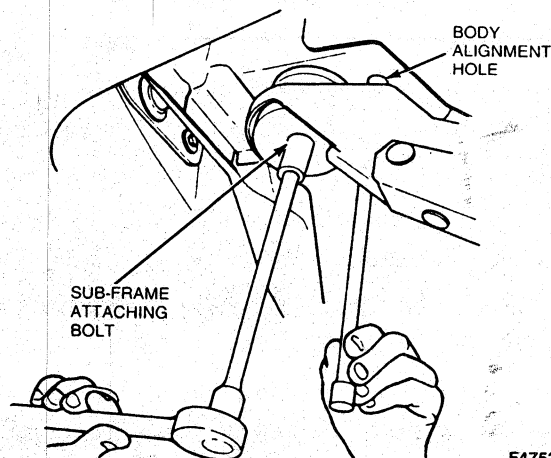
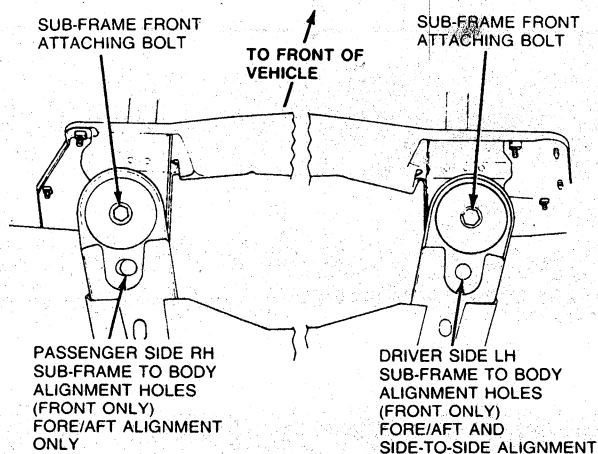
### Removal

1. Install Engine Support Tool D79P-6000-B or equivalent to existing engine lifting eyes.
2. Raise vehicle on hoist with hoist resting on four contact points. Refer to Pre-Delivery manual, Section 50-04.
3. Remove front tires and wheels.
4. Support steering gear with wire from the tie rod end to coil spring to hold steering gear in position. Secure housing of gear to suitable support to hold it in position.
5. Disconnect exhaust system at flex coupling and drop down.
6. Disconnect lower control arm at pinch bolts to ball joints.
7. Remove two nuts that attach steering gear to No. 2 crossmember. *24MM*
8. Remove attaching nuts from RH front engine mount and RH rear engine mount to sub-frame. *13/16"*
9. Remove stabilizer bar link attachment to stabilizer bar. *Hold w/ 11/16" Drive w/ 8MM*
10. Remove LH engine mount insulator at through bolts to sub-frame. *15MM*
11. Support sub-frame with adjustable jacks at sub-frame body mount location points.

12. Remove four body mount attaching bolts.
13. With an assistant, lower adjustable jacks and allow sub-frame to lower. Rotate front of sub-frame down and pick up rear of sub-frame off of exhaust pipe. Work sub-frame rearward until it can be lowered down past exhaust pipe.
14. Place sub-frame on floor or bench and transfer suspension components to the new sub-frame.

### Installation

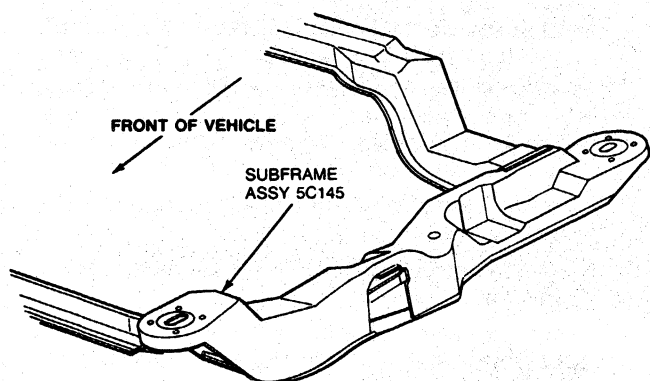
1. With an assistant, align sub-frame to body. Install four sub-frame to body rubber mounts and bolts. DO NOT TIGHTEN AT THIS TIME.
2. Install a 19.0mm (3/4-inch) outside diameter pipe or similar tool into front LH (driver's side) sub-frame and body alignment holes. After aligning the holes, slightly tighten the LH (driver's side) front body mount bolt.
3. Repeat Step 2 on front RH (passenger's side) alignment holes.
4. Check front LH (driver's side) alignment holes with tool.
5. After sub-frame alignment is complete, tighten four sub-frame to body bolts to 90-115 N·m (65-85 lb-ft).



F4753-A

**REMOVAL AND INSTALLATION (Continued)**

6. Install LH engine mount insulator at through bolts to sub-frame. Tighten to 61-88 N·m (45-65 lb-ft).
7. Install stabilizer bar link attachment to stabilizer bar. Tighten to specification.
8. Install two attaching nuts that secure the steering gear to the No. 2 crossmember. Tighten to specification.
9. Install attaching nuts that secure the RH front engine mount and the RH rear engine mount to sub-frame. Tighten to 61-88 N·m (45-65 lb-ft).
10. Connect lower control arm at pinch bolts to ball joints.
11. Connect exhaust system at flex coupling and position in place. Tighten to specification.
12. Remove wire supporting steering gear from tie rod end to coil spring.
13. Install tires and wheels. Tighten to specification.
14. Lower hoist.
15. Remove Engine Support Tool D79P-6000-B or equivalent.
16. Check front end alignment. Adjust if necessary. Refer to Section 14-01.



LH SIDE SHOWN RH SIDE SIMILAR

F3887-A

**SPECIFICATIONS****TORQUE SPECIFICATIONS**

Description	N·m	Lb·Ft
Body Mount Attaching Bolts	90-115	65-85
Body Mount to Subframe (All Front and Four Cylinder Rear)	7.3-11	5.4-8
Insulator-to-Subframe (LH Side)	95-130	70-96
Engine Mount-to-Subframe (RH Side)	75-102	55-75

CF4208-B

**SPECIAL SERVICE TOOLS**

Tool Number	Description
D79P-6000-B	Engine Support Tool

CF4209-A

# SECTION 14-10 Suspension—Front

SUBJECT	PAGE	SUBJECT	PAGE
<b>DESCRIPTION</b>		<b>REMOVAL AND INSTALLATION (Cont'd.)</b>	
Component Replacement .....	14-10-2	Steering Knuckle .....	14-10-10
Components .....	14-10-2	Tension Strut-to-Sub-Frame Insulators .....	14-10-5
Suspension Fasteners .....	14-10-2	<b>SPECIAL SERVICE TOOLS</b> .....	14-10-12
<b>REMOVAL AND INSTALLATION</b>		<b>SPECIFICATIONS</b> .....	14-10-12
Control Arm, Lower .....	14-10-4	<b>VEHICLE APPLICATION</b> .....	14-10-1
Stabilizer Bar/Link Assembly and/or Insulators .....	14-10-6		

## VEHICLE APPLICATION

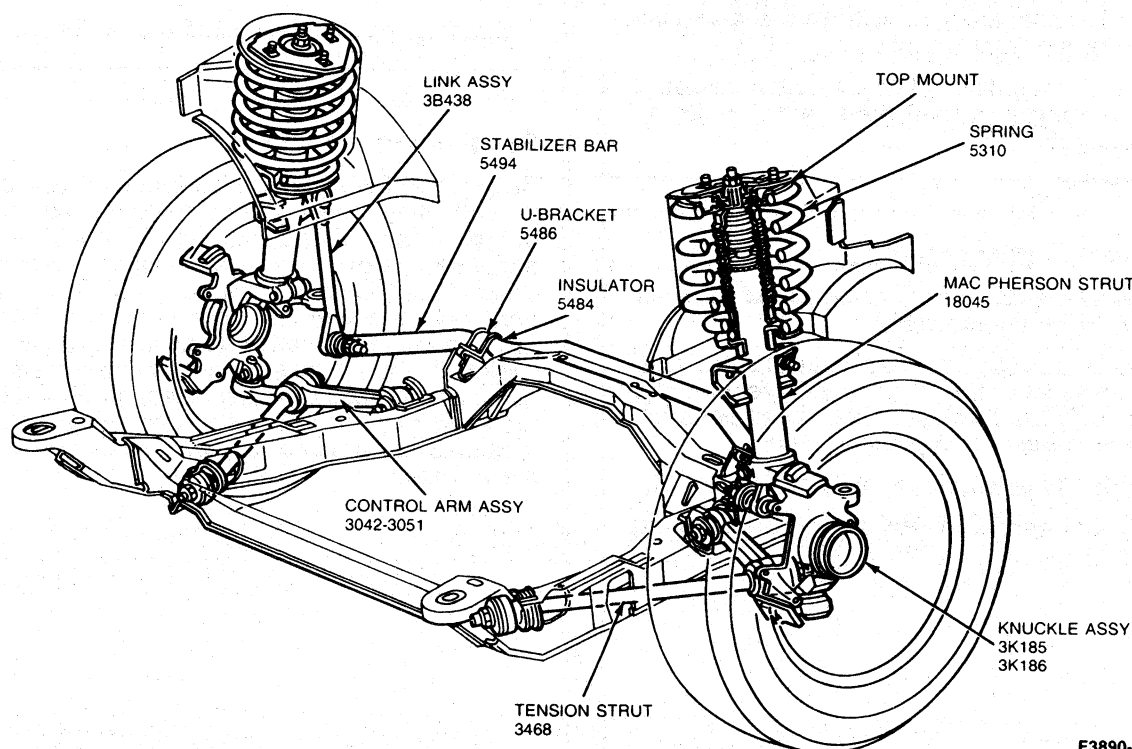
Taurus/Sable.

## DESCRIPTION

The front-wheel drive front suspension is a MacPherson gas filled strut design. The shock absorber strut assembly includes a rubber isolated top mount, seat and bearing assembly and coil spring insulator, and is attached at the top by three bolts which retain the top mount of the strut to the body side apron. The lower end of the assembly is inserted into a pinch joint designed into the knuckle. A forged lower arm assembly is attached to the sub-frame and steering knuckle. A tension strut connects to the lower arm and to the sub-frame. A

sealed cartridge bearing is pressed into the steering knuckle and retained with a snap ring. The front-wheel hub is pressed into the bearing. A halfshaft outboard CV joint spline is pressed through the hub and is retained by a prevailing torque nut.

**WARNING: ALL VEHICLES ARE EQUIPPED WITH GAS-PRESSURIZED SHOCK ABSORBERS WHICH WILL EXTEND UNASSISTED. DO NOT APPLY HEAT OR FLAME TO THE SHOCK STRUT DURING REMOVAL.**



F3890-A

**DESCRIPTION (Continued)****Components**

- **Strut Upper Mounts:** Isolate strut and spring from body.
- **Seat and Bearing Assembly:** Provides a bearing pivot point and retains suspension spring.
- **Coil Springs:** Allow proper setting of suspension ride heights and control suspension travel during driving/handling maneuvers.
- **Steering Knuckles:** Transmit steering input pivoting about the lower control arm ball joints and mount bearing, house driveline components which propel vehicle, and support brake caliper through pins.
- **Forged Lower Control Arms:** Control lateral (side-to-side) movement of each front wheel.
- **Ball Joints:** Connect steering knuckle to outer ends of forged lower control arms. They are pivot points for suspension travel and turning.
- **Tension Struts:** Control longitudinal (fore-and-aft) movement of wheels to reduce harshness when wheels hit sudden irregularities in road surface.
- **Stabilizer Bar:** Transmits forces to keep the vehicle level during cornering.
- **Stabilizer Bar Link Assembly:** Provides increased roll control by attaching the stabilizer bar to the shock strut.
- **Shock Absorber Struts:** Provide dynamic damping of suspension, limit downward movement of wheels by an internal rebound stop and upward movement with an external jounce bumper. Provide lateral, longitudinal and vertical support for the front wheels.

All suspension mounting points are rubber insulated to minimize transfer of road noise and vibration to body and interior.

- Coil springs may be replaced individually.
- Steering knuckles may be replaced individually.
- Wheel hubs may be replaced individually.
- Bearings and/or retaining rings may be replaced individually.
- Forged lower arm assemblies are replaceable with the ball joint, inner bushing and tension strut-to-arm insulator included in the assembly. The arm assemblies may be replaced individually.
- Ball joint seals are not replaceable.
- Ball joint is not replaceable.
- Tension strut insulators in the lower arm may be replaced individually.
- Lower arm inner pivot bushings may be replaced individually.
- Tension struts may be replaced individually.
- Tension strut-to-sub-frame insulators are replaceable individually.
- Tension strut washers at the sub-frame and lower control arm are replaceable with proper Ford approved hardened components.
- Stabilizer bar may be replaced.
- Stabilizer bar-to-body insulators may be replaced individually.
- Stabilizer bar brackets may be replaced individually.
- Stabilizer bar double ball joint links may be replaced individually.
- Stabilizer bar link ball joints are not replaceable.

**Component Replacement**

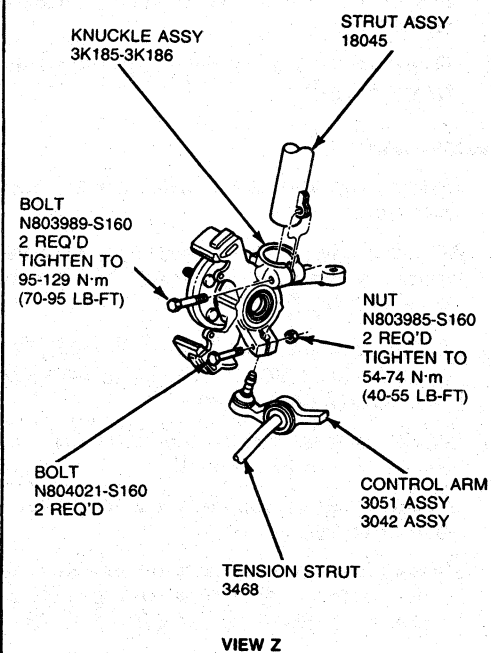
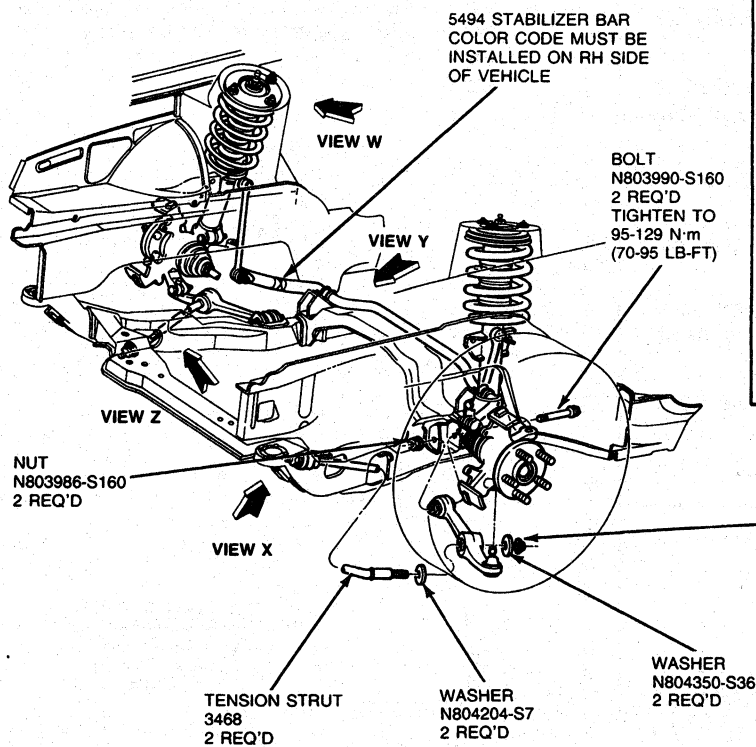
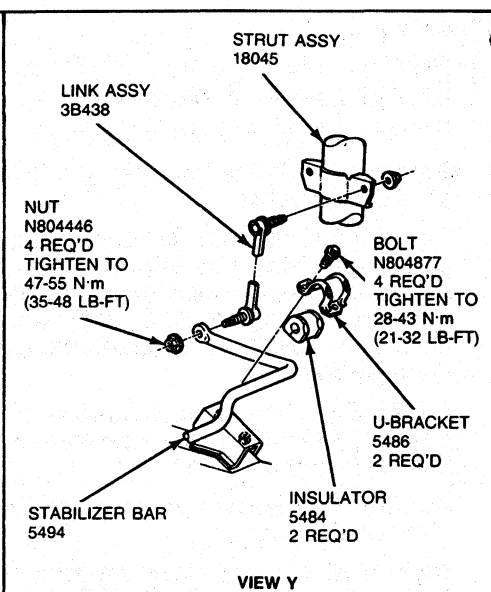
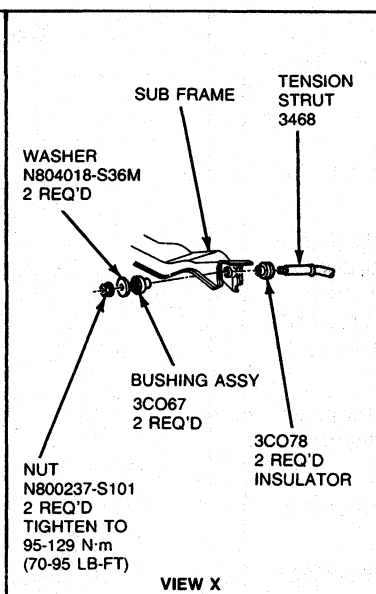
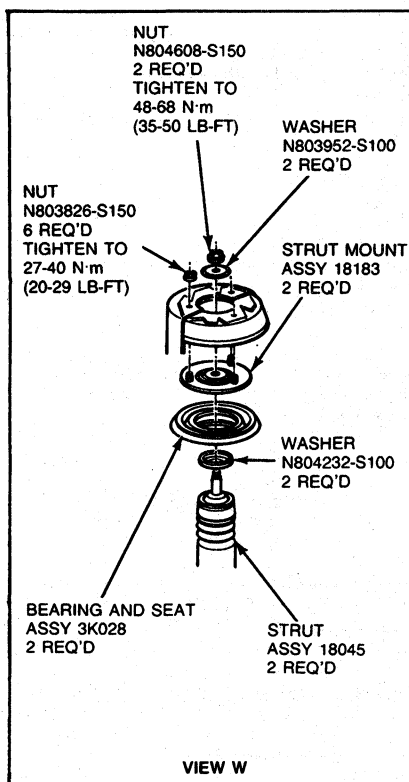
The following components may be replaced either individually or as an assembly:

- Gas filled shock absorber struts must be replaced as an assembly. The strut is not serviceable. Replace only the damaged shock absorber strut. It is not necessary to replace in pairs.
- Strut upper mounts may be replaced individually.
- Bearing and seat assemblies may be replaced individually.

**Suspension Fasteners**

Suspension fasteners are important attaching parts in that they could affect performance of vital components and systems, and/or could result in major service expense. They must be replaced with ones of the same part number or with an equivalent part if replacement becomes necessary. DO NOT use a replacement part of lesser quality or substitute design. Torque values must be as specified during assembly to ensure proper retention of parts. New fasteners must be used whenever old fasteners are loosened or removed and when new components are installed.

## DESCRIPTION (Continued)



## REMOVAL AND INSTALLATION

### Control Arm, Lower

#### Removal

1. Raise vehicle on a hoist. Refer to the Pre-Delivery manual, Section 50-04.
2. Remove wheel and tire assembly.
3. Remove and discard nut from tension strut. Pull off dished washer.
4. Remove and discard lower control arm ball joint pinch bolt. Using a screwdriver, slightly spread the knuckle pinch joint and separate control arm from steering knuckle. A drift punch may be used to remove bolt. Use extreme care to not damage bolt seal.

NOTE: Ensure steering column is in unlocked position. DO NOT use a hammer to separate ball joint from knuckle.

5. Remove and discard lower control arm inner pivot bolt and nut.

**CAUTION: Do not allow steering knuckle/halfshaft to move outward. Over extension of the tripod CV joint could result in separation of internal parts, causing failure of the joint.**

6. Remove lower control arm assembly from tension strut.

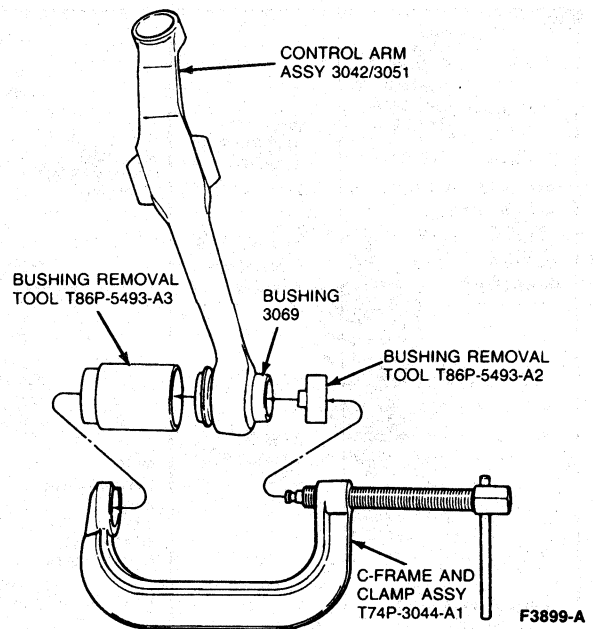
#### Installation

1. Insert tension strut into lower control arm bushing.
2. Position lower control arm to subframe bracket. Install a new nut and bolt. Tighten to 95-129 N·m (70-95 lb-ft).
3. Assemble lower control arm ball joint stud to steering knuckle, ensuring that ball stud groove is properly positioned.
4. Insert a new pinch bolt and nut. Tighten to 54-74 N·m (40-55 lb-ft).
5. Clean tension strut threads to remove dirt and contamination.
6. Install dished washer, dished away from lower arm bushing, and new nut on tension strut. Tighten to 95-129 N·m (70-95 lb-ft).
7. Install wheel and tire assembly. Tighten nuts to 109-142 N·m (80-105 lb-ft).
8. Lower vehicle.

### Inner Pivot Bushing

#### Removal

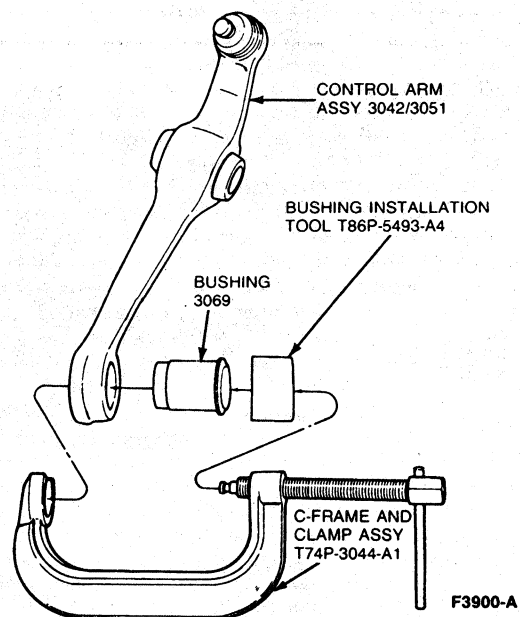
1. Refer to Control Arm, Lower Removal.
2. Using Bushing Removal Tools T86P-5493-A3, T86P-5493-A2 from Tool Set T86P-5493-A, and C-Frame and Clamp Assembly T74P-3044-A1 or equivalent, remove old bushing from control arm.



NOTE: C-Clamp must be held tight in a bench vise.

#### Installation

1. Using Bushing Installation Tool T86P-5493-A4 from Tool Set T86P-5493-A, and C-Frame and Clamp Assembly T74P-3044-A1 or equivalent, install new bushing in lower control arm by tightening C-Clamp slowly until it bottoms on arm.



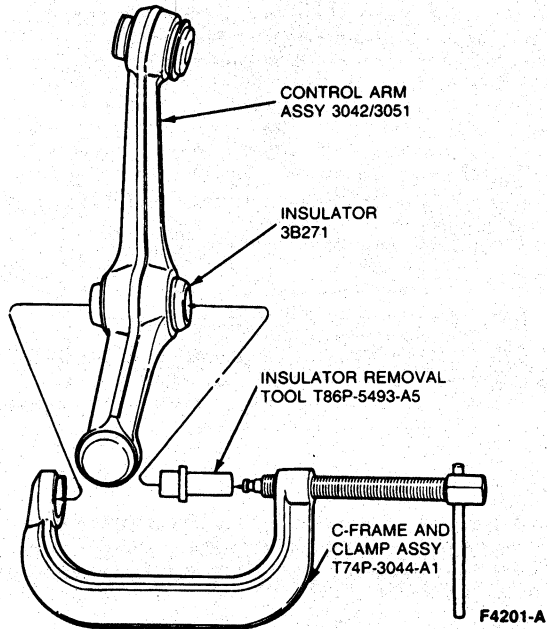
2. Refer to Control Arm, Lower Installation.



**REMOVAL AND INSTALLATION (Continued)****Lower Control Arm-to-Tension Strut Insulator****Removal**

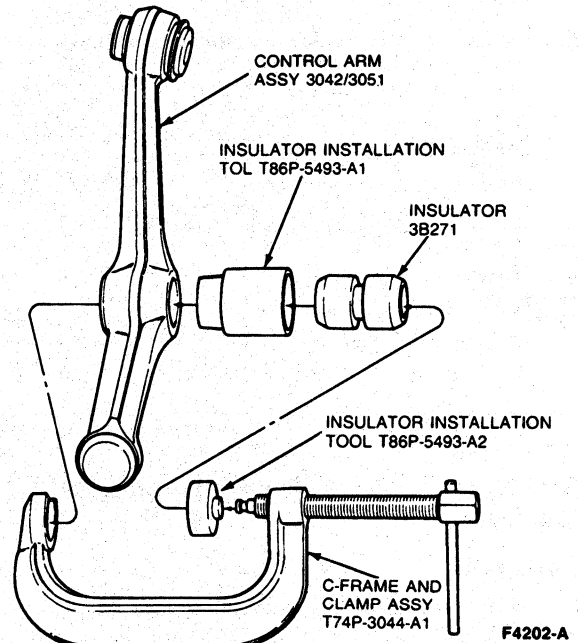
1. Refer to Control Arm, Lower Removal.
2. Using Insulator Removal Tool T86P-5493-A5 from Tool Set T86P-5493-A, and C-Frame and Clamp Assembly T74P-3044-A1 or equivalent remove old bushing from control arm.

NOTE: C-Clamp must be held tight in a bench vise.



NOTE: Saturate new bushing and lower arm with vegetable oil such as Mazola® or an equivalent oil. Use only vegetable oil. Any mineral- or petroleum-based oil or brake fluid will deteriorate the rubber bushing.

2. Refer to Control Arm, Lower Installation.

**Installation**

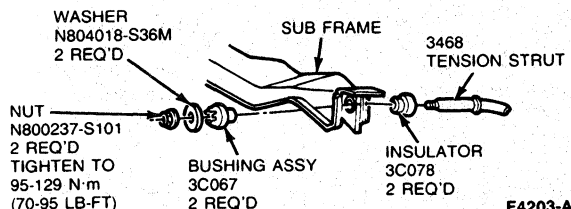
1. Using Insulator Installation Tools T86P-5493-A1, T86P-5493-A2 from Tool Set T86P-5493-A, and C-Frame and Clamp Assembly T74P-3044-A1 or equivalent install new insulator bushing in lower control arm by tightening the C-clamp very slowly until bushing pops into place.

**Tension Strut-to-Sub-Frame Insulators****Removal**

1. Refer to Control Arm, Lower Removal.
2. Remove and discard nut, washer and insulator from front of tension strut and pull strut rearward to remove from sub-frame.
3. Remove and discard insulator from tension strut.

**REMOVAL AND INSTALLATION (Continued)****Installation**

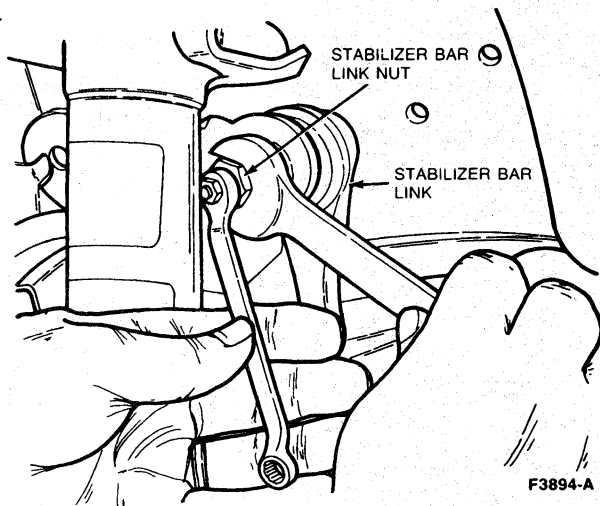
1. Install new insulator on tension strut end and insert into sub-frame.
2. Install new front insulator.
3. Clean tension strut threads to remove dirt and contamination.
4. Install new washer and new nut. Tighten to 95-129 N·m (70-95 lb-ft).
5. Refer to Control Arm, Lower Installation.



F4203-A

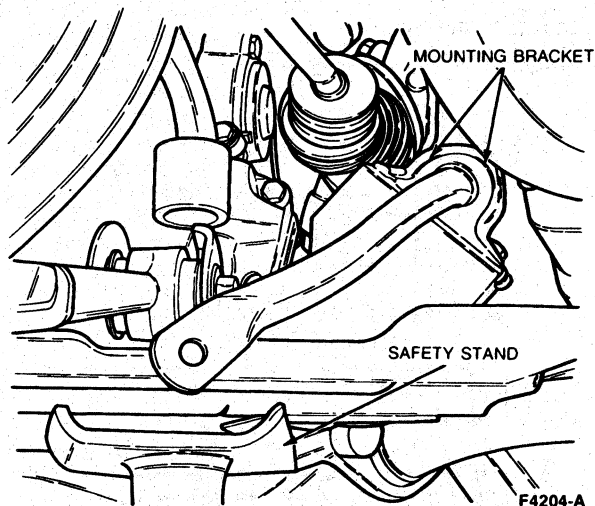
**Stabilizer Bar/Link Assembly and/or Insulators****Removal**

1. Raise vehicle on a hoist. Refer to the Pre-Delivery manual, Section 50-04.
2. Support vehicle with hoist or safety stands behind sub-frame.
3. Remove and discard nuts that attach link assembly to stabilizer bar and shock strut with a 8mm closed end wrench and 18mm open end wrench.



F3894-A

4. Remove nuts retaining steering gear to sub-frame, and move gear off the sub-frame.
5. With another set of support safety stands under sub-frame, remove two rear sub-frame mounting bolts. Lower rear of the sub-frame to obtain access to stabilizer bar mounting brackets.



F4204-A

6. Remove stabilizer bar U-bracket bolts and replace insulators, U-brackets and/or stabilizer bar as required. Discard insulators and bolts.

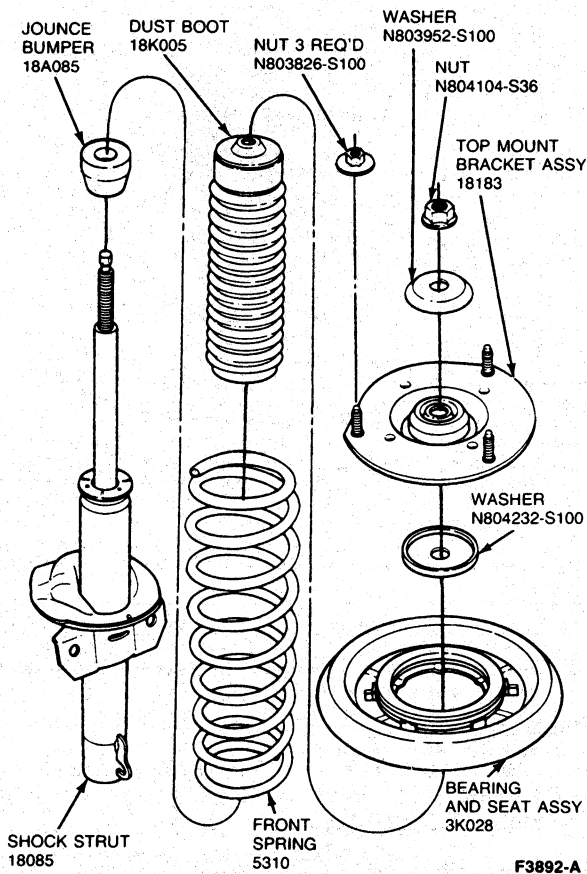
**Installation**

1. Clean stabilizer bar to remove dirt and contamination in area of stabilizer bar insulator installation position.
2. Lubricate inside diameter of new insulators with E25Y-19553-A or equivalent.
3. Install new insulators onto stabilizer bar and position them in approximate location.
4. Install U-brackets on insulators and install new bolts. Tighten to 28-43 N·m (21-32 lb-ft).
5. Raise sub-frame and install new sub-frame-to-body attaching bolts. Position steering gear onto sub-frame and install retaining nuts. Tighten to 115-135 N·m (85-100 lb-ft).
6. Install new nuts and secure link assembly to stabilizer bar and shock strut. Tighten to 47-65 N·m (35-48 lb-ft).
7. Remove safety stands.
8. Lower vehicle.

## REMOVAL AND INSTALLATION (Continued)

### Shock Absorber Strut, Spring, Bearing and Seat Assembly, and Upper Mount

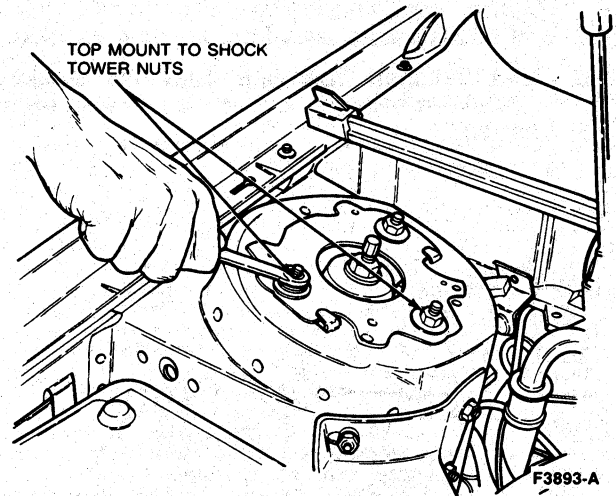
**CAUTION:** Never attempt to disassemble the spring or top mount without first compressing the spring using Coil Spring Compressor D85P-7178-A or equivalent.



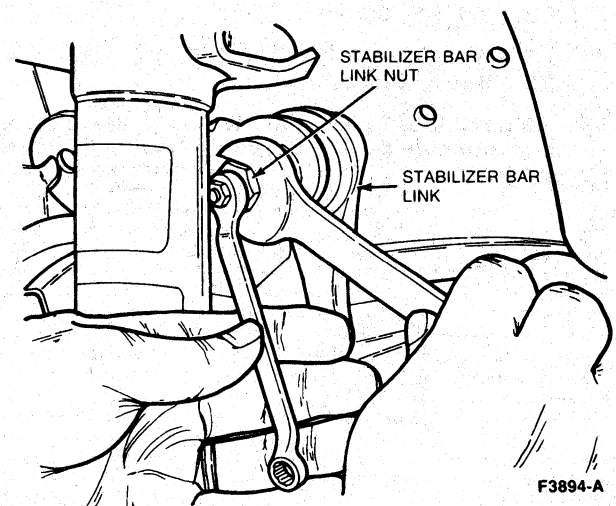
### Removal

1. Turn ignition to OFF position to place steering column in unlocked position.
2. Remove hub nut. Refer to Section 11-12.

3. Loosen but do not remove three top mount-to-shock tower nuts.

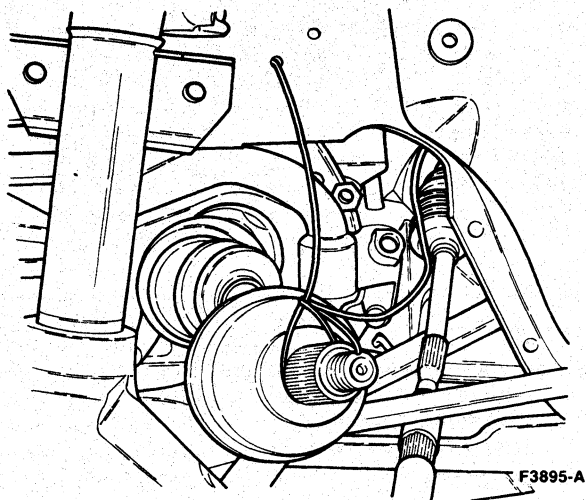


4. Raise vehicle on a hoist. Refer to the Pre-Delivery manual, Section 50-04. Remove tire and wheel assembly.  
NOTE: Do not raise vehicle by lower control arms.
5. Remove tire and wheel assembly.
6. Move brake caliper and wire out of the way. Refer to Section 12-20.
7. Remove brake rotor. Refer to Section 12-20.
8. Remove cotter pin from tie rod end stud and remove slotted nut. Discard cotter pin and nut.
9. Using Tie Rod End Remover TOOL 3290-C and Tie Rod Remover Adapter T81P-3504-W or equivalent, remove tie rod from knuckle.
10. Remove stabilizer bar link nut, and remove link from strut.



## REMOVAL AND INSTALLATION (Continued)

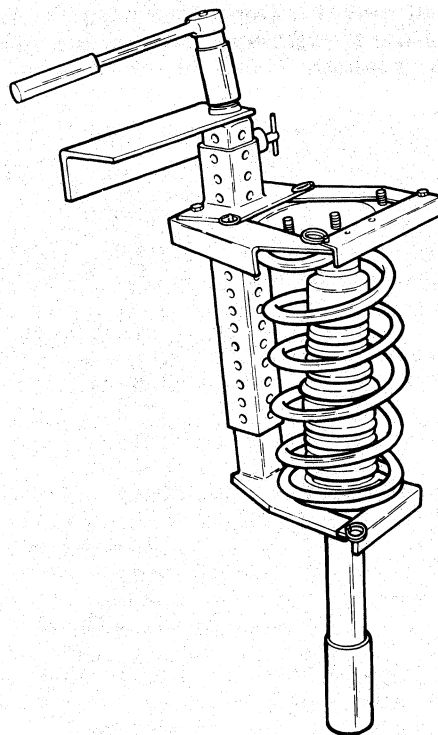
11. Remove and discard lower arm-to-steering knuckle pinch bolt and nut. (A drift punch may be used to remove bolt.) Using a screwdriver, slightly spread knuckle-to-lower arm pinch joint and remove lower arm from steering knuckle.
12. Press halfshaft from hub. Refer to Section 11-12. Wire halfshaft to body to maintain level position.



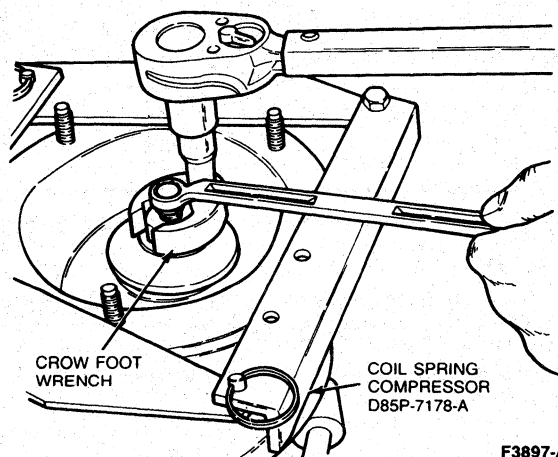
**CAUTION:** Do not allow the halfshaft to move outboard. Over extension of the tripod CV joint could result in separation of internal parts, causing failure of the joint.

13. Remove shock absorber strut-to-steering knuckle pinch bolt. Using a large screwdriver, slightly spread knuckle-to-strut pinch joint, if required, for removal.
14. Remove steering knuckle and hub assembly from shock absorber strut.
15. Remove three top mount-to-shock tower nuts and remove strut and spring assembly from vehicle.

16. Compress spring with Coil Spring Compressor D85P-7178-A or equivalent.



17. Place 10mm box wrench on top of shock strut shaft and hold while removing top shaft mounting nut with a 21mm 6-point crow foot wrench and ratchet.



**CAUTION:** It is important that the mounting nut be turned and rod held still to prevent fracture of the rod at the base of the hex.

18. Loosen spring compressor tool, then remove top mount bracket assembly, bearing plate assembly and spring.

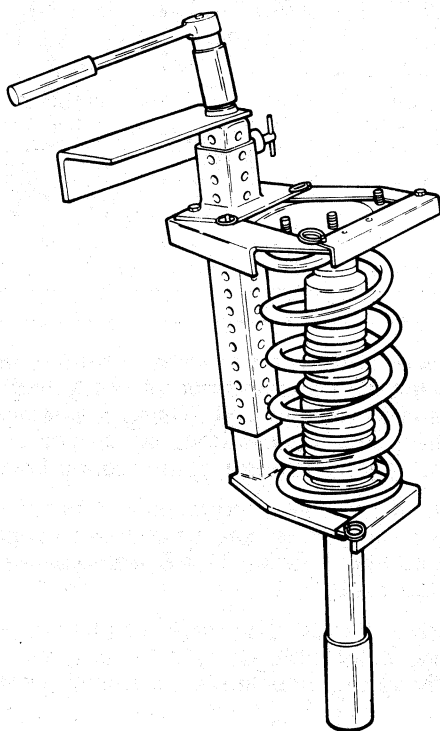
## REMOVAL AND INSTALLATION (Continued)

## Installation

**CAUTION:** Ensure that the correct assembly sequence and proper positioning of bearing and seat assembly are followed. The bearing and seat assembly is press-fit onto the upper mount. The mount washers must be installed with orientation.

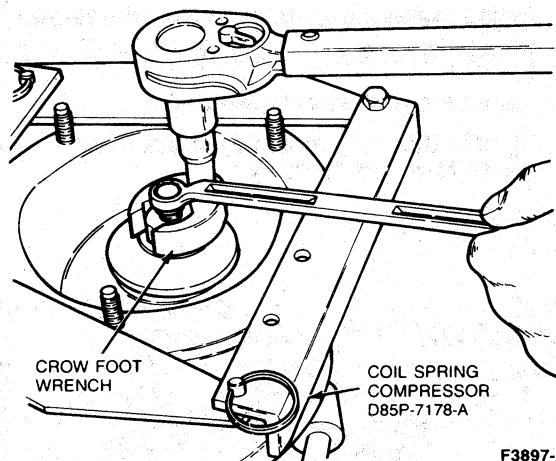
**NOTE:** When servicing, check the spring insulator for damage before assembly. If the outer metal splash shield is bent or damaged, it must be bent back carefully so that it does not touch the locator tabs on the bearing and seal assembly.

1. Install Spring Compressor D85P-7178-A or equivalent.
2. Install spring, bearing plate assembly, lower washer and top mount bracket assembly.
3. Compress spring with Coil Spring Compressor D85P-7178-A or equivalent.
4. Install upper washer and nut on the shock strut shaft.



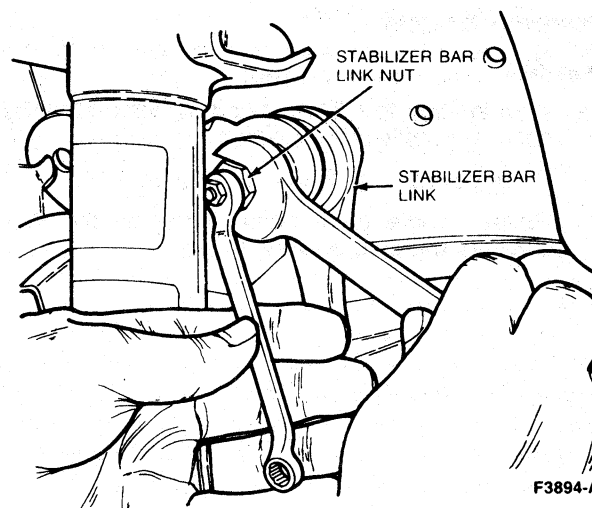
F3896-B

5. Place a 10mm box end wrench on top of shock strut shaft and hold while tightening top shaft mounting nut with a 21mm 6-point crow foot wrench and ratchet.



F3897-A

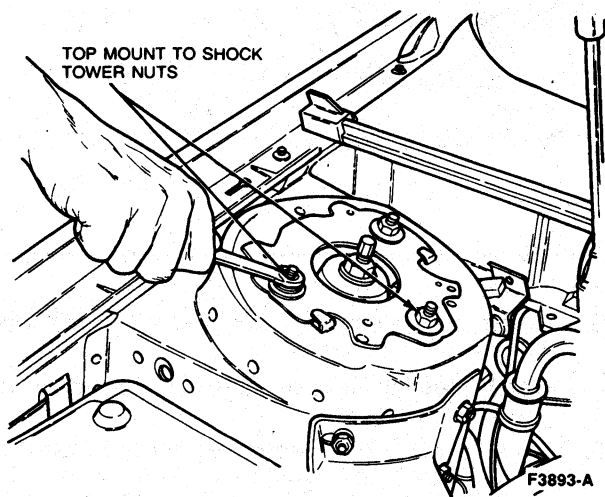
6. Install strut and spring assembly and three top mount-to-shock tower nuts.
7. Install steering knuckle and hub assembly to shock absorber strut.
8. Install a new shock absorber strut-to-steering knuckle pinch bolt. Tighten to 95-129 N·m (70-95 lb-ft).
9. Install halfshaft into hub. Refer to Section 11-12.
10. Install lower arm to steering knuckle and install a new pinch bolt and nut. Tighten to 54-74 N·m (40-55 lb-ft).
11. Install stabilizer bar link to strut and install a new stabilizer bar link nut. Tighten to 47-65 N·m (35-48 lb-ft).



F3894-A

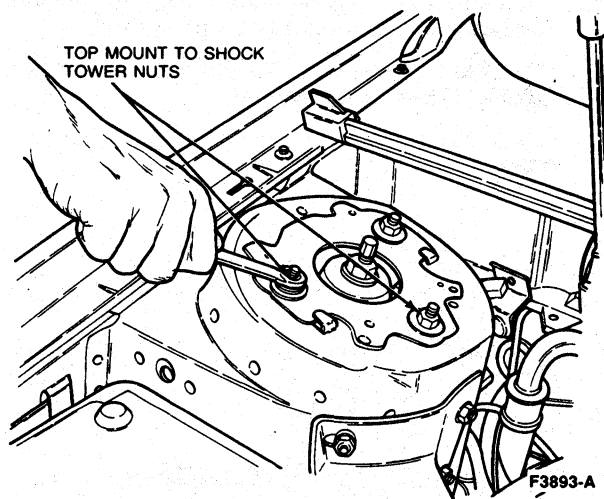
**REMOVAL AND INSTALLATION (Continued)**

12. Install tie rod end onto knuckle.
13. Install a new tie rod end slotted nut. Tighten to 31-47 N·m (23-35 lb-ft).
14. Install a new slotted nut retaining cotter pin.
15. Install brake rotor. Refer to Section 12-20.
16. Install brake caliper. Refer to Section 12-20.
17. Install tire and wheel assembly.
18. Tighten three top mount-to-shock tower nuts to 30-43 N·m (22-32 lb-ft).



19. Lower vehicle and tighten hub nut to 244-271 N·m (180-200 lb-ft).
20. Depress brake pedal several times prior to moving vehicle.

4. Remove tire and wheel assembly.
5. Remove cotter pin from the tie rod end stud and remove slotted nut. Discard cotter pin and nut.
6. Using Tie Rod End Remover TOOL-3290-C and Tie Rod Adapter T81P-3504-W or equivalent, remove tie rod end from knuckle.
7. Remove stabilizer bar link assembly from strut.
8. Remove brake caliper and wire in such a manner as to obtain working space. Remove brake rotor. Refer to Section 12-20.
9. Loosen but do not remove three top mounting nuts (top mount-to-shock tower).



10. Remove and discard lower arm-to-steering knuckle pinch bolt and nut. (A drift punch may be used to remove bolt.) Using a screwdriver, slightly spread knuckle-to-lower arm pinch joint and remove lower arm from steering knuckle.

**NOTE:** Ensure steering column is in unlocked position, and do not use a hammer to separate ball joint from knuckle. Use extreme care not to damage seal.

11. Remove shock absorber strut-to-steering knuckle pinch bolt. Using a large screwdriver, slightly spread knuckle-to-strut pinch joint.

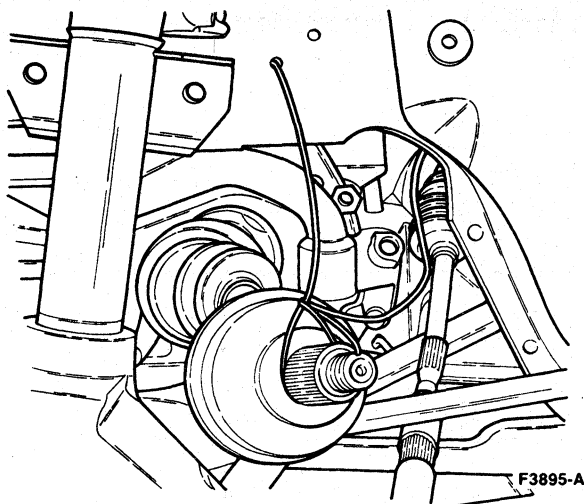
**Steering Knuckle****Removal**

1. Turn ignition to OFF position to place steering column in unlocked position.
2. Remove hub nut. Refer to Section 11-12.
3. Raise vehicle on a hoist. Refer to the Pre-Delivery manual, Section 50-04.

## REMOVAL AND INSTALLATION (Continued)

**CAUTION:** Do not allow the halfshaft to move outboard. Over extension of the tripod CV joint could result in separation of internal parts, causing failure of the joint.

12. Press halfshaft from hub. Refer to Section 11-12. Wire halfshaft to body to maintain a level position.

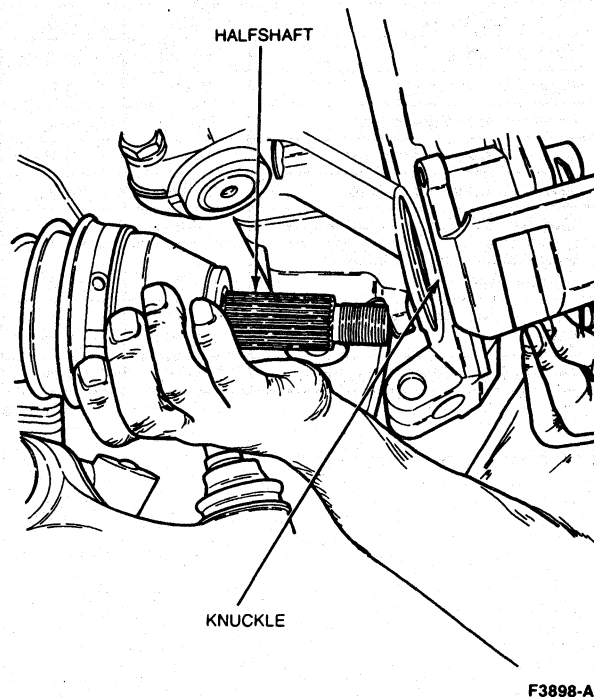


13. Remove rotor splash shield, if so equipped, from knuckle. Refer to Section 12-20.
14. Remove steering knuckle and hub assembly from the shock absorber strut.
15. Place assembly on a bench and remove the hub, retainer ring and bearing. Refer to Section 11-12.

**Installation**

1. Install rotor splash shield using new rivets and Heavy Duty Riveter D80L-23200-A or equivalent. Refer to Section 12-20.
2. Install bearing, retainer ring and hub. Refer to Section 11-12. Replace seal pressed on outboard CV joint, if required.
3. Install steering knuckle onto shock absorber strut and loosely install a new pinch bolt in knuckle to retain strut.

4. Install steering knuckle and hub on halfshaft.



5. Install lower control arm to knuckle, ensuring that ball stud groove is properly positioned. Install a new nut and bolt and tighten nut. Use extreme care not to damage boot seal. Tighten to 54-74 N·m (40-55 lb-ft). Tighten strut-to-knuckle pinch bolt to 95-129 N·m (70-95 lb-ft).
6. Install the rotor and brake caliper. Tighten caliper locking pins to 25-34 N·m (18-25 lb-ft). Refer to Section 12-20.
7. Position tie rod end into knuckle, install a new slotted nut and tighten. If necessary, advance nut to align slot and install a new cotter pin. Tighten to 31-47 N·m (23-35 lb-ft).
8. Install stabilizer bar link assembly to strut and install a new nut. Tighten to 47-65 N·m (35-48 lb-ft).
9. Install tire and wheel assembly.
10. Lower vehicle.
11. Install the three nuts retaining top mount to apron. Tighten to 30-43 N·m (22-32 lb-ft). Tighten hub nut to 244-271 N·m (180-200 lb-ft).
12. Pump brake pedal prior to moving vehicle to position brake linings.

## SPECIFICATIONS

## TORQUE SPECIFICATIONS

Description	N-m	Lb-Ft
Strut Top Mount to Body	30-43	22-32
Strut to Top Mount	48-68	35-50
Strut to Knuckle	95-129	70-95
Control Arm to Knuckle	54-74	40-55
Control Arm to Sub-Frame	95-129	70-95
Tension Strut to Control Arm	95-129	70-95
Tension Strut to Sub-Frame	95-129	70-95
Stabilizer Bar Bracket to Sub-Frame	28-43	21-32
Stabilizer Bar Link Assembly to Stabilizer Bar	47-65	35-48
Stabilizer Bar Link Assembly to Shock Strut	47-65	35-48
Tie Rod End to Steering Knuckle	31-47	23-25

CF4205-B

## SPECIAL SERVICE TOOLS

Tool Number	Description
T74P-3044-A1	C-Frame and Clamp Assembly
D85P-7178-A	Coil Spring Compressor
Tool-3290-C	Tie Rod End Remover
T81P-3504-W	Tie Rod End Remover Adapter
T86P-5493-A	Control Arm Tension Strut Bushing and Inner Pivot Bushing Remover and Replacer — Tool Set
D80L-23200-A	Heavy Duty Riveter

CF4207-A



# SECTION 14-32 Suspension—Rear, Coil Springs—Sedan

SUBJECT	PAGE	SUBJECT	PAGE
DESCRIPTION AND OPERATION		REMOVAL AND INSTALLATION (Cont'd.)	
Component Replacement .....	14-32-2	Spindle .....	14-32-9
Components .....	14-32-2	Stabilizer Bar/Link/Insulators .....	14-32-9
REMOVAL AND INSTALLATION		Tension Strut .....	14-32-8
Control Arm .....	14-32-8	SPECIAL SERVICE TOOLS .....	14-32-10
Shock Absorber Strut, Upper Mount and		SPECIFICATIONS .....	14-32-10
Spring .....	14-32-4	VEHICLE APPLICATION .....	14-32-1

## VEHICLE APPLICATION

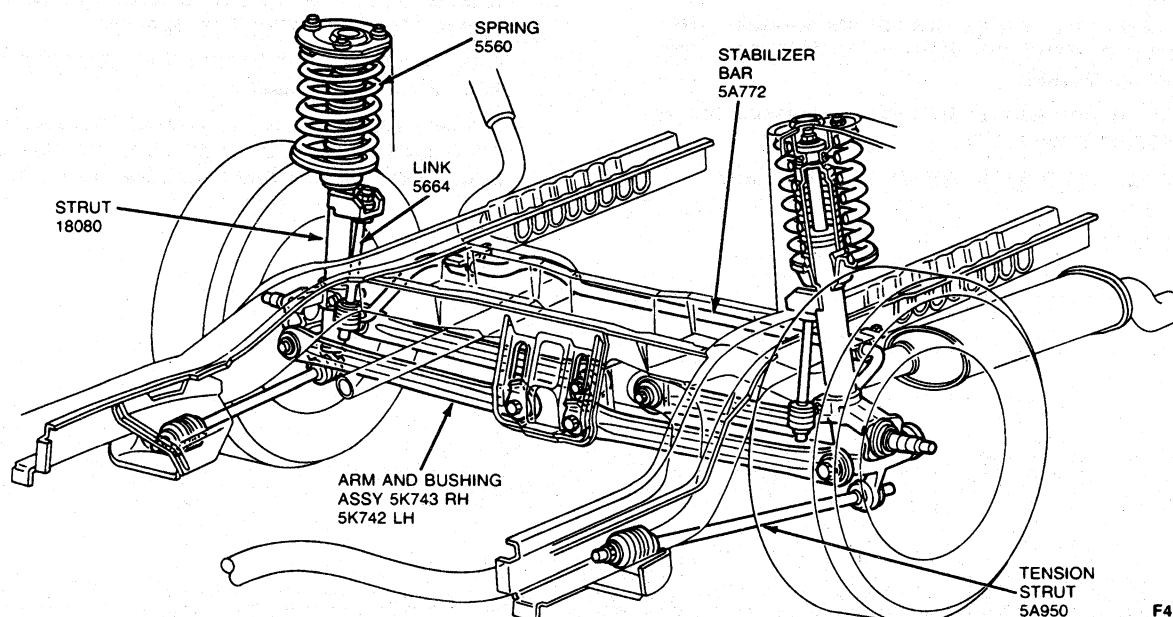
Taurus/Sable.

## DESCRIPTION AND OPERATION

These vehicles utilize a MacPherson strut independent rear suspension. Each side consists of an upper mount and washers, a shock absorber strut assembly, two parallel control arms per side, tension strut, cast spindle and shock strut mounted stabilizer bar.

The shock absorber strut assembly includes an upper washer, top mount, dust shield, jounce bumper, coil spring insulator, coil spring and spring

damper. Some vehicles are also equipped with a lower washer. The strut assembly is attached at the top by three studs, which retain the top mount of the strut to the inner body side panel. The lower end of the assembly is attached to the spindle with a pinch clamp and bolt that goes through a locator tab welded to the strut. The two stamped control arms attach to the underbody and spindle with nuts and bolts. A tension strut attaches to the underbody and to the cast spindle.



F4349-A

**DESCRIPTION AND OPERATION (Continued)****Components**

- **Stamped Control Arms:** Two per side, control lateral (side-to-side) movement of each wheel.
- **Toe Adjustment Cam:** Adjusts length of rear control arms for setting rear wheel toe-in alignment.
- **Tension Strut:** Controls fore-and-aft wheel movement.
- **Coil Spring:** Controls suspension travel and provides ride height control.
- **Shock Absorber Strut:** Reacts to braking forces, provides necessary suspension damping, and also provides rebound control through an internal rebound stop, and jounce control through an integral jounce bumper.
- **Cast Spindle:** This two-piece cast spindle with pressed-in stem, supports the wheel and attaches the two control arms, tension strut, shock absorber strut, and brake assembly.
- **Stabilizer Bar:** Resists body roll to keep vehicle level during cornering.
- **Suspension Bushing and Insulator:** All suspension mounting points are rubber insulated to minimize transmission of road noise and vibrations to the passengers.
- **Suspension Fasteners:** These fasteners are important attaching parts that could affect the performance of vital components and systems and/or could result in major service expense. They must be replaced with fasteners of the same part number or with an equivalent part if replacement becomes necessary. **Do not** use a replacement part of lesser quality or substitute design. Torque values must be used as specified during assembly to ensure proper retention of these parts. New attaching fasteners must be used whenever the old attaching fasteners are loosened or removed and when new component parts are installed.

**Component Replacement**

On the MacPherson strut independent rear suspension, the following components may be replaced individually or as an assembly:

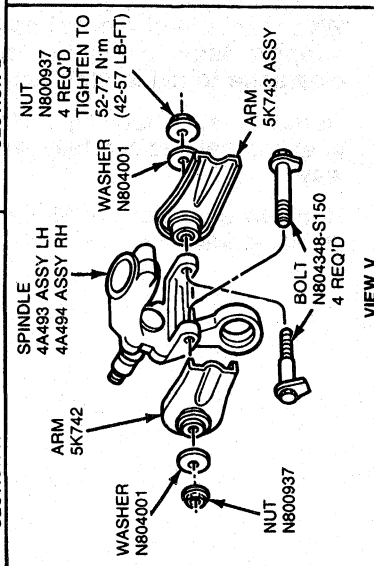
- The shock absorber strut upper mount may be replaced individually.
- The jounce bumpers may be replaced individually.
- The shock absorber strut is not serviceable as a cartridge and must be replaced as an assembly. (They do not need to be replaced in pairs).
- Control arm bushings are not serviceable. They must be replaced with a control arm and bushing assembly.
- Tension strut and tension strut bushings may be replaced individually.
- Coil springs may be replaced individually.

- The spindle stem is not serviceable and must be replaced with a spindle and stem assembly.
- All stabilizer bar components may be replaced individually.

**Inspection**

1. Check for evidence of fluid leaks on shock absorbers (A light film of fluid is permissible. Verify fluid is not from sources other than shock absorber).
2. Check shock absorber operation (whether operation is stiff, rough or spongy).
3. Check condition of control arm pivot bushings and tension strut bushings.

If the above checks reveal evidence of excessive wear, deterioration, or improper operation, replace damaged components.



## REMOVAL AND INSTALLATION

**Shock Absorber Strut, Upper Mount and Spring**

**WARNING: DO NOT ATTEMPT TO REMOVE THE SPRING FROM THE STRUT WITHOUT FIRST COMPRESSING THE SPRING WITH A TOOL DESIGNED FOR THAT PURPOSE.**

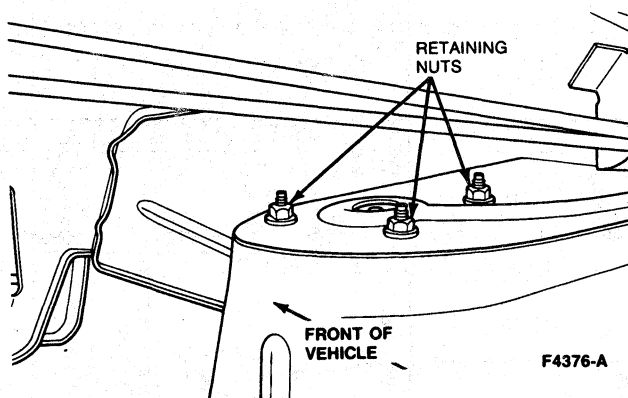
NOTE: Refer to Section 14-01, Diagnosis, before replacing strut for noise problem.

**Removal**

1. Raise hoist or jack only enough to contact body. Refer to Pre-Delivery manual, Section 50-04.

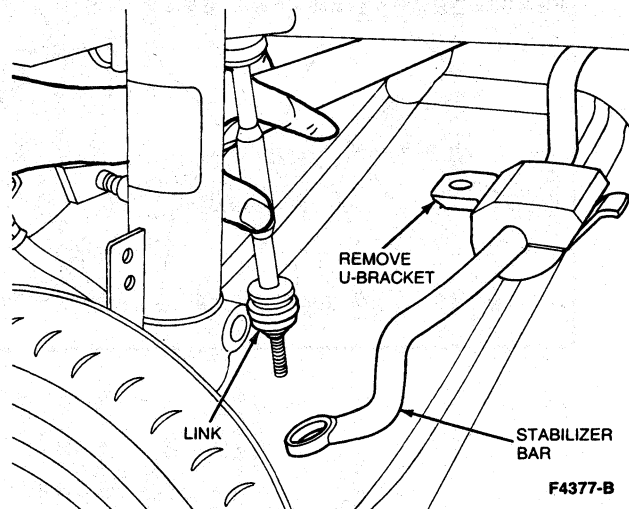
NOTE: Do not raise vehicle by tension strut.

2. Open luggage compartment lid and loosen, but do not remove, three nuts retaining the upper strut mount to body.



3. Raise vehicle. Remove wheel and tire.
4. Remove bolt retaining brake differential control valve to control arm.
5. Wire rear control arm to body to ensure proper support leaving about 152mm (6-inches) clearance to aid in strut removal.
6. Remove clip attaching brake hose to shock strut bracket and carefully move hose out of the way.
7. Remove stabilizer bar U-bracket from body, if so equipped.

8. Remove nut, washer and insulator attaching stabilizer bar to link and separate stabilizer bar from link, if so equipped.



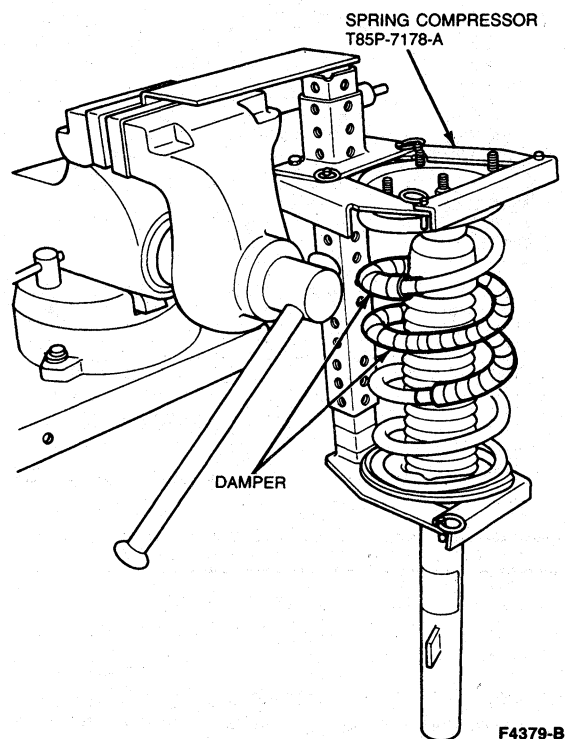
**CAUTION: Care should be taken when removing the shock strut that the rear brake flex hose is not stretched or the steel brake tube is not bent.**

9. Remove nut, washer and insulator, retaining tension strut to spindle. Move spindle rearward enough to separate it from the tension strut.
10. Remove and discard shock strut-to-spindle pinch bolt. Using a large screwdriver, slightly spread strut-to-spindle pinch joint, if required, for removal.
11. Lower jackstand and separate shock strut from spindle.
12. From inside of luggage compartment area, remove and discard three upper mount-to-body nuts. Care should be taken so the shock strut does not drop when removing the three upper nuts.
13. Remove strut from vehicle.
14. Remove nut, washer and insulator attaching link to shock strut and remove link.

## REMOVAL AND INSTALLATION (Continued)

15. Place strut, spring and upper mount assembly in spring compressor such as Universal MacPherson Strut Spring Compressor D85P-7178-A or equivalent.

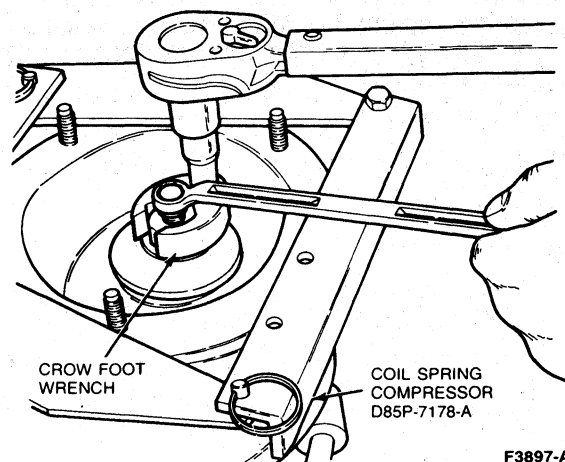
NOTE: Before compressing spring, mark location of insulator to top mount using a grease pencil.



**WARNING: DO NOT ATTEMPT TO REMOVE THE SPRING FROM THE STRUT WITHOUT FIRST COMPRESSING THE SPRING WITH A TOOL DESIGNED FOR THAT PURPOSE.**

**CAUTION: Do not attempt to remove strut rod nut by turning rod and holding nut. Nut must be turned and rod held stationary to avoid possible fracture of rod at base of hex.**

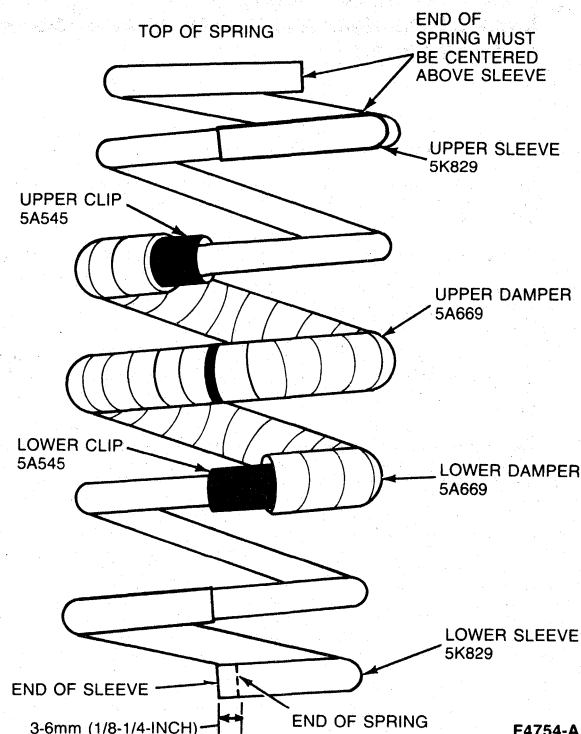
16. Place 10mm box wrench on top of shock strut shaft and hold while removing top shaft mounting nut with a 21mm 6-point crow's foot wrench and ratchet.



17. Loosen spring compressor tool, then remove top mount bracket assembly, spring insulator and spring.

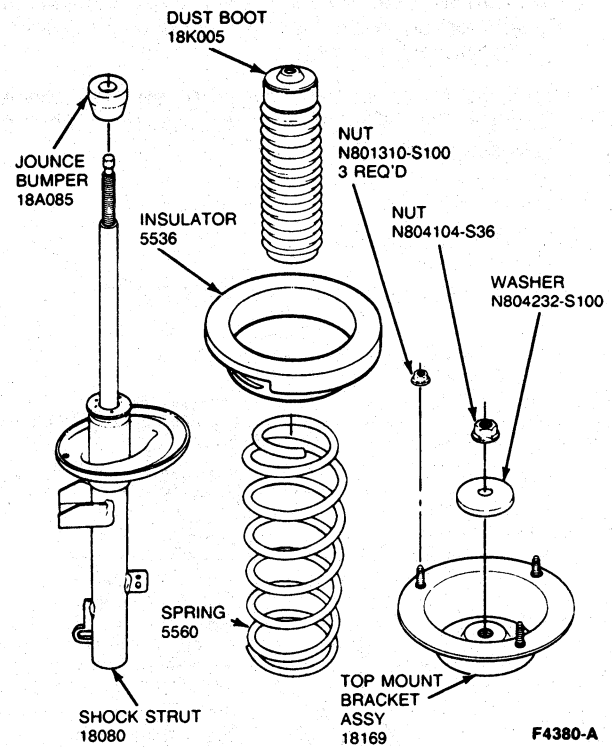
## Installation

1. Inspect spring to ensure dampers, sleeves and clips are properly positioned.

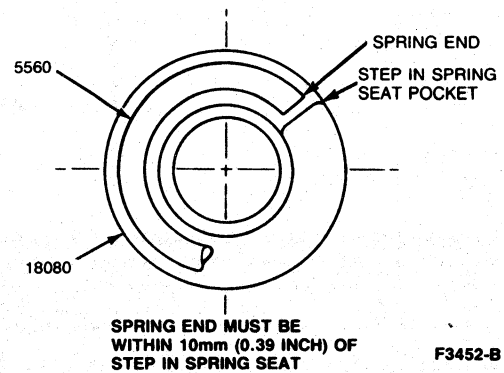


## REMOVAL AND INSTALLATION (Continued)

2. Using Universal MacPherson Strut Spring Compressor D85P-7178-A or equivalent, install spring, spring insulator, bottom washer, if equipped, top mount, upper washer and nut on strut shaft.

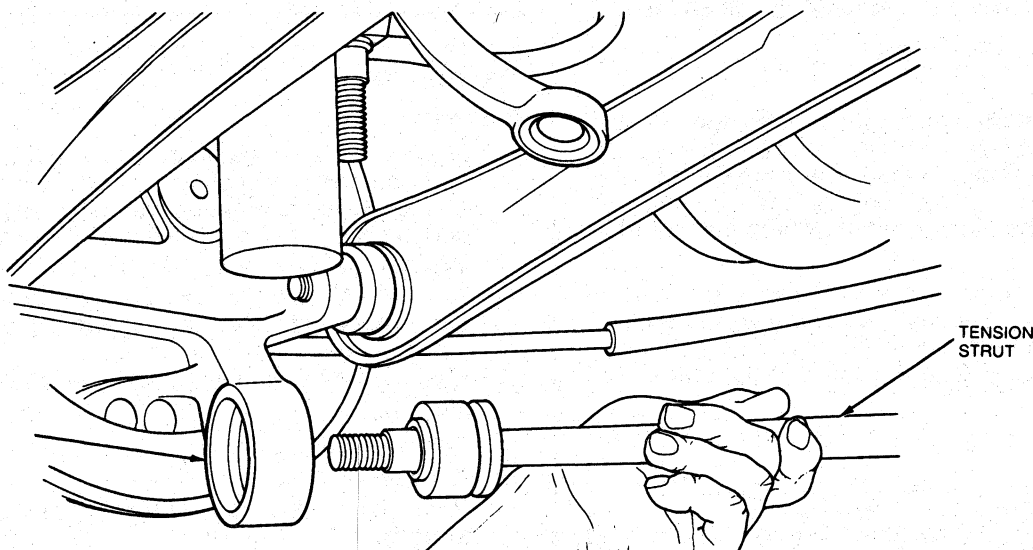


3. Ensure spring is properly located in upper and lower spring seats and that mount washers are oriented correctly.

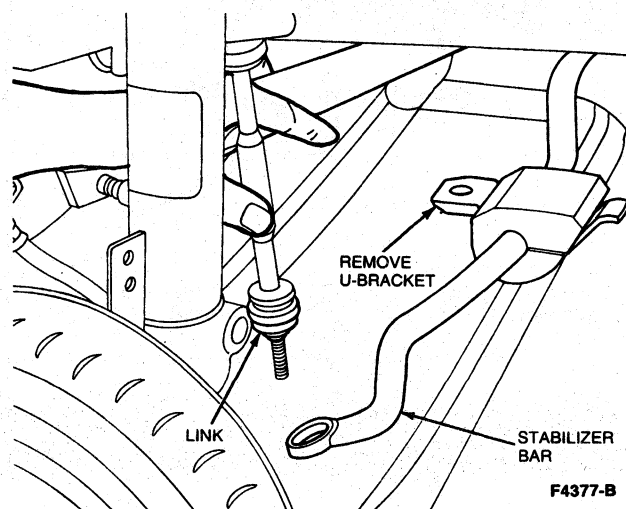


## REMOVAL AND INSTALLATION (Continued)

4. Tighten rod nut to 47-68 N·m (35-50 lb-ft). Use 10mm box wrench to **turn** the nut and 21mm crows foot wrench to **hold** shaft so it will not turn while tightening nut. Do not use pliers or vise-grips on strut rod as finished rod surface could be damaged.
5. Position stabilizer bar link in shock strut bracket. Install insulator, washer and nut. Tighten to 8-16 N·m (6-12 lb-ft).
6. Insert three upper mount studs into strut tower in apron and hand start three new nuts. **Do not** tighten at this time.
7. Partially raise vehicle.
8. Install shock strut into spindle pinch joint.
9. Install a new pinch bolt into spindle and through the shock strut bracket. Tighten to 70-110 N·m (52-81 lb-ft).
10. Move spindle rearward and install tension strut into spindle. Install insulator, washer and nut on tension strut. Tighten nut to 70-100 N·m (52-74 lb-ft).



11. Position link into stabilizer bar. Install insulator, washer and nut on link. Tighten to 8-16 N·m (6-12 lb-ft).
12. Position stabilizer bar U-bracket on body. Install bolt. Tighten to 34-50 N·m (26-30 lb-ft).
13. Install brake hose to shock strut bracket.
14. Install brake control differential valve on control arm and remove retaining wire.
15. Tighten two top mount-to-body nuts to 26-35 N·m (19-26 lb-ft).
16. Install wheel and tire assembly and lower vehicle.



## REMOVAL AND INSTALLATION (Continued)

## Control Arm

## Removal

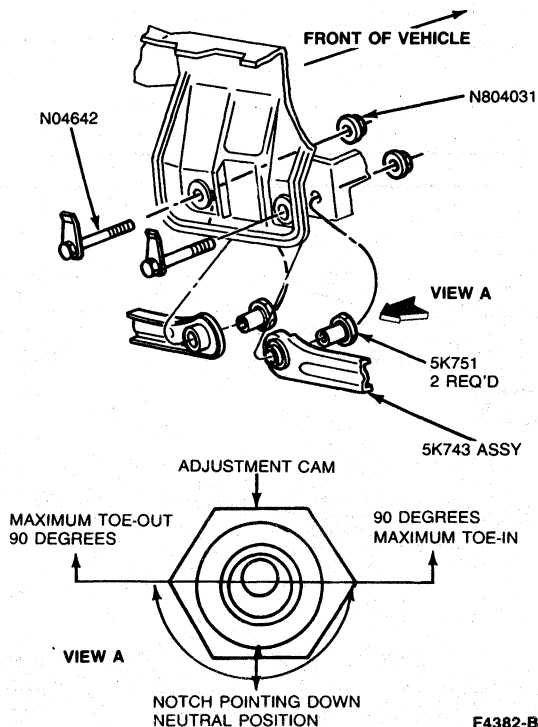
NOTE: Do not raise vehicle by tension strut.

1. Raise vehicle on a hoist. Refer to Pre-Delivery manual, Section 50-04.
2. Disconnect brake proportioning valve from left side front arm. Refer to Section 12-01.
3. Disconnect parking brake cable from front arms. Refer to Section 12-70.
4. Remove and discard arm-to-spindle bolt, washer and nut.
5. Remove and discard arm-to-body bolt and nut.
6. Remove arm from vehicle.

## Installation

NOTE: When installing new control arms, the offset on all arms must face up. (The arms are stamped "bottom" on the lower edge.) The flange edge of the right side rear arm stamping must face the front of the vehicle. The other three must face the rear of the vehicle.

NOTE: The rear control arms have two adjustment cams that fit inside the bushings at the arm-to-body attachment. The cam is installed from the rear on the left arm and from the front on the right arm.



1. Position arm, and cam where required, at center of vehicle. Insert new bolt and nut. **Do not** tighten at this time.

2. Move arm end up to spindle and insert new bolt, washer and nut. Tighten nut to 57-77 N·m (42-57 lb-ft).
3. Tighten arm-to-body nut to 62-88 N·m (45-55 lb-ft).
4. Attach parking brake cable to front arms. Refer to Section 12-70.
5. Attach brake proportioning valve to left side front arm. Refer to Section 12-01.
6. Lower vehicle.
7. After control arm replacement, the alignment should be checked for rear toe and reset if required.

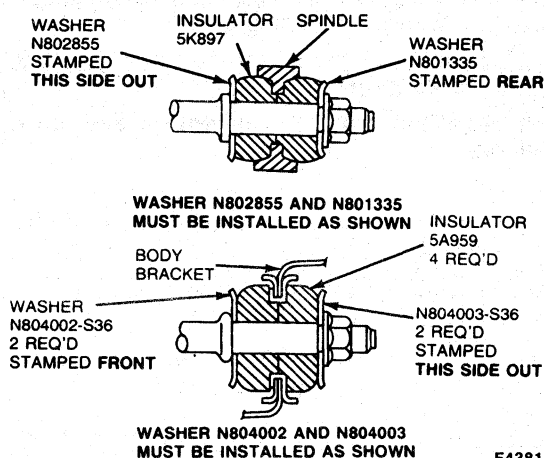
## Tension Strut

## Removal

1. Raise vehicle on frame contact hoist using lift pads located to rear of front wheels and forward of rear wheels. Raise hoist only enough to contact body. Refer to the Pre-Delivery manual, Section 50-04.
2. From inside trunk, loosen, but **do not** remove, three nuts retaining the upper shock strut mount to body.
3. Raise vehicle and remove wheel and tire assembly.
4. Remove and discard nut retaining tension strut to spindle.
5. Remove and discard nut retaining tension strut to body.
6. Move spindle rearward enough so tension strut can be removed.

## Installation

1. Place new washers and bushings on both ends of new tension strut. Bushings at front and rear of tension strut are different. The rear bushings have indentations in them.
2. Insert one end into body bracket and install a new bushing, washer and nut. **Do not** tighten at this time.





**REMOVAL AND INSTALLATION (Continued)**

3. Pull back on spindle enough so tension strut end can be installed in spindle.
4. Install new bushing, washer and nut. Refer to illustration under Installation, Step 2. Verify that bushings are correctly piloted into the spindle. Tighten nut to 70-100 N·m (52-74 lb-ft).
5. Verify that bushings are correctly piloted into the body bracket. Tighten nut to 70-100 N·m (52-74 lb-ft).
6. Support spindle with jackstand. Remove three strut-to-body mount nuts. Install three new strut-to-body mount nuts. Tighten to 26-35 N·m (19-26 lb-ft).
7. Remove jackstand.
8. Install tire and wheel assembly.
9. Lower vehicle.

4. Install new control arm to spindle bolts, washers and nuts.
5. Install a jackstand to support suspension at normal curb height before tightening fasteners.
6. Tighten spindle-to-strut bolt to 70-110 N·m (52-81 lb-ft).
7. Tighten tension strut nut to 70-100 N·m (52-74 lb-ft).
8. Tighten control arm to spindle nuts to 57-77 N·m (42-57 lb-ft).
9. Install brake backing plate. Refer to Section 12-02.
10. Install brake flex line clip onto shock strut.
11. Install brake drum. Refer to Section 12-02.
12. Install wheel and tire assembly.
13. Lower vehicle.

**Spindle****Removal**

NOTE: Do not raise vehicle by tension strut.

1. Raise vehicle on a hoist. Refer to Pre-Delivery manual, Section 50-04.
2. Remove tire and wheel assembly.
3. Remove brake drum. Refer to Section 12-02.
4. Remove clip retaining brake flex hose to shock strut bracket.
5. Remove four bolts retaining brake backing plate to the spindle. Refer to Section 12-02.

NOTE: Care should be taken to ensure that brake flex hose is not stretched and brake tube is not bent.

6. Remove brake backing plate from spindle and wire it out of the way.
7. Remove and discard control arm to spindle bolts, washers and nuts.
8. Remove tension strut nut, washer and bushing. Discard nut.
9. Remove and discard pinch bolt retaining spindle to shock strut and remove spindle from vehicle.

**Installation**

1. Position spindle onto tension strut and then onto shock strut.
2. Insert a new strut-to-spindle pinch bolt. **Do not** tighten at this time.
3. Install tension strut bushing, washer and new nut. **Do not** tighten at this time.

**Stabilizer Bar/Link/Insulators****Removal**

NOTE: Do not raise vehicle by tension strut.

1. Raise vehicle on a hoist. Refer to Pre-Delivery manual, Section 50-04.
2. Remove nuts, washers and insulators attaching stabilizer bar to right side and left side links. Discard nuts.
3. Remove and discard bolts attaching U-brackets and stabilizer bar to body and remove stabilizer bar.
4. Inspect U-bracket insulators and replace if damaged or worn.
5. Remove nut, washer and insulator retaining link to shock strut bracket. Discard nut.
6. Check link insulators and replace if damaged or worn.

**Installation**

1. Position link into shock strut bracket and install the insulator, washer and a new nut. Tighten to 8-16 N·m (6-12 lb-ft).
2. Position stabilizer bar, U-brackets and insulators on body. Install new bolt. Tighten to 34-50 N·m (25-39 lb-ft).
3. Position stabilizer bar onto links. Install insulators, washers and new nuts. Tighten to 8-16 N·m (6-12 lb-ft).
4. Lower vehicle.

## SPECIFICATIONS

## TORQUE SPECIFICATIONS

Description	N·m	Lb·Ft
Strut top mount to body	26-35	19-26
Strut to top mount	47-68	35-50
Strut to spindle	75-110	55-81
Control arm to spindle	57-77	42-57
Control arm to body	62-88	45-65
Tension Strut to spindle	70-100	52-74
Tension Strut to body	70-100	52-74
Stabilizer bar link to strut	8-16	6-12
Stabilizer bar link to stabilizer bar	8-16	6-12
Stabilizer U-bracket to body	34-50	25-37

CF4383-B

## REAR WHEEL ALIGNMENT (CURB HEIGHT WITH 1/2 TANK OF FUEL)

Vehicle	Alignment Factors	Units	Nominals	Minimum	Maximum
Taurus/Sable Sedan (rear alignment)	Camber① (Taurus)	Decimal	- 0.94	- 1.64	- 0.24
		Fractional	- 15/16	- 1-5/8	- 1/4
		Minutes	- 0 56'	- 1 38'	- 0 15'
	Camber① (Sable)	Decimal	- 0.88	- 1.58	- 0.18
		Fractional	- 7/8	- 1-9/16	- 3/16
		Minutes	- 0 53'	- 1 35'	- 0 11'
	Camber difference① side-to-side (left minus right)	Decimal	0	- 1.20	+ 1.20
		Fractional	0	- 1-7/32	+ 1-7/32
		Minutes	0	- 1 12'	+ 1 12'
	Toe (individual sides)	Decimal inches	+ 0.031"	- 0.031"	+ 0.094"
		Fractional inches	+ 1/32"	- 1/32"	+ 3/32"
		Millimeters	+ 0.79mm	- 0.79mm	+ 2.38mm
		Decimal degrees	+ 0.062	- 0.062	+ 0.188
	Total toe (left plus right)	Decimal inches	+ 0.062"	- 0.062"	+ 0.188"
		Fractional inches	+ 1/16"	- 1/16"	+ 3/16"
		Millimeters	+ 1.59mm	- 1.59mm	+ 4.76mm
		Decimal degrees	+ 0.125	- 0.125	+ 0.375

① Camber is factory set and cannot be adjusted.

CF4707-A

## SPECIAL SERVICE TOOLS

Tool Number	Description
D85P-7178-A	Spring Compressor

CF4385-A

# SECTION 14-35 Suspension—Rear, Coil Springs—Station Wagon

SUBJECT	PAGE	SUBJECT	PAGE
<b>ADJUSTMENTS AND CHECKS</b>		<b>REMOVAL AND INSTALLATION (Cont'd.)</b>	
Toe .....	14-35-16	Springs .....	14-35-12
Toe Connection, Rear .....	14-35-16	Stabilizer Bar, Insulators and Link Assembly .....	14-35-6
Wheel Toe—Individual .....	14-35-19	Suspension Arm, Lower .....	14-35-9
<b>DESCRIPTION</b>		Suspension Arms, Upper .....	14-35-8
Component Replacement .....	14-35-2	Tension Strut .....	14-35-10
Components .....	14-35-2	<b>SPECIFICATIONS</b> .....	14-35-19
<b>REMOVAL AND INSTALLATION</b>		<b>VEHICLE APPLICATION</b> .....	14-35-1
Shock Absorber .....	14-35-4		
Spindle .....	14-35-11		

## VEHICLE APPLICATION

Taurus/Sable.

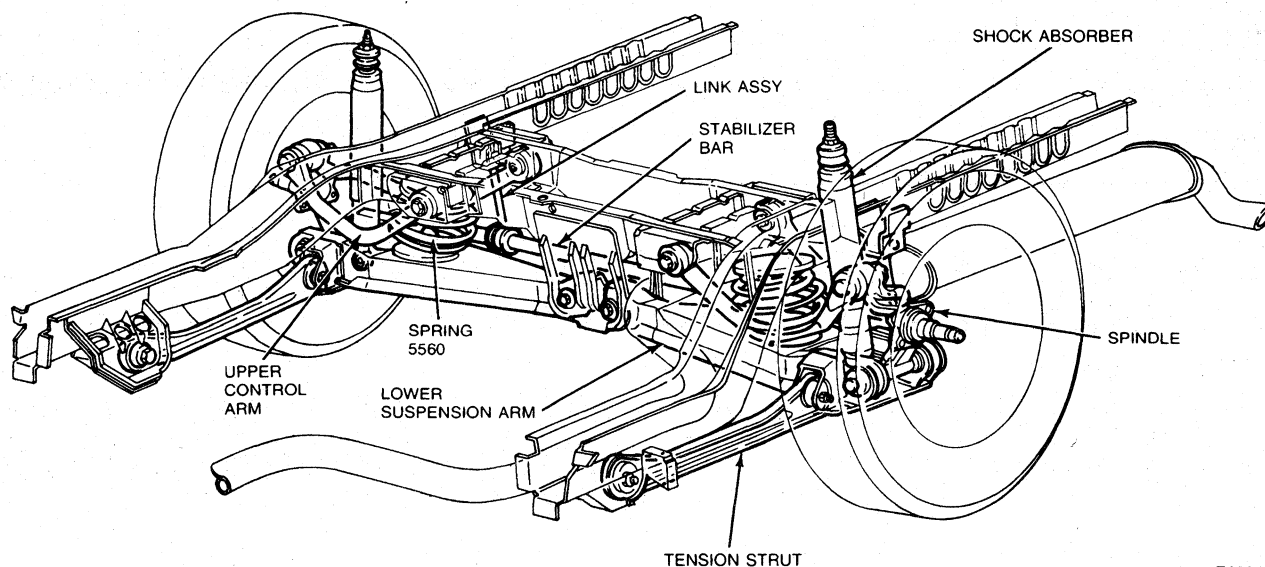
## DESCRIPTION

The suspension used on the station wagons consists of five major components: the upper and lower control arms, shock absorber, two piece cast spindle tension strut and a coil spring mounted between the lower suspension arm and the body crossmember.

The shock absorber assembly is attached to the body side panel by a rubber insulated top mount assembly and nut and to the lower suspension arm by two studs pressed into a bar-pin mounted in a

rubber bushing. The upper suspension arms are attached to the spindle and the crossmember. The lower suspension arm attaches to the underbody and spindle. A coil spring is located between the lower suspension arm and body crossmember inboard of the shock absorber. A tension strut attaches to the underbody and the lower suspension arm.

**NOTE:** Never attempt to heat, quench, or straighten any rear suspension part. Replace with a new part.



F4231-A

**DESCRIPTION (Continued)****Components**

- **Upper control arms:** Control lateral (side-to-side) movement of each wheel.
- **Stamped Lower Arm:** Controls the lateral (side-to-side) movement of each wheel and contains the lower spring seat and holds the rear suspension toe setting cam.
- **Tension Strut:** Controls fore-and-aft wheel movement.
- **Coil Spring:** Controls suspension travel, and provides ride height control.
- **Shock Absorber:** Provides necessary suspension damping. It also provides rebound control through an internal rebound stop.
- **Cast Spindle:** Supports the wheel and attaches the lower and upper arms, shock absorber and brake assembly.
- **Stabilizer Bar/Link Assembly:** Controls body lean during cornering.
- **Suspension Bushings and Insulators (Rubber):** Minimize transmission of road noise and vibration to the passengers.
- **Suspension Fasteners:** These fasteners are important attaching parts that could affect the performance of vital components and system and/or could result in major service expense. They must be replaced with ones of the same part number or with an equivalent part if replacement becomes necessary. **DO NOT** use a replacement part of lesser quality or substitute design. Torque value must be used as specified during assembly to ensure proper part retention. New attaching fasteners must also be used whenever the old attaching fasteners are loosened or removed and when new components are installed.

**Component Replacement**

- The shock absorber upper mounting is serviceable.
- The shock absorber is serviceable and must be replaced as an assembly. It is not necessary to replace them in pairs.
- Upper and lower suspension arms are serviced as an assembly. The bushings are not serviced.
- Tension strut bushings are not serviced. They must be replaced with a tension strut and bushing assembly.
- Stabilizer bar, U-brackets and insulators are serviceable. The link is serviced as an assembly.
- Coil springs are serviceable.

## INSTRUCTION SHEET

This procedure applies to any 1986 and 1987 Taurus/Sable Station Wagon vehicle which exhibits excessive wear on the inboard edges of the rear tires and is out of specification for rear toe and/or camber. Out of specification toe setting is the major alignment contributor to inboard edge rear tire wear. Out of specification camber can also accelerate tire wear when combined with out of specification toe. The procedure listed below pertains to both toe and camber corrections. The released alignment specifications are as follows:

Toe-in:  $+0.18^{\circ}/-0.06^{\circ}$  per wheel

Camber:  $-1.9^{\circ}/+0.1^{\circ}$

Maximum side-to-side camber difference:  $1.2^{\circ}$

1. Inspect the rear suspension for signs of damage and replace any damaged components before continuing with this procedure.
2. Measure and record vehicle rear wheel alignment settings as received for LH camber, RH camber, LH toe, and RH toe.
  - If the vehicle is in specification for camber but out of specification for toe, reset toe to the nominal specification of  $+0.06^{\circ}$  toe-in for each individual wheel.
  - If both camber and toe are within specification, reset toe to the nominal specification of  $+0.06^{\circ}$  toe-in for each individual wheel.
  - If the vehicle is out of specification for camber on either side, proceed with step 3.
3. Raise the vehicle using a frame hoist by supporting the rear of the vehicle forward of the rear suspension tension strut, and allow the suspension to hang in rebound.
4. Remove stabilizer bar U-brackets from outboard ends of lower arms.
5. Remove parking brake cable attaching bracket from crossmember center bracket.
6. Place a floor jack with a block of wood under the lower arm stamping midway between the lower arm inner pivot bushing and the lower arm coil spring.
7. Remove and discard the lower arm inner pivot attachment nut.
8. Using the floor jack, preload the under side of the lower arm, and remove and discard the lower arm inner pivot bolt.
9. Using the floor jack, slowly lower the lower arm out of the crossmember pocket until the coil spring is completely relaxed. A pry bar will be required to guide the lower arm toward the outboard direction to clear the crossmember stamping as the arm is being lowered.
10. Using  $1/2''$  diameter tapered rotary file, elongate both the forward and rearward lower arm crossmember holes to the following dimensions:
  - If the camber measurement from step No. 2 was out of specification in the negative direction, elongate the hole horizontally on the inboard side until the overall slot length measures 24mm (0.94").
  - If the camber measurement from step No. 2 was out of specification in the positive direction, elongate the hole horizontally on the outboard side until the overall slot length measures 16mm (0.63").
11. Using the floor jack, raise the lower arm back up into the crossmember pocket.



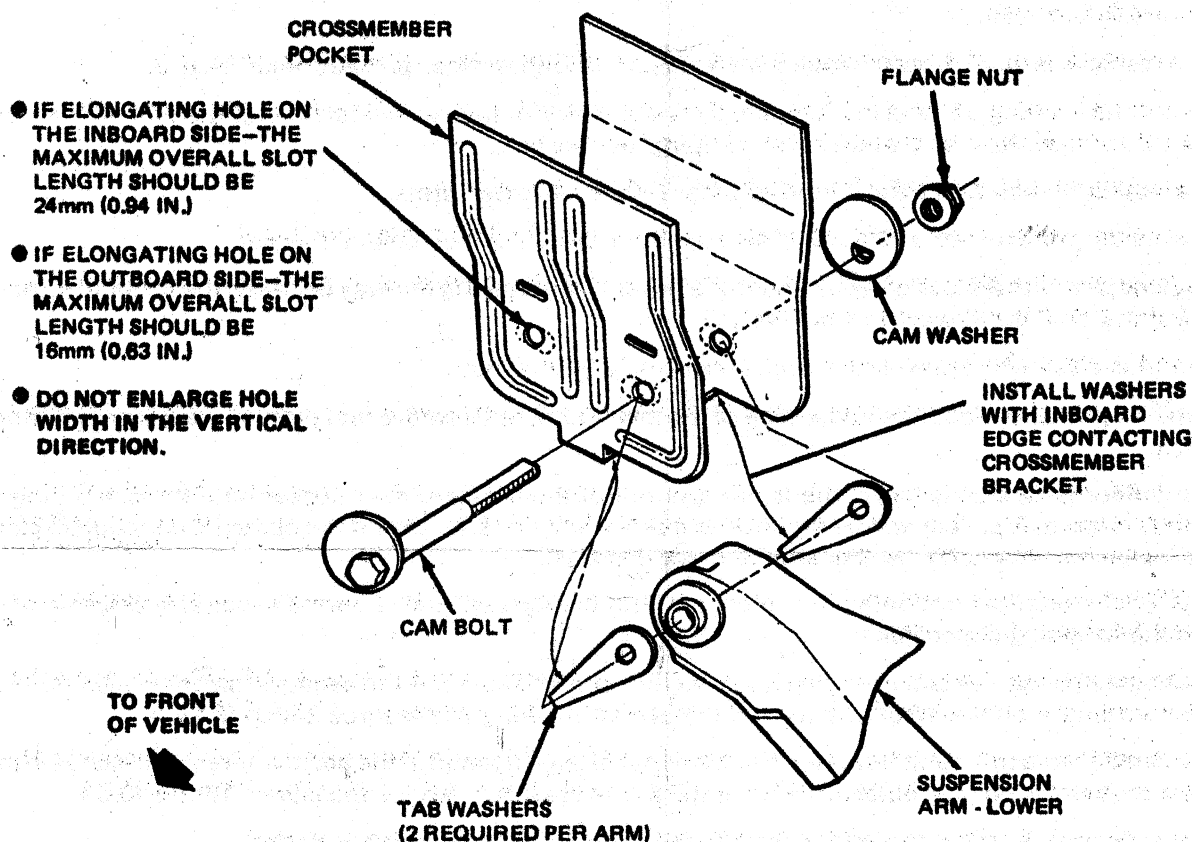
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I.S. 5732

SHEET 1 OF 2

**TAURUS/SABLE  
STATION WAGON CAMBER KIT**

12. Install the kit inner pivot cam bolt from the front side of the crossmember. As the cam bolt is being installed, the two (2) kit tab washers are to be installed on the bolt such that one washer is trapped between each end of the inner pivot bushing inner sleeve and the inside surface of the crossmember pocket.
13. Place the kit cam washer and nut on the bolt, position the tab washers to be in contact with the crossmember bracket, and tighten the nut to approximately 50 ft.-lbs.
14. Repeat steps No. 6 through No. 13 for the opposite side of the vehicle.
15. Reinstall stabilizer bar U-brackets and parking brake cable bracket.
16. Remove the vehicle from the hoist and place on an alignment rack.
17. Reset toe to the nominal specification of  $+0.06^\circ$  toe-in for each individual wheel.
18. Loosen the lower arm inner pivot nut approximately one turn.
19. Adjust camber to  $-0.7^\circ$  by rotating the cam bolt. **NOTE: The rim of the cams will ride against the ribs which are formed in the crossmember bracket. The cam is not intended to be turned a full  $360^\circ$ .**
20. Hold the cam bolt head in position with a backup wrench and tighten the inner pivot nut to specification (40-60 ft.-lbs.). Take care not to disturb the cam/alignment setting while tightening.



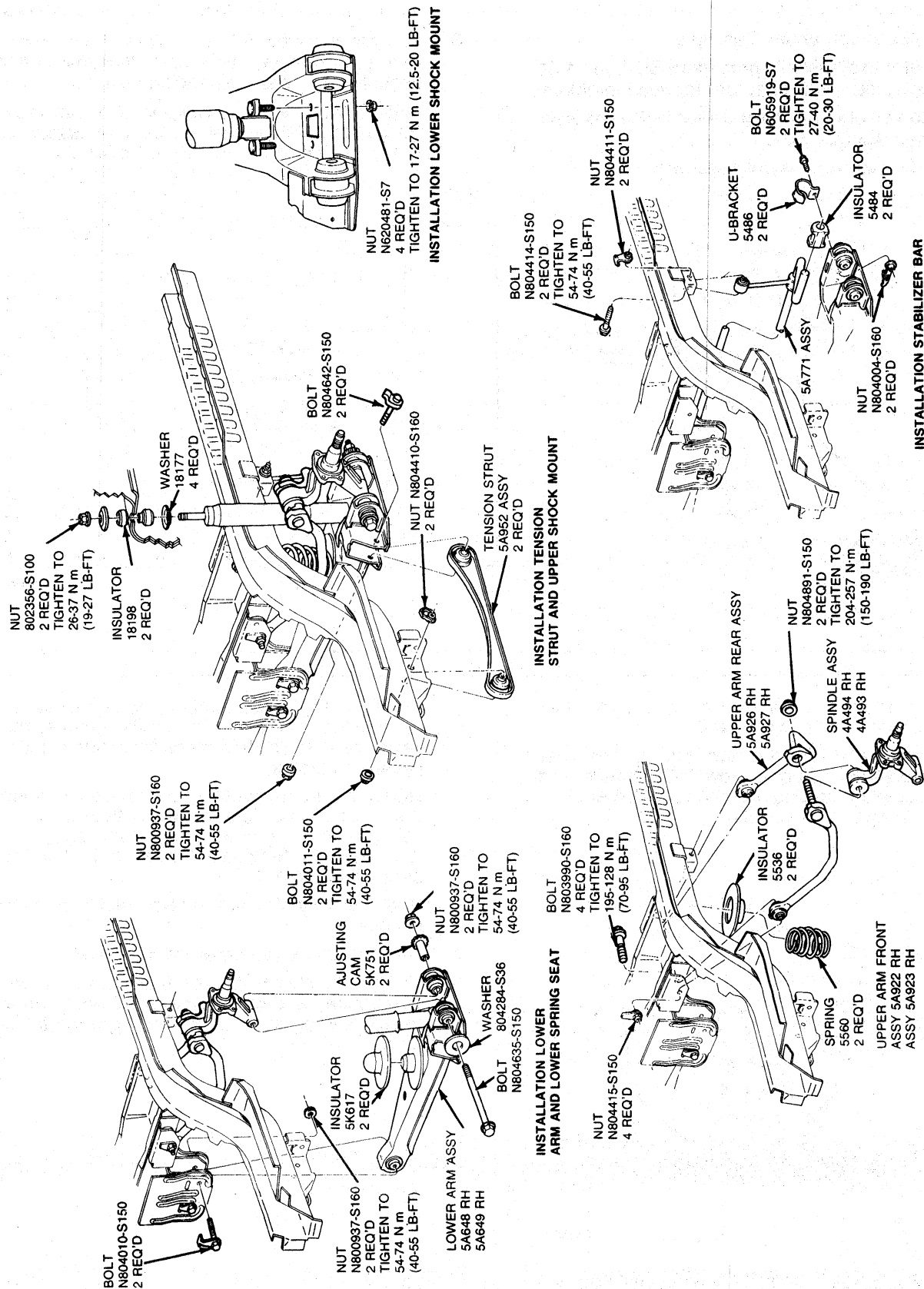
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SHEET 2 OF 2

**TAURUS/SABLE  
STATION WAGON CAMBER KIT**

## DESCRIPTION (Continued)



F4232-B

## REMOVAL AND INSTALLATION

## Shock Absorber

## Removal

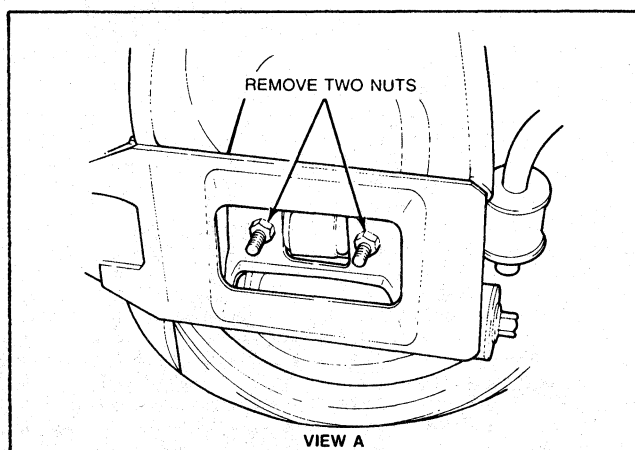
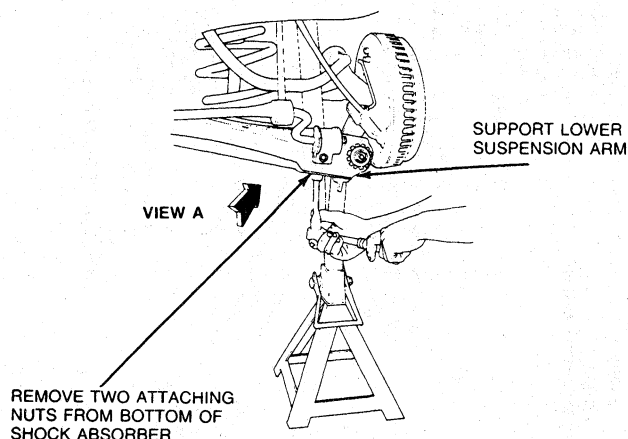
Refer to illustration under Description.

NOTE: Refer to diagnostic procedure Section 14-01 before replacing shock absorber for noise problem.

1. Raise vehicle on a hoist. Refer to Pre-Delivery manual, Section 50-04.
2. Remove tire and wheel assembly.

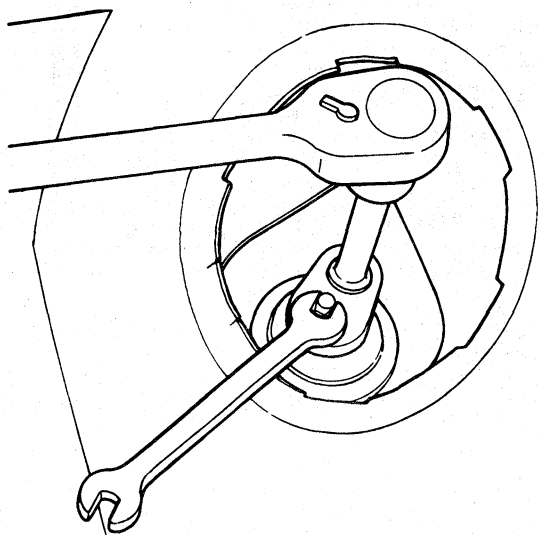
3. Position a jackstand under lower suspension arm and remove two nuts retaining shock absorber to lower suspension arm.

**CAUTION: The lower suspension arm must be supported before removal of upper or lower shock absorber attachments.**



F4234-B

4. From inside of vehicle, remove rear compartment access panels.
5. Remove and discard top shock absorber attaching nut using a crow foot wrench and ratchet while holding the shock absorber shaft with an open end wrench.



F4233-A

NOTE: If the shock absorber is to be reused, do not grip the shaft with pliers or vise grips as this will damage the shaft surface finish and result in severe oil leakage.

NOTE: If a frame contact hoist is used, support the lower suspension arm with a floor jack. If a twin-post hoist is used, support the body with floor jacks on lifting pads forward of the tension strut body bracket.

6. Remove washer and rubber insulator from shock.
7. Remove shock absorber from vehicle.

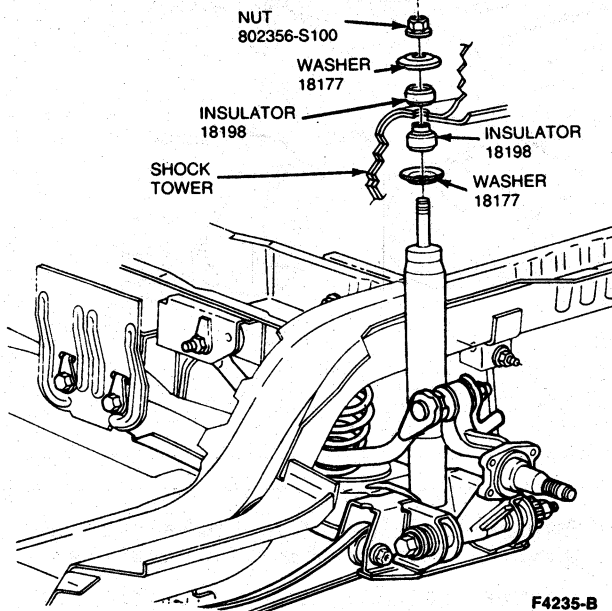
NOTE: The shock absorbers are gas filled and will require an effort to collapse shock in order to remove the shock absorber from the lower arm.



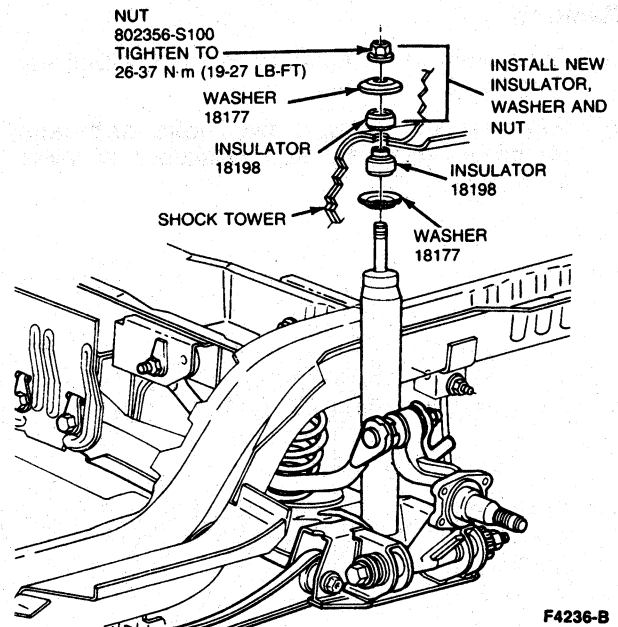
## REMOVAL AND INSTALLATION (Continued)

## Installation

1. Install a new washer and insulator on the upper shock absorber rod.

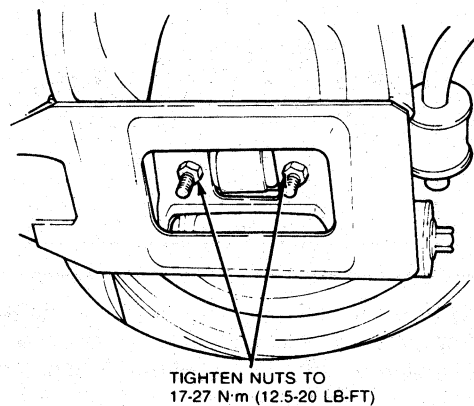


5. Install rear compartment access panel.



2. Position upper part of shock absorber into shock tower opening in the body and push slowly on lower part of shock absorber until mounting studs are lined up with mounting holes in the lower suspension arm.
3. Install new lower attaching nuts. Do not tighten at this time.
4. Install a new insulator, washer and nut on top of shock absorber. Tighten nut to 26-37 N·m (19-27 lb-ft).

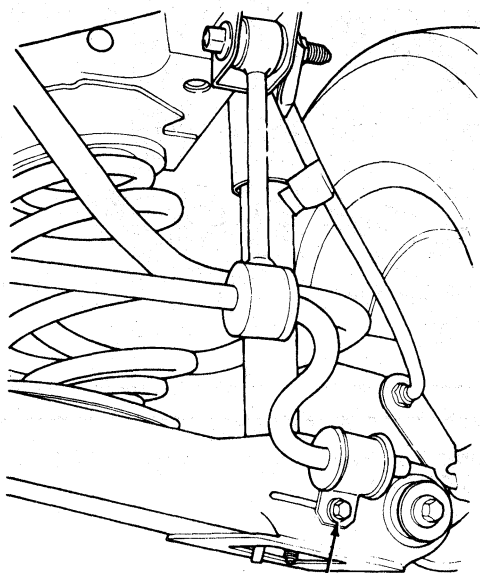
6. Tighten two lower attaching nuts to 17-27 N·m (12.5-20 lb-ft).



7. Install wheel and tire assembly.
8. Remove floor jack and lower vehicle.

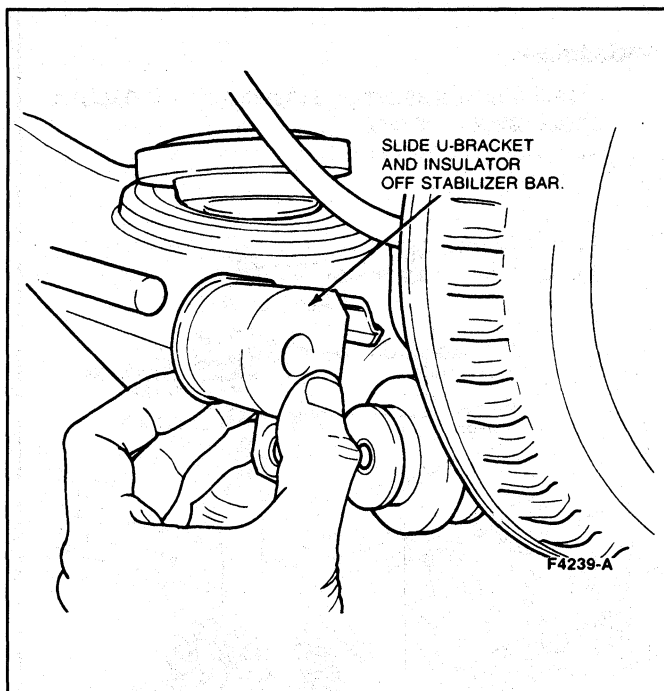
**REMOVAL AND INSTALLATION (Continued)****Stabilizer Bar, Insulators and Link Assembly****Removal**

1. Raise vehicle on hoist. Refer to Pre-Delivery manual, Section 50-04.
2. Remove and discard two bolts and nuts retaining U-brackets and insulators to lower suspension arms.

REMOVE BOLT  
AND NUT

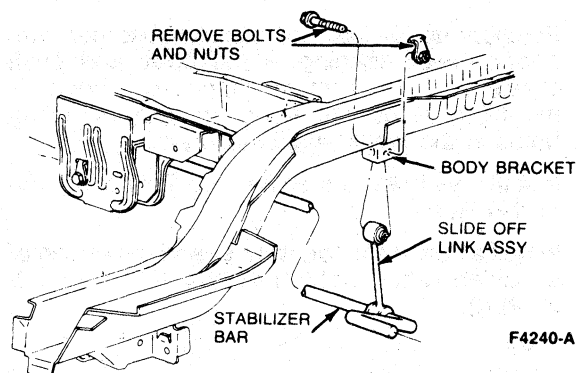
F4238-A

3. Slide U-bracket and insulator off of stabilizer bar. Separate U-bracket from insulator and inspect insulator. Replace insulator if damaged or worn.

SLIDE U-BRACKET  
AND INSULATOR  
OFF STABILIZER BAR.

F4239-A

4. Remove and discard two bolts and nuts attaching link assemblies to body brackets.
5. Remove stabilizer bar and link assemblies from vehicle.
6. Slide link assemblies off of stabilizer bar. Inspect link assemblies and replace if damaged or worn.

REMOVE BOLTS  
AND NUTS

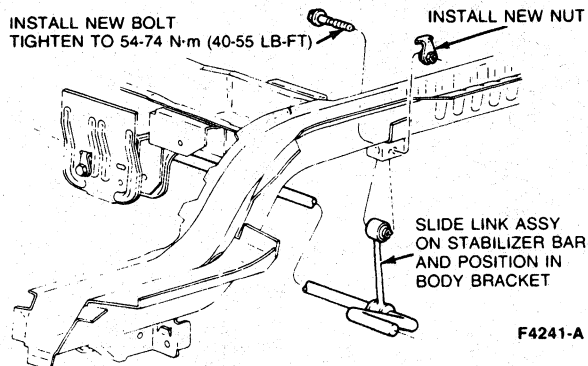
BODY BRACKET

SLIDE OFF  
LINK ASSYSTABILIZER  
BAR

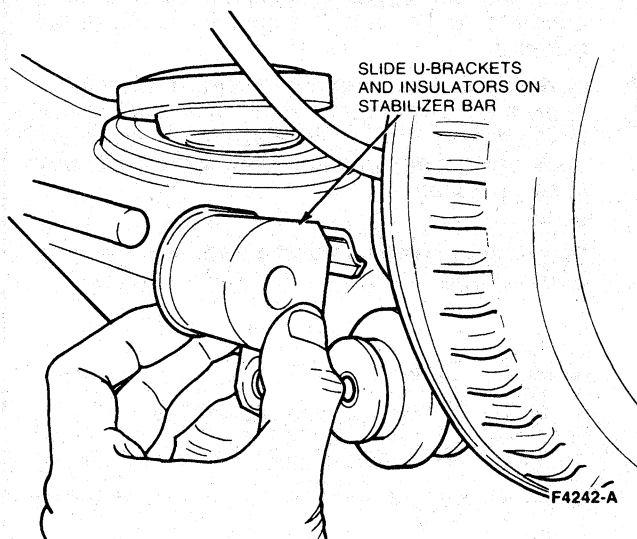
F4240-A

**REMOVAL AND INSTALLATION (Continued)****Installation**

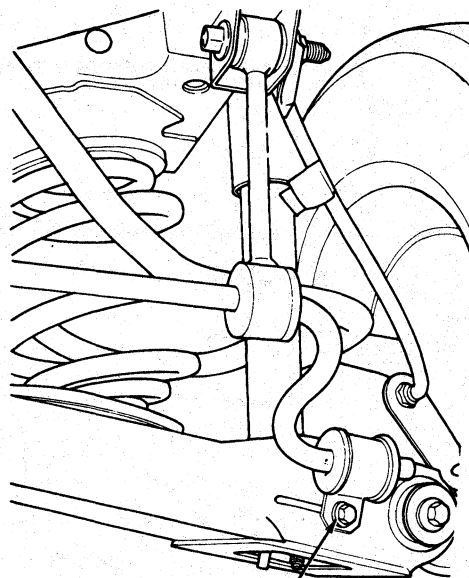
1. Clean stabilizer bar of dirt and other contamination and slide on two link assemblies to approximate position.
2. Install stabilizer bar and link assemblies on vehicle. Attach link assemblies to body brackets with two new bolts and nuts. Tighten bolts to 54-74 N·m (40-55 lb-ft).



3. Slide U-brackets and insulators on both ends of stabilizer bar.



4. Position U-brackets on lower suspension arms and install two new bolts and nuts. Tighten bolts to 27-40 N·m (20-30 lb-ft).

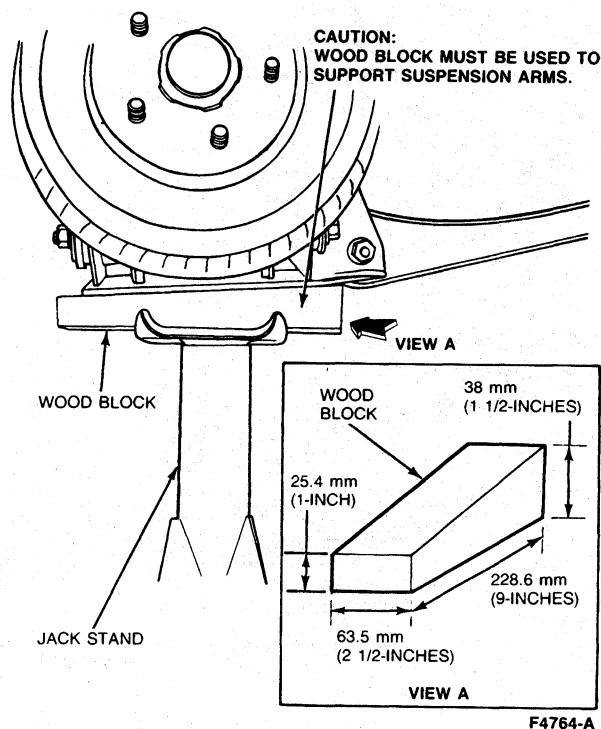


## REMOVAL AND INSTALLATION (Continued)

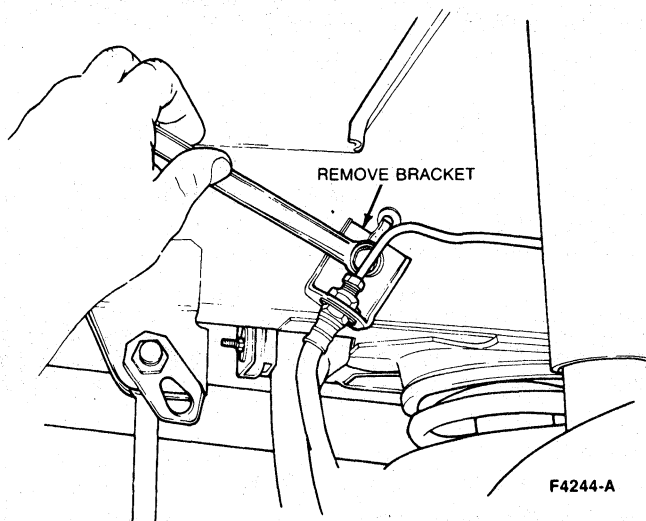
## Suspension Arms, Upper

## Removal

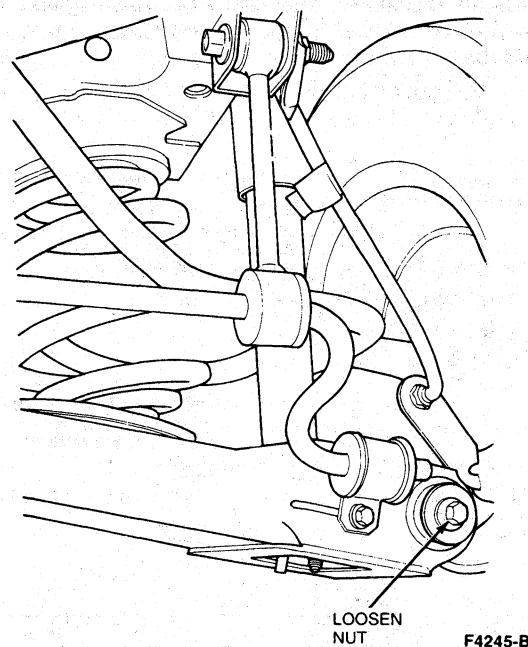
1. Raise vehicle on a hoist and place a jackstand and wood block under rear lower suspension arm to support it at normal curb height. Refer to Pre-Delivery manual, Section 50-04.



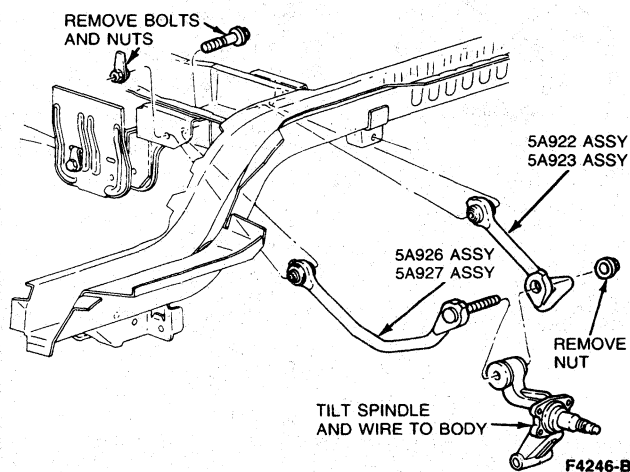
2. Remove wheel and tire assembly.
3. Remove brake line flexible hose bracket from body.



4. Loosen, do not remove, nut attaching spindle to upper arms.
5. Loosen, do not remove, nut attaching spindle to lower suspension arm.

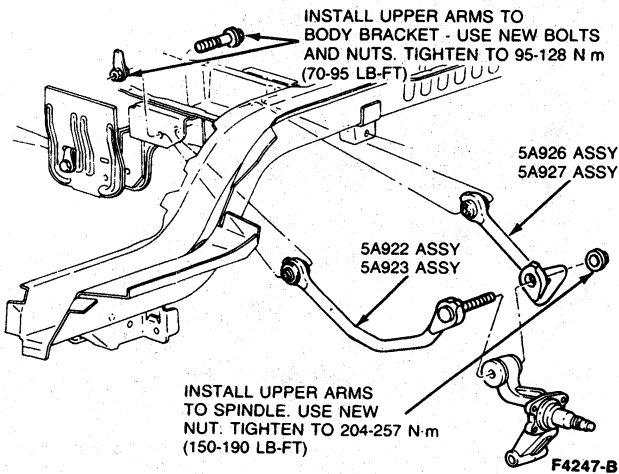


6. Remove and discard bolts and nuts attaching front and rear upper suspension arms to body brackets. Make sure that spindle does not fall outward.
7. Carefully tilt top of spindle outward, allowing it to pivot on lower suspension arm attaching bolt until ends of the upper suspension arms are clear of the body bracket. Wire spindle to body in this position.
8. Remove and discard nut attaching upper suspension arms to spindle and remove arms from vehicle.

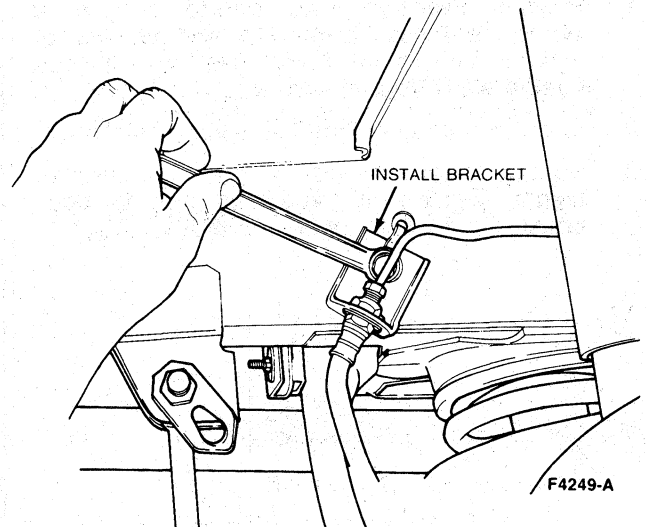


**REMOVAL AND INSTALLATION (Continued)****Installation**

1. Install upper suspension arms on spindle and install a new nut. DO NOT tighten at this time.
2. Position upper suspension arm ends to body bracket and install new bolts and nut. Tighten to 95-128 N·m (70-95 lb-ft). Remove wire from spindle.
3. Tighten nut attaching upper suspension arms to spindle to 204-257 N·m (150-190 lb-ft).

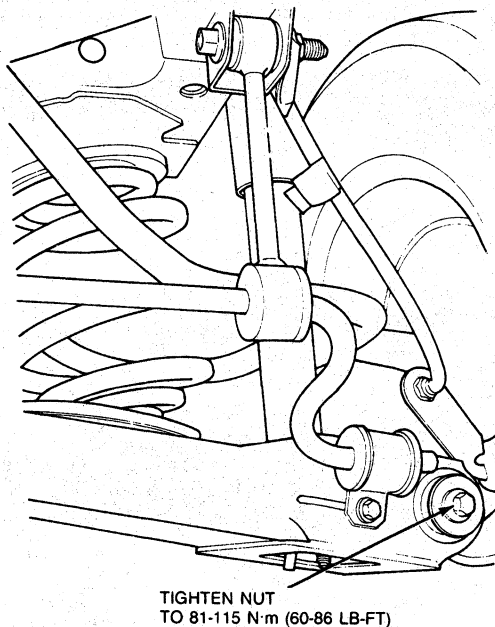


5. Install brake line bracket to body.



6. Install wheel and tire assembly.
7. Remove jackstand and lower vehicle.
8. Check rear wheel alignment.

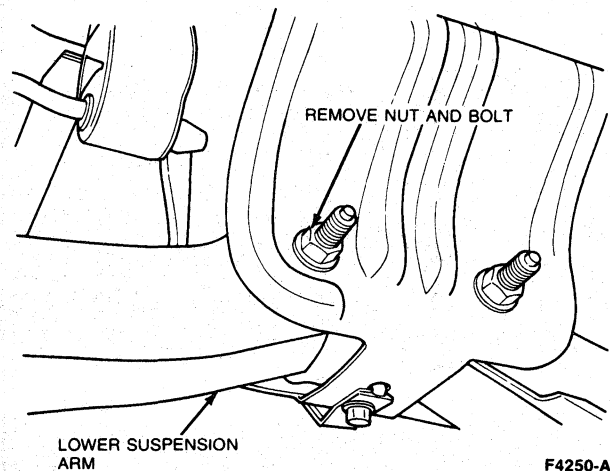
4. Tighten nut attaching lower suspension arm to spindle to 81-116 N·m (60-86 lb-ft).

**Suspension Arm, Lower****Removal**

1. Raise vehicle on a hoist. Refer to Pre-Delivery manual, Section 50-04.

NOTE: If a twin-post hoist is used, floor jack must be placed under lifting pads on underbody forward of the tension strut body bracket. Lower rear hoist post out of the way.

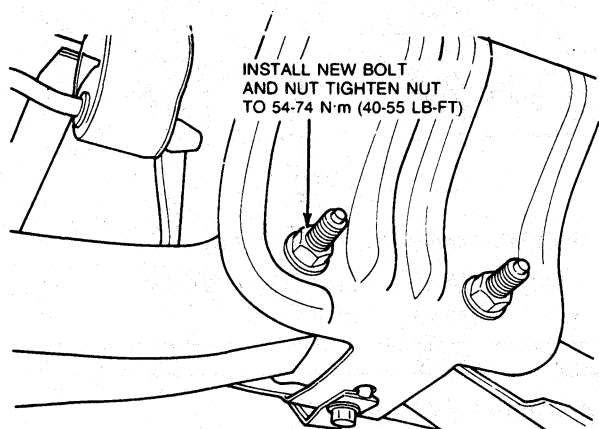
2. Remove tire and wheel assembly.
3. Remove and discard spring as outlined in Spring Removal.
4. Remove and discard bolt and nut attaching lower suspension arm to center body bracket and remove arm.



## REMOVAL AND INSTALLATION (Continued)

## Installation

1. Position lower suspension arm to center body bracket and install a new bolt and nut. Do not tighten at this time. Install this bolt with bolt head toward front of vehicle.
2. Install spring as outlined in Spring Installation.
3. Support lower suspension arm in normal curb height. Tighten nut attaching arm to body bracket to 54-74 N·m (40-55 lb-ft).



F4326-A

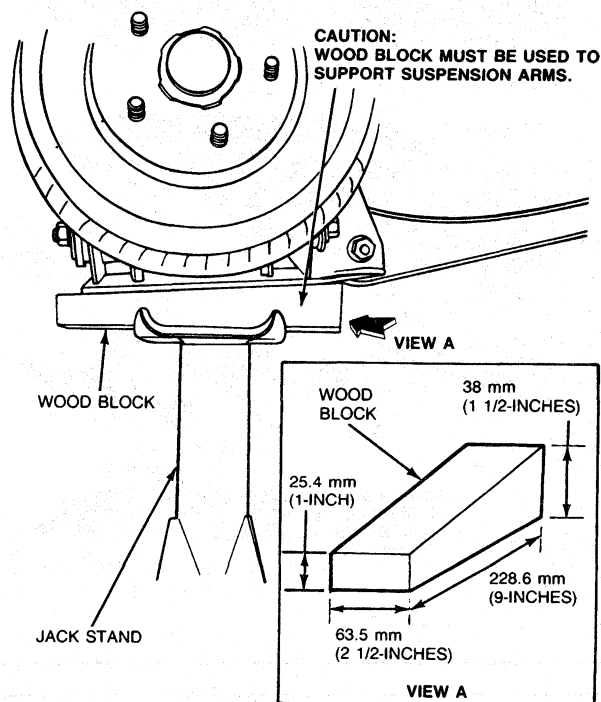
4. Tighten nut attaching lower suspension arm to spindle to 81-116 N·m (60-86 lb-ft).
5. Remove floor jacks and lower vehicle.

NOTE: After lower arm installation it is necessary to check rear alignment.

## Tension Strut

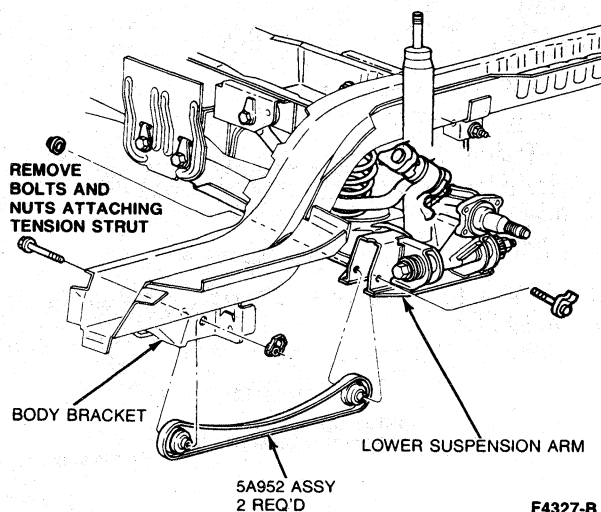
## Removal

1. Raise vehicle on a frame contact hoist. Refer to the Pre-Delivery manual, Section 50-04.
2. Place a floor jack and a wood block under rear lower suspension arm and raise arm to normal curb height.



F4764-A

3. Remove wheel and tire assembly.
4. Remove and discard nut and bolt retaining tension strut to lower suspension arm.
5. Remove and discard nut and bolt retaining tension strut to body bracket and remove strut assembly.

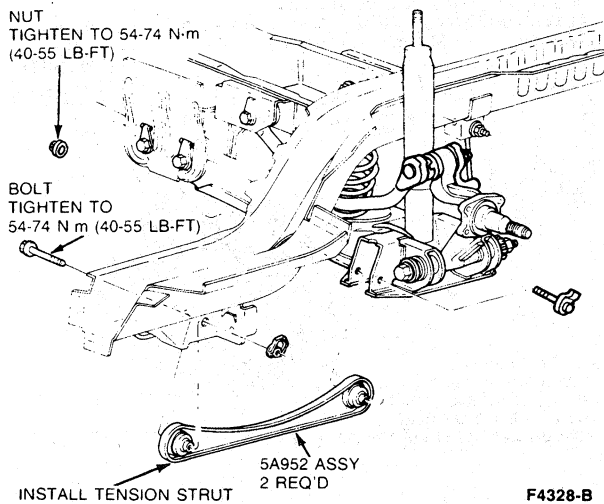


F4327-B

**REMOVAL AND INSTALLATION (Continued)****Installation**

1. Insert front end of tension strut into body bracket and install a new bolt and nut. Do not tighten at this time.
2. Position tension strut in lower suspension arm. Install a new bolt and nut. Tighten nut to 54-74 N·m (40-55 lb-ft).
3. Tighten attaching bolt at front of tension strut to body bracket to 54-74 N·m (40-55 lb-ft).
4. Install wheel and tire assembly.
5. Remove floor jack and lower vehicle.

NOTE: After tension strut installation it may be necessary to check rear wheel alignment.

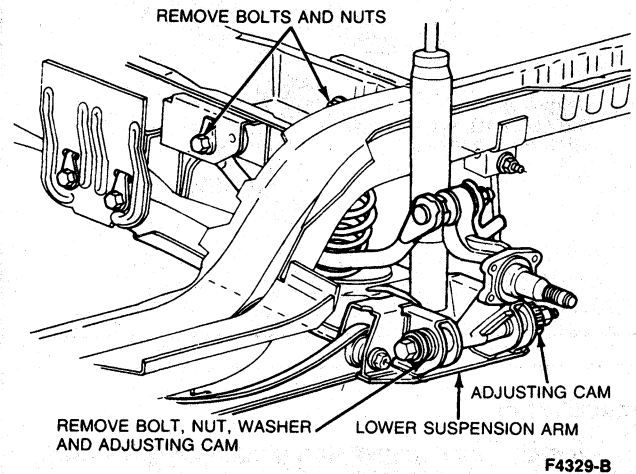


F4328-B

**Spindle****Removal**

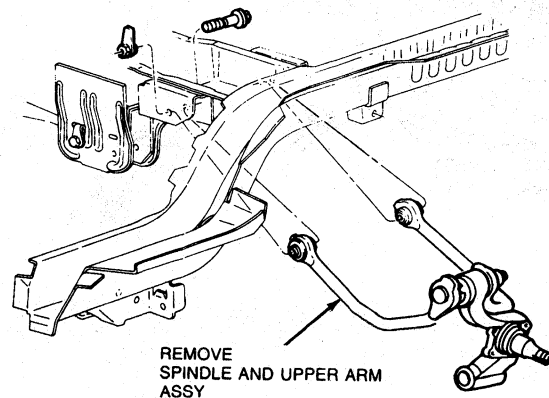
1. Raise vehicle on hoist. Refer to Pre-Delivery manual, Section 50-04.  
NOTE: If a frame contact hoist is used, a jack stand must be placed under lower suspension arm to raise it to curb height.
2. Remove wheel and tire assembly.
3. Remove brake drum and wheel bearings. Refer to Section 11-15.

4. Remove brake backing plate assembly from spindle. Refer to Section 12-02.
5. Remove and discard bolts and nuts attaching front and rear upper suspension arms to body crossmember.
6. Remove bolt, one washer, adjusting cam and nut attaching spindle to lower suspension arm. Discard bolt, washer and nut.



F4329-B

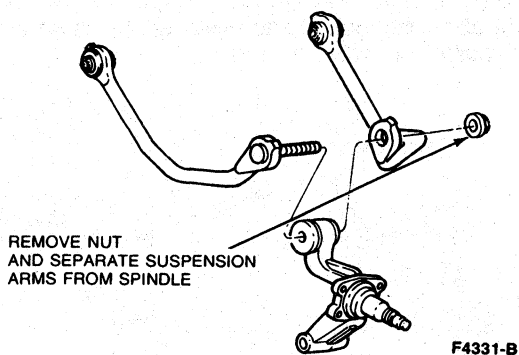
7. Remove spindle and upper suspension arms from vehicle as an assembly.



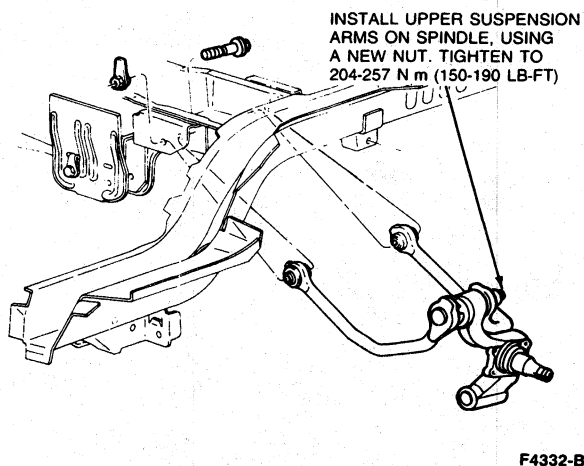
F4330-B

**REMOVAL AND INSTALLATION (Continued)**

8. Remove and discard nut attaching upper suspension arm to spindle and remove suspension arms from spindle.

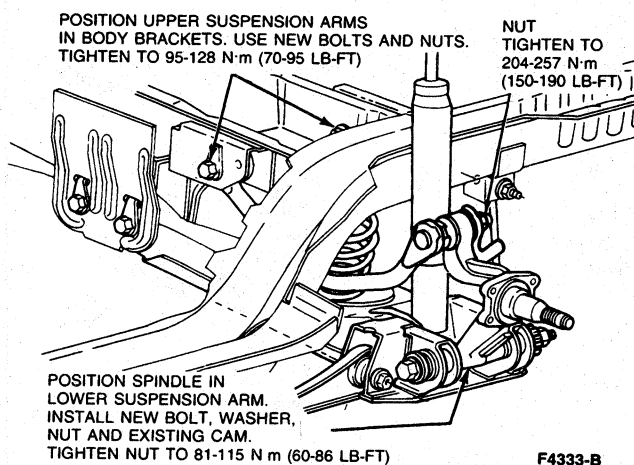
**Installation**

1. Install upper suspension arms on spindle using a new nut. DO NOT tighten at this time.



2. Position spindle and suspension arm assembly on lower suspension arm. Install new bolt, washer, existing adjusting cam and a new nut. DO NOT tighten at this time.

3. Position front and rear upper suspension arms to body bracket and install new bolts and nuts. DO NOT tighten at this time.
4. Ensure that the lower suspension arm is supported so that the lower suspension arm is at normal curb height.
5. Tighten the bolts attaching the front and rear upper suspension arms to body to 95-128 N·m (70-95 lb-ft).
6. Tighten the nut attaching the upper suspension arms to spindle to 204-257 N·m (150-190 lb-ft).
7. Tighten the nut attaching the spindle to lower suspension arm to 81-115 N·m (60-86 lb-ft).
8. Install brake backing plate assembly to spindle. Refer to Section 12-02.



9. Install brake drum and wheel bearings. Refer to Section 11-15.
10. Install wheel and tire assembly.
11. Remove jackstand and lower vehicle.
12. Check rear wheel alignment.

**Springs****Removal**

1. Raise vehicle on a hoist and place a floor jack under lower suspension arm. Raise lower arm to normal curb height. Refer to the Pre-Delivery manual, Section 50-04.

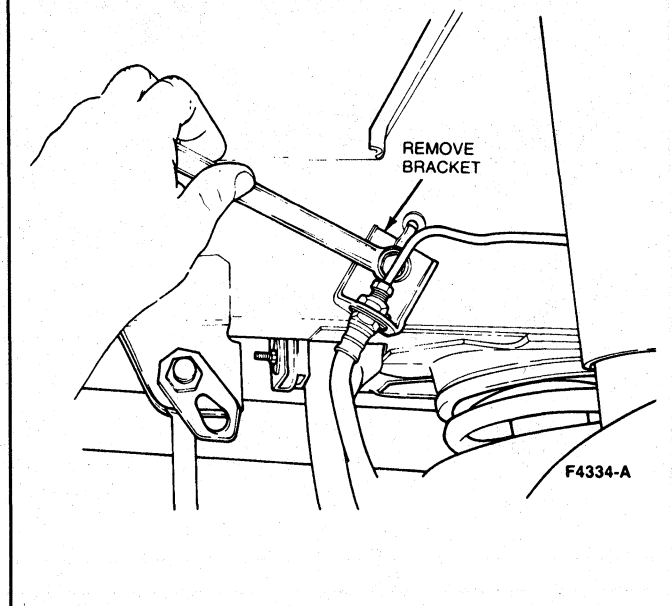
NOTE: If a twin-post hoist is used, vehicle must be supported on jackstands placed under pads of the underbody forward of the tension strut bracket.

2. Remove wheel and tire assembly.

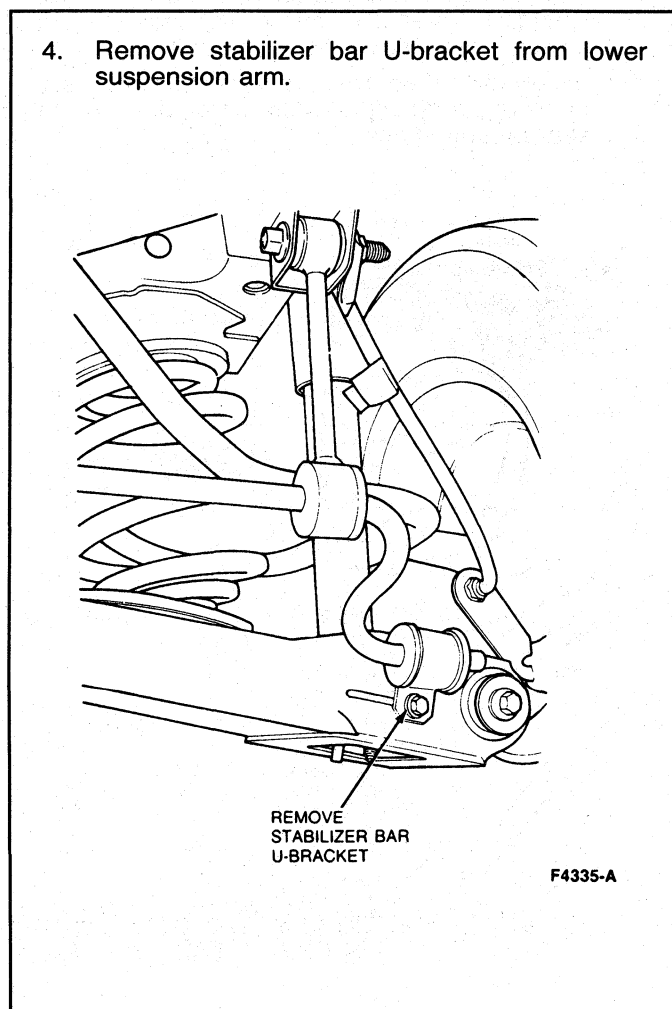


**REMOVAL AND INSTALLATION (Continued)**

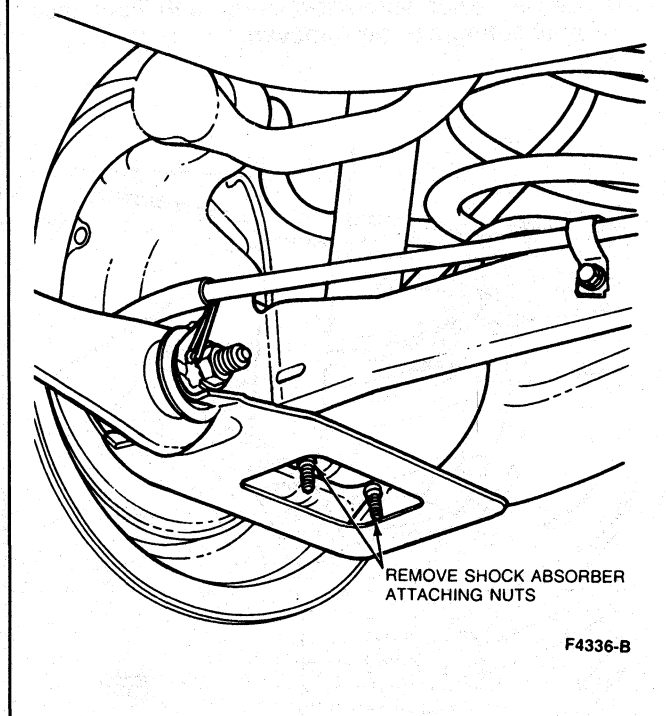
3. Remove the bracket retaining the brake flexible hose to body.



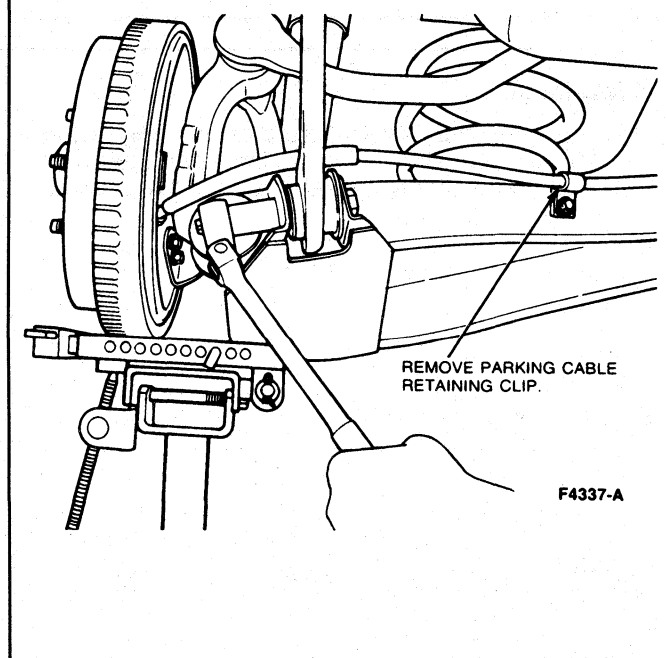
4. Remove stabilizer bar U-bracket from lower suspension arm.



5. Remove and discard nuts attaching shock absorber to lower suspension arm.

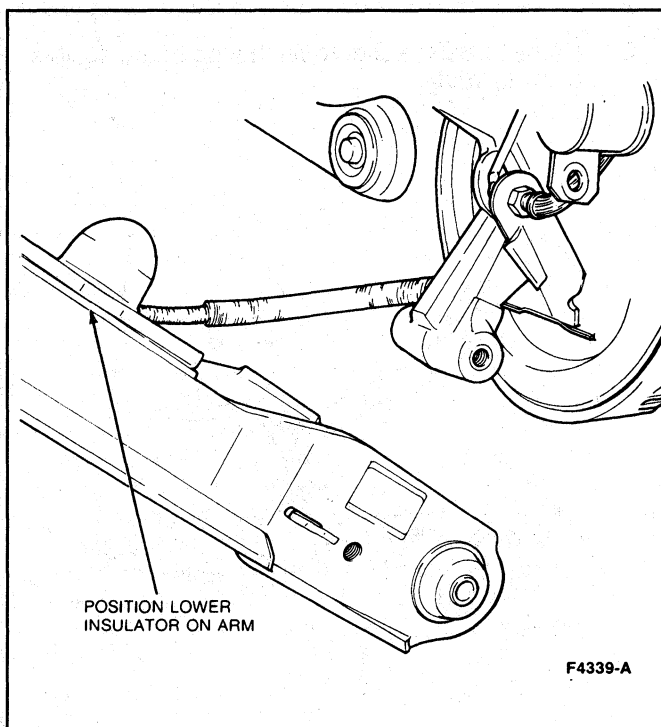
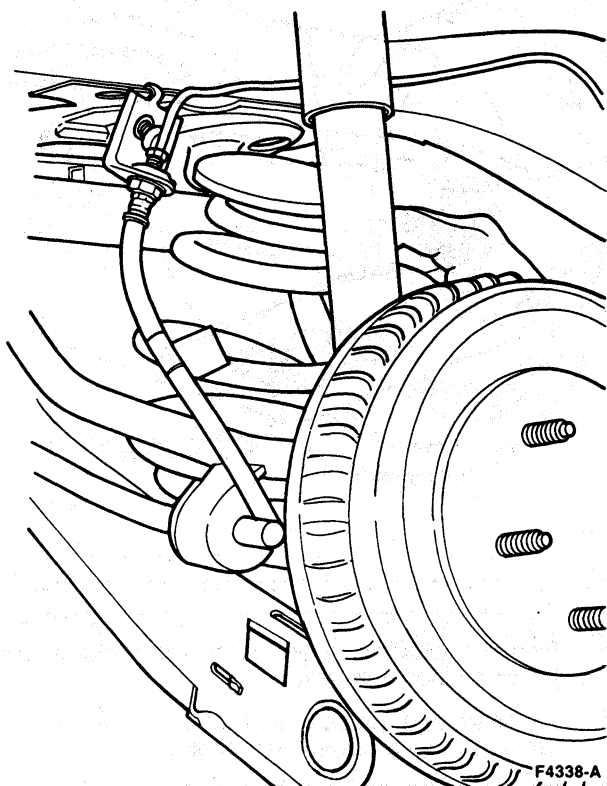


6. Remove parking brake cable and clip from lower suspension arm.
7. Remove and discard bolt and nut attaching tension strut to lower suspension arm.
8. Wire spindle and upper suspension arms to body to prevent them from dropping down.

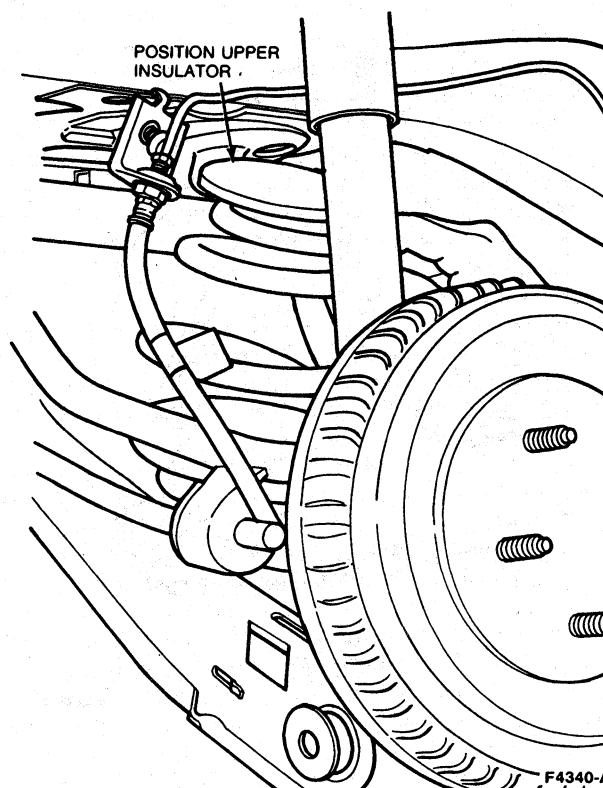


**REMOVAL AND INSTALLATION (Continued)**

9. Remove nut, bolt, washer and adjusting cam retaining lower suspension arm to spindle. Discard nut, bolt, and washer.
10. Slowly lower suspension arm with floor jack until spring can be removed.



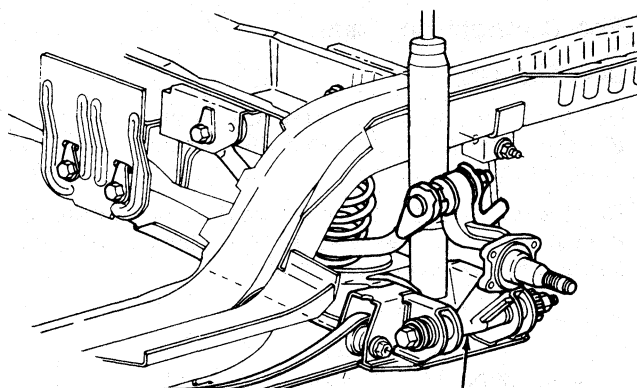
2. Position upper insulator on top of spring. Install spring on lower suspension arm making sure spring is properly seated.
3. Slowly raise suspension arm with floor jack and guide upper spring insulator onto upper spring seat on underbody.

**Installation**

1. Position the lower insulator on the lower suspension arm and press insulator downward into place. Verify insulator is properly seated.

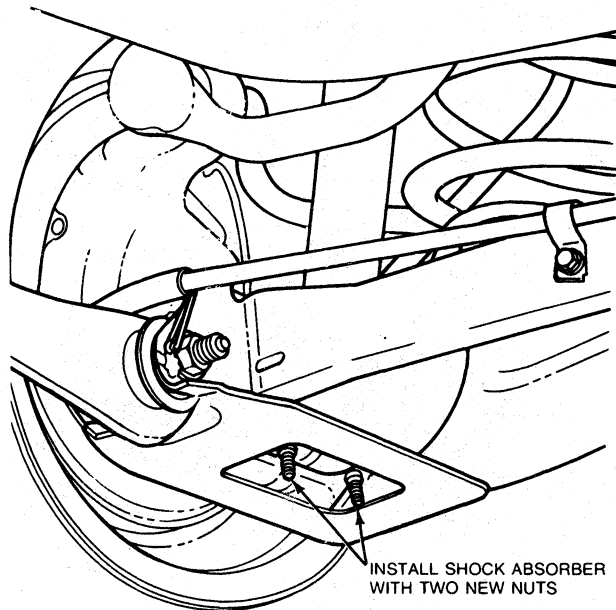
**REMOVAL AND INSTALLATION (Continued)**

4. Position spindle in lower suspension arm and install a new bolt, nut, washer and existing cam. Install bolt with the head toward front of vehicle. DO NOT tighten at this time.



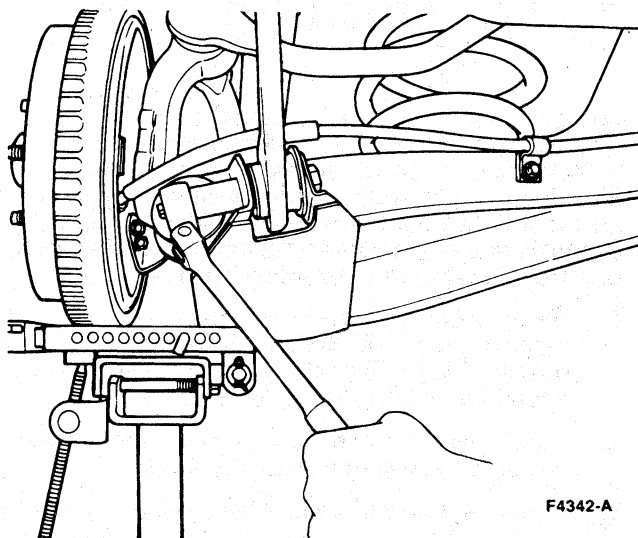
POSITION SPINDLE IN LOWER SUSPENSION ARM. INSTALL NEW BOLT, WASHER, NUT AND EXISTING CAM. TIGHTEN NUT TO 81-115 N·m (60-86 LB-FT) **F4341-B**

8. Position shock absorber on lower suspension arm and install two new nuts. Tighten to 17-27 N·m (12.5-20 lb-ft).



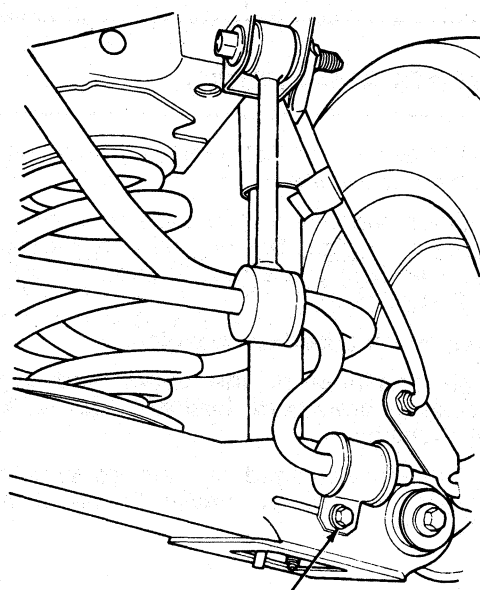
INSTALL SHOCK ABSORBER WITH TWO NEW NUTS **F4343-B**

5. Remove wire from spindle and suspension arms.
6. Install tension strut in lower suspension arm using a new bolt and nut. DO NOT tighten at this time.
7. Install parking brake cable and clip to lower suspension arm.



**F4342-A**

9. Install stabilizer bar and U-bracket to lower suspension arm using a new bolt. Tighten to 27-40 N·m (20-30 lb-ft).

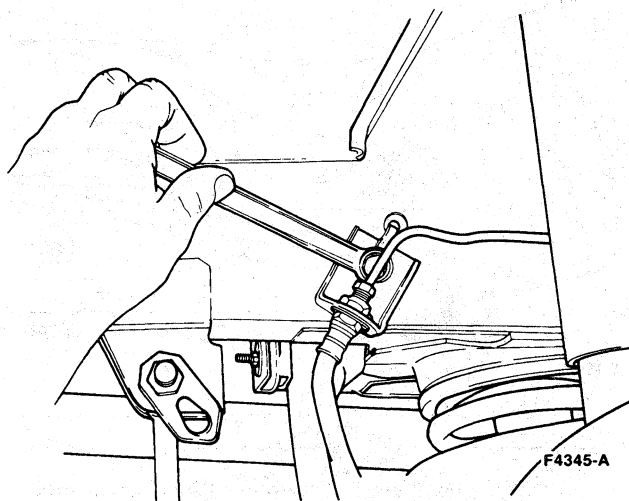


INSTALL STABILIZER BAR U-BRACKET. TIGHTEN TO 27-40 N·m (20-30 LB-FT)

**F4344-A**

**REMOVAL AND INSTALLATION (Continued)**

10. Install flexible brake hose bracket to body. Tighten bolt to 11-16 N·m (8-12 lb-ft).



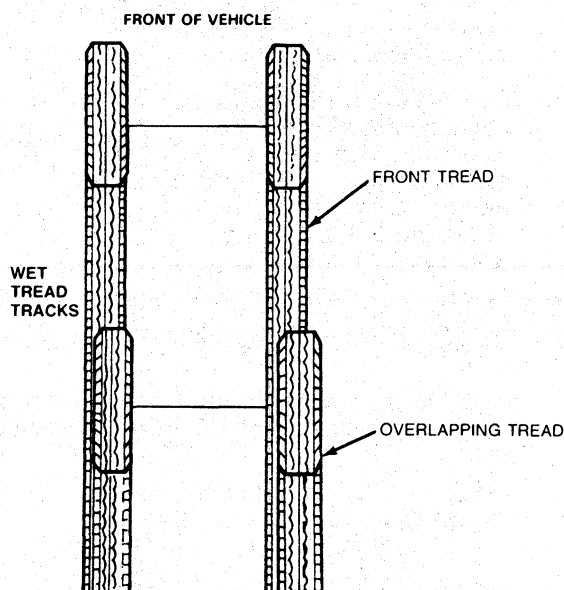
11. Using floor jack, raise lower suspension arm to normal curb height. Tighten lower suspension arm to spindle nut to 81-115 N·m (60-86 lb-ft). Tighten tension strut to body bracket bolt to 54-74 N·m (40-55 lb-ft).
12. Install wheel and tire assembly.
13. Remove floor jack and lower vehicle.
14. Check rear wheel alignment.

2. Turn adjusting cam to obtain the required alignment setting.
3. While holding adjusting cam in position, tighten attaching nut to 81-115 N·m (60-86 lb-ft).

**Toe Connection, Rear****Dog Tracking**

Use the following procedure to check and reset rear toe after service or accident damage or to correct "dog tracking."

Dog tracking is a condition where the rear wheels do not follow the front wheels and the vehicle does not travel squarely down the road.



IF THE WIDTH OF ONE REAR OVERLAPPING TRACK IS MORE THAN 38mm (1.50 INCHES) WIDER THAN ONE FRONT TRACK, ADJUST TO CORRECT REAR TOE (DOG TRACKING).

F3690-B

**ADJUSTMENTS AND CHECKS**

At regular intervals, the following rear suspension checks should be made:

1. Check for evidence of fluid leaks on rear shock absorbers. (A light film of fluid is permissible. Make sure fluid is not from sources other than shock absorber).
2. Check shock absorber operation.
3. Check condition of the upper and lower suspension arms pivot bushings and tension strut bushings.

Replace any damaged or worn components. Refer to procedures under Removal and Installation.

**Toe**

After checking toe alignment for rear wheels as outlined, the toe alignment can be adjusted, if necessary, as follows:

1. Loosen nut and bolt attaching spindle to lower suspension arm.

The amount of dog tracking can be quickly checked by placing water on a flat surface and driving the vehicle across in a straight ahead direction. Measure the total width of each overlapping imprint on the left and right side. If the width of one rear imprint is more than 38mm (1.5-inches) greater than one front imprint, use the following procedures:

1. Back vehicle onto alignment equipment, making sure the vehicle is as straight as possible. Front wheels are to be set straight ahead by sighting along tire and body.
2. Attach alignment heads to rear wheels and adjust for wheel runout as required.
3. Lower rear end of vehicle and jounce.

**ADJUSTMENTS AND CHECKS (Continued)**

4. Total rear toe can be read. Total rear toe is sum of left and right toe.

NOTE: With the vehicle backed onto the alignment equipment, toe-in and toe-out are reversed. Toe-in on the rear wheels will be read as toe-out.

For examples, with vehicle backed onto the alignment equipment, refer to the following chart.

If the Actual Readings are:		The Corrected (Reversed) Readings are:		The Total Corrected Toe is:
Left	Right	Left	Right	Total
1/4 inch toe-in	1 1/16 inch toe-in	1 4/16 inch toe-out	1 1/16 inch toe-out	5 1/16 inch toe-out
1 1/16 inch toe-out	3/16 inch toe-out	1 1/16 inch toe-in	3/16 inch toe-in	1 4/16 inch toe-in
1/4 inch toe-in	5 1/16 inch toe-out	1 4/16 inch toe-out	5 1/16 inch toe-in	1 1/16 inch toe-in
1 4/16 inch toe-out	7 1/16 inch toe-in	1 4/16 inch toe-in	7 1/16 inch toe-out	3 1/16 inch toe-out

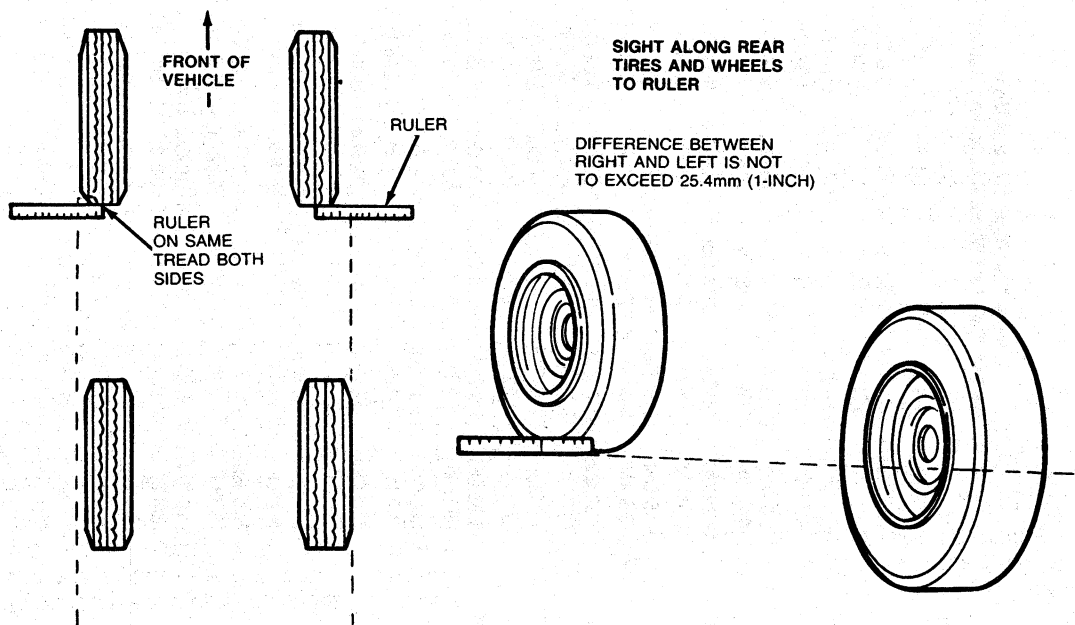
CF3689-A

5. It is important that rear wheel toe be set with each individual wheel toed-in the same amount to prevent dog tracking. This can be done by sighting along outer side walls of rear tires along horizontal centerline of wheel and observing position where this line, if extended, would meet front tires.

To closely measure sighted position, locate a ruler at bottoms of front tires using one of the tire treads as the reference. (Use same tread on

both sides of vehicle.) The difference between left and right measurement at front tires should not exceed 25.4mm (1 inch).

6. If total toe reading is not within specification, or line of sight is not within 25.4mm (1 inch) (Step 5), adjust rear wheel toe.
7. The following chart can be used to determine amount of adjustment required for each wheel when total rear toe and difference in left and right sighting are known.



F3691-B

## ADJUSTMENTS AND CHECKS (Continued)

This table shows the amount of adjustment and direction when the total toe reading and the measured difference of the line of sight along the rear wheels is known. The top number is the adjustment required for the left wheel. The bottom number is the adjustment required for the right wheel. These adjustments are the amount of change to be made. Direction (in or out) will be reversed when vehicle is backed onto aligner.

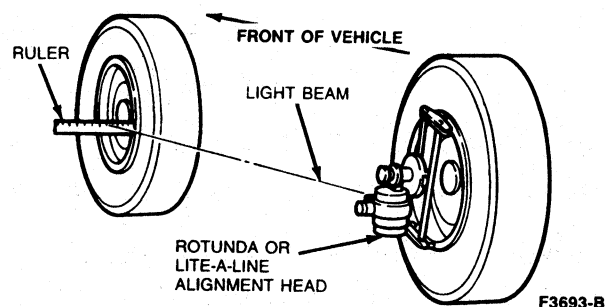
		Amount That Right Wheel Is More Toe-Out Than Left Wheel By Sighting Method										Amount That Left Wheel Is More Toe-Out Than Right Wheel By Sighting Method									
Total Toe		3"	2-1/2"	2"	1-1/2"	1"	1/2"	0"	1/2"	1"	1-1/2"	2"	2-1/2"	3"							
Left	5/8"	11/16 Out	19/32 Out	17/32 Out	7/16 Out	3/8 Out	9/32 Out	7/32 Out	5/32 Out	1/16 Out	0	3/32 In	5/32	1/4 In							
	Right	1/4 In	5/32 In	3/32 In	0	1/16 Out	5/32 Out	7/32 Out	9/32 Out	3/8 Out	7/16 Out	17/32 Out	19/32 Out	11/16 Out							
Left	9/16"	21/32 Out	9/16 Out	1/2 Out	13/32 Out	11/32 Out	1/4 Out	3/16 Out	1/8 Out	1/32 Out	0	1/8 In	3/16 In	9/32 In							
	Right	9/32 In	3/16 In	1/8 In	1/32 In	1/32 Out	1/8 Out	3/16 Out	1/4 Out	1/32 Out	11/32 Out	1/2 Out	3/16 In	9/32 In							
Left	1/2"	5/8 Out	17/32 Out	15/32 Out	3/8 Out	5/16 Out	7/32 Out	5/32 Out	3/32 Out	0	1/16 In	5/32 In	7/32 In	5/16 In							
	Right	5/16 In	7/32 In	5/32 In	1/16 In	0	3/32 Out	5/32 Out	7/32 Out	5/16 Out	3/8 Out	15/32 Out	17/32 Out	5/8 Out							
Left	7/16"	19/32 Out	1/2 Out	7/16 Out	11/32 Out	9/32 Out	3/16 Out	1/8 Out	1/16 Out	1/32 In	0	3/16 In	1/4 In	11/32 In							
	Right	11/32 In	1/4 In	3/16 In	3/32 In	1/32 In	1/16 Out	1/8 Out	3/16 Out	9/32 Out	11/32 Out	7/16 Out	1/2 Out	19/32 Out							
Left	3/8"	9/16 Out	15/32 Out	13/32 Out	5/16 Out	1/4 Out	5/32 Out	3/32 Out	1/32 Out	1/16 In	1/4 Out	7/32 In	9/32 In	3/8 In							
	Right	3/8 In	9/32 In	7/32 In	1/8 In	1/16 In	1/32 Out	3/32 Out	5/32 Out	1/4 Out	5/16 Out	13/32 Out	15/32 Out	9/16 Out							
Left	5/16"	17/32 Out	7/16 Out	3/8 Out	9/32 Out	7/32 Out	1/8 Out	1/16 Out	0	3/32 In	5/32 In	3/8 Out	7/16 Out	13/32 In							
	Right	13/32 In	5/16 In	1/4 In	5/32 In	3/32 In	0	1/16 Out	1/8 Out	7/32 Out	9/32 Out	3/8 Out	5/16 In	17/32 Out							
Left	1/4"	1/2 Out	13/32 Out	11/32 Out	1/4 Out	3/16 Out	3/32 Out	1/32 Out	1/32 Out	1/8 In	1/4 Out	9/32 In	11/32 In	7/16 In							
	Right	7/16 In	11/32 In	9/32 In	3/16 In	1/8 In	1/32 In	1/32 Out	3/32 Out	3/16 Out	1/4 Out	11/32 Out	13/32 Out	1/2 Out							
Left	3/16"	15/32 Out	3/8 Out	5/16 Out	7/32 Out	5/32 Out	1/16 Out	0	1/16 In	5/32 In	7/32 In	5/16 In	3/8 In	15/32 In							
	Right	15/32 In	3/8 In	5/16 In	7/32 In	5/32 In	1/16 In	0	1/16 Out	5/32 Out	7/32 Out	5/16 Out	3/8 Out	15/32 Out							
Left	1/8"	7/16 Out	11/32 Out	9/32 Out	3/16 Out	1/8 Out	1/32 Out	1/32 In	3/32 In	3/16 In	1/4 In	11/32 In	13/32 In	1/2 In							
	Right	1/2 In	13/32 In	11/32 In	1/4 In	3/16 In	3/32 In	1/32 In	1/32 Out	1/8 Out	3/16 Out	9/32 Out	11/32 Out	7/16 Out							
Left	1/16"	13/32 Out	5/16 Out	1/4 Out	5/32 Out	3/32 Out	0	1/16 In	1/8 In	7/32 In	9/32 In	3/8 In	7/16 In	17/32 In							
	Right	17/32 In	7/16 In	3/8 In	9/32 In	7/32 In	1/8 In	1/16 In	0	3/32 Out	5/32 Out	1/4 Out	5/16 Out	13/32 Out							
Left	0"	3/8 Out	9/32 Out	7/32 Out	1/8 Out	1/16 Out	1/32 In	3/32 In	5/32 In	1/4 In	5/16 In	13/32 In	15/32 In	9/16 In							
	Right	9/16 In	15/32 In	13/32 In	5/16 In	1/4 In	5/32 In	3/32 In	1/32 In	1/16 Out	1/8 Out	7/32 Out	9/32 Out	3/8 Out							
Left	1/16"	11/32 Out	1/4 Out	3/16 Out	3/32 Out	1/32 Out	1/16 In	1/8 In	3/16 In	9/32 In	11/32 In	5/8 In	7/32 In	5/16 In							
	Right	19/32 In	1/2 In	7/16 In	11/32 In	9/32 In	3/16 In	1/8 In	1/16 In	1/32 Out	3/32 Out	1/4 Out	5/16 Out	19/32 In							
Left	1/8"	5/16 Out	7/32 Out	5/32 Out	1/16 Out	0	3/32 In	5/32 In	7/32 In	5/16 In	3/8 In	15/32 In	17/32 In	5/8 In							
	Right	5/8 In	17/32 In	15/32 In	5/32 In	3/8 In	7/32 In	5/32 In	3/32 In	0	1/16 Out	5/32 Out	7/32 Out	5/16 Out							
Left	3/16"	9/32 Out	3/16 Out	1/8 Out	1/32 Out	1/32 Out	1/8 In	3/16 In	1/4 In	11/32 In	13/32 In	1/2 In	9/16 In	21/32 In							
	Right	21/32 In	9/16 In	1/2 In	13/32 In	11/32 In	1/4 In	3/16 In	1/8 In	1/32 In	1/32 Out	1/8 Out	3/16 Out	9/32 Out							
Left	1/4"	1/4 Out	5/32 Out	3/32 Out	0	1/16 In	5/32 In	7/32 In	9/32 In	3/8 In	1/16 In	17/32 In	19/32 In	11/16 In							
	Right	11/16 In	19/32 In	17/32 In	7/16 In	3/8 In	9/32 In	7/32 In	5/32 In	1/16 In	0	3/32 Out	5/32 Out	1/4 Out							

CF3692-A

**ADJUSTMENTS AND CHECKS (Continued)****Wheel Toe—Individual**

NOTE: If the alignment equipment is Rotunda or Hunter Lite-a-Line, the following method for determining individual rear wheel toe can be used instead of sighting the rear wheels (Rear Toe Connection, Step 5).

Place a ruler on the center of the front wheel and note where the vertical line of light crosses the scale. Do the same for the other side.



The difference between the two readings should not exceed 25.4mm (1 inch).

**SPECIFICATIONS****TORQUE SPECIFICATIONS**

Description	N·m	Lb·Ft
Shock Absorber to Body	26-37	19-27
Shock Absorber to Lower Suspension Arm	17-27	12.5-20
Upper Suspension Arms to Body	95-128	70-95
Upper Suspension Arms to Spindle	204-257	150-190
Lower Suspension Arm to Body	54-74	40-55
Lower Suspension Arm to Spindle	81-116	60-86
Tension Strut to Body	54-74	40-55
Tension Strut to Lower Suspension Arm	54-74	40-55
Stabilizer Bar U-Bracket to Lower Suspension Arm	27-40	20-30
Stabilizer Link Assembly to Body	54-74	40-55

CF4346-A

<b>Taurus/Sable Station Wagon (rear alignment)</b>	<b>Camber<sup>①</sup></b>	Decimal Fractional Minutes	-0.62 -5/8 -0 37'	-1.32 -1-5/16 -1 19'	+0.08 +1/16 +0 05'
	<b>Camber difference<sup>①</sup> side-to-side (left minus right)</b>	Decimal Fractional Minutes	0 0 0	-1.20 -1-7/32 -1 12'	+1.20 +1-7/32 +1 12'
	<b>Toe (individual sides)</b>	Decimal inches Fractional inches Millimeters Decimal degrees	+0.031" +1/32" +0.79mm +0.062	-0.031" -1/32" -0.79mm -0.062	+0.094" +3/32" +2.38mm +0.188
	<b>Total toe (left plus right)</b>	Decimal inches Fractional inches Millimeters Decimal degrees	+0.06" +1/16" +1.59mm +0.125	-0.06" -1/16" -1.59mm -0.125	+0.19" +3/16" +4.76mm +0.375

<sup>①</sup> Camber is factory set and cannot be adjusted.

CF4712-A





# DIFFERENTIAL AND HALFSHAFTS

## GROUP 15

(4000)

SECTION TITLE	PAGE	SECTION TITLE	PAGE
DIFFERENTIAL—AUTOMATIC TRANSAXLE, ATX .....	15-20-1	HALFSHAFTS AND CV JOINTS—FRONT WHEEL DRIVE .....	15-22-1
DIFFERENTIAL—MANUAL 5-SPEED TRANSAXLE .....	15-21-1		

## SECTION 15-20 Differential—Automatic Transaxle, ATX

SUBJECT	PAGE	SUBJECT	PAGE
<b>CLEANING AND INSPECTION</b>		<b>MAJOR SERVICE OPERATIONS (Cont'd.)</b>	
Ball Bearing Assemblies .....	15-20-17	Differential Seals .....	15-20-17
Differential Case .....	15-20-17	OPERATION .....	15-20-3
Gears .....	15-20-17	<b>REMOVAL AND INSTALLATION</b>	
DESCRIPTION .....	15-20-2	ATX Differential—In Vehicle .....	15-20-4
<b>DISASSEMBLY AND ASSEMBLY</b>		<b>SPECIAL SERVICE TOOLS</b> .....	15-20-18
Differential .....	15-20-11	<b>SPECIFICATIONS</b> .....	15-20-18
<b>MAJOR SERVICE OPERATIONS</b>		<b>VEHICLE APPLICATION</b> .....	15-20-1
Differential Ball Bearing End Play .....	15-20-14		

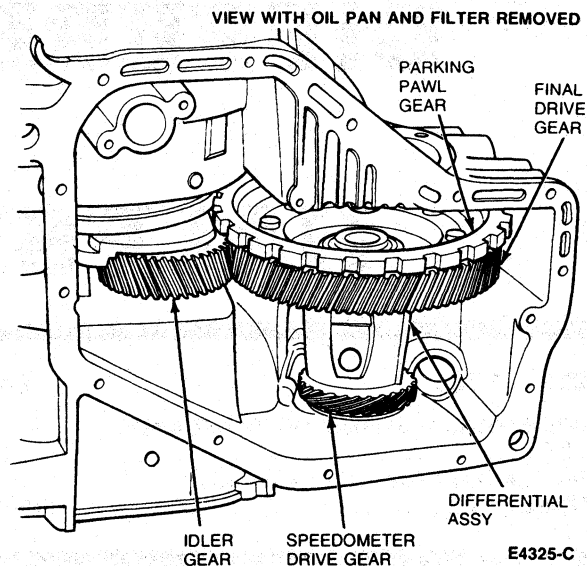
### VEHICLE APPLICATION

Taurus/Sable.

**DESCRIPTION**

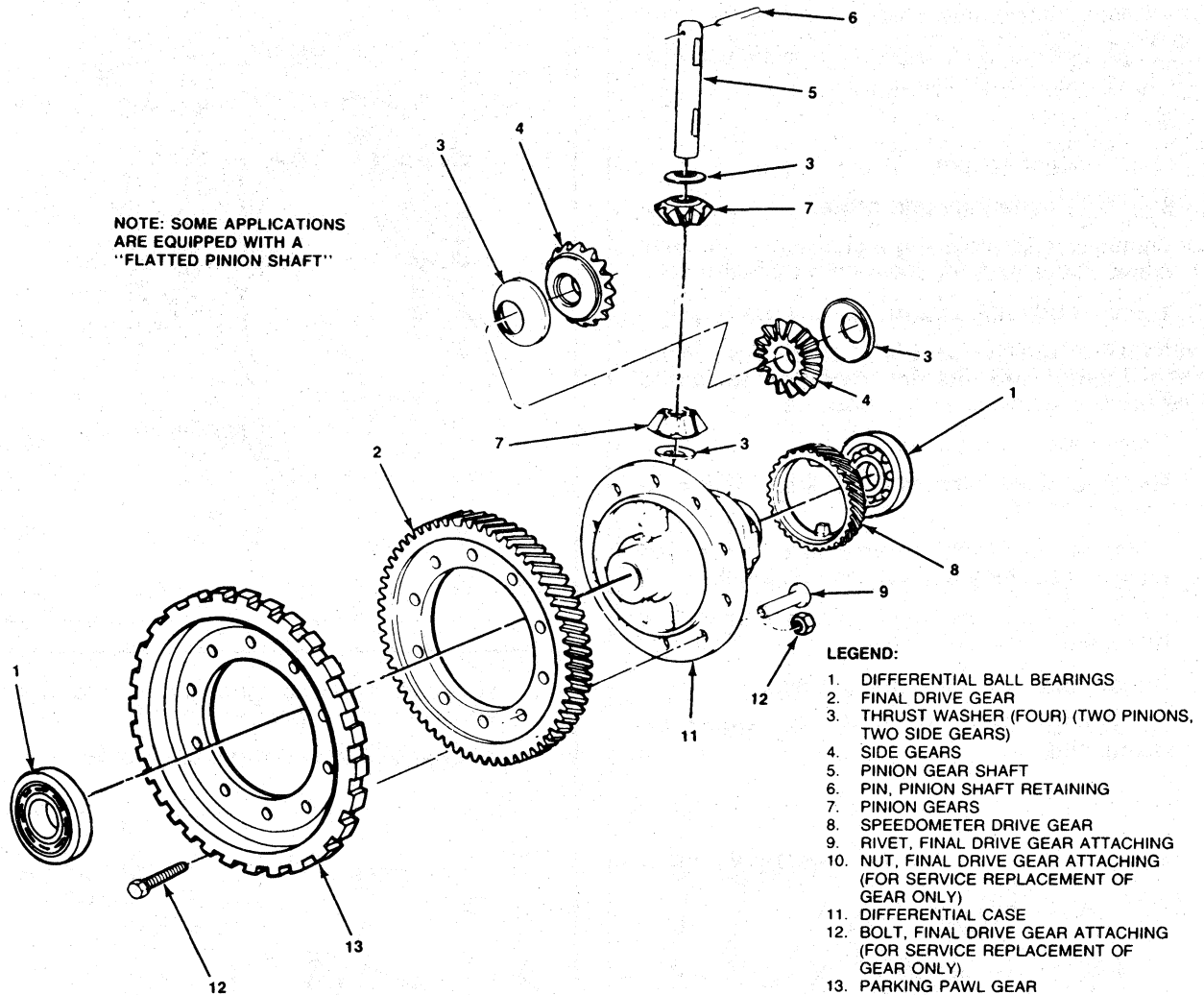
**NOTE:** This Section covers the ATX transmission differential. Refer to Section 17-15 for information and procedures for the AXOD transmission differential.

The transaxle assembly consists of the transmission and differential, transversely mounted (side-to-side) in the vehicle. The transmission and differential are both housed in a one-part lightweight alloy housing which is bolted to the engine assembly. The differential is supported by two opposed ball bearings. Preload or clearance on both differentials is maintained by means of a selected shim. The inboard constant velocity joints are positively connected with the differential side gears by means of splines and secured in the case with two circlips. The final drive gear is riveted to the differential case. Service replacement of the final drive gear or the differential case requires that the rivets be drilled or pressed out of the case and service nuts and bolts installed.



## DESCRIPTION (Continued)

The following illustration shows the exploded view of the differential assembly.



E4167-A

## OPERATION

Torque is transmitted from the engine through the transaxle output shaft to the final drive gear which is riveted to the differential case. Inside the case, two differential pinion gears are mounted on the differential pinion shaft which is pinned to the case. These pinion gears are engaged with the side gears to which the stub shafts are splined. Therefore, as the differential case turns, it rotates the constant velocity joints and the front wheel. When it is necessary for one wheel and shaft to rotate faster than the other, such as in turning a corner, the faster turning side gear causes the pinions to roll on the slower turning side gear to allow the differential action between the two constant velocity joints.

## REMOVAL AND INSTALLATION

## ATX Differential—In Vehicle

## Removal

Before beginning the Removal procedure, perform the following preliminary Steps:

- Position vehicle on a hoist. Refer to the Pre-Delivery manual, Section 50-04.
  - Raise hood.
  - Position fender covers.
  - Disconnect battery ground cable.
1. Remove bolts attaching managed air valve-to-transaxle valve body cover, if so equipped.
  2. Remove bolt that retains Thermactor hoses.

**CAUTION: Position hoses and valve away from brake tubing and master cylinder to avoid interference when raising transaxle.**

3. Raise vehicle on a hoist.

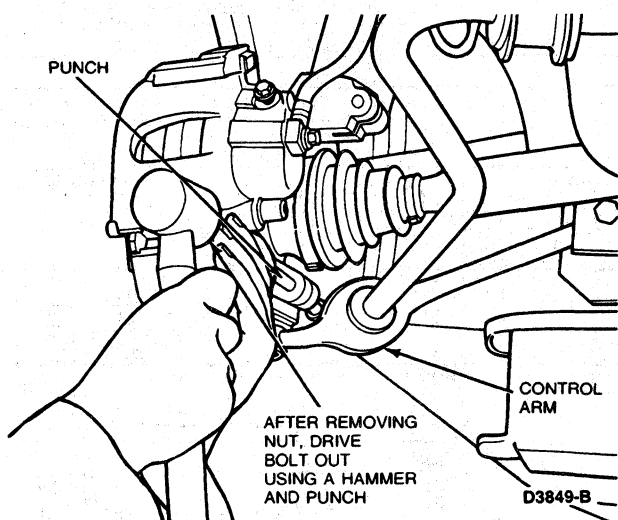
Remove front wheels and tires. Refer to Section 11-01.

Remove nut from control arm-to-steering knuckle attaching bolt (at the ball joint).

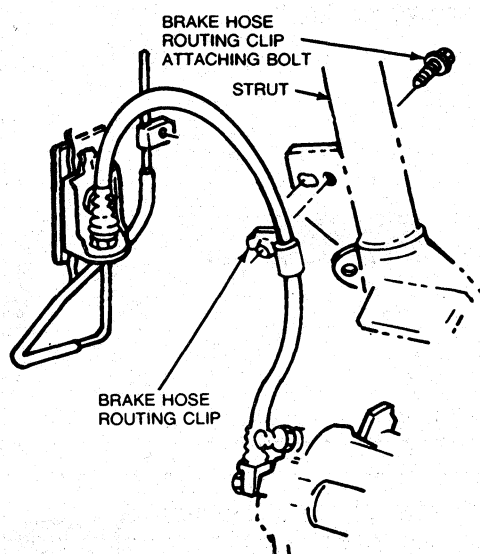
Drive bolt out of the knuckle using a punch and hammer.

Repeat this Step on remaining side.

**CAUTION: The nut and bolt must be discarded.**

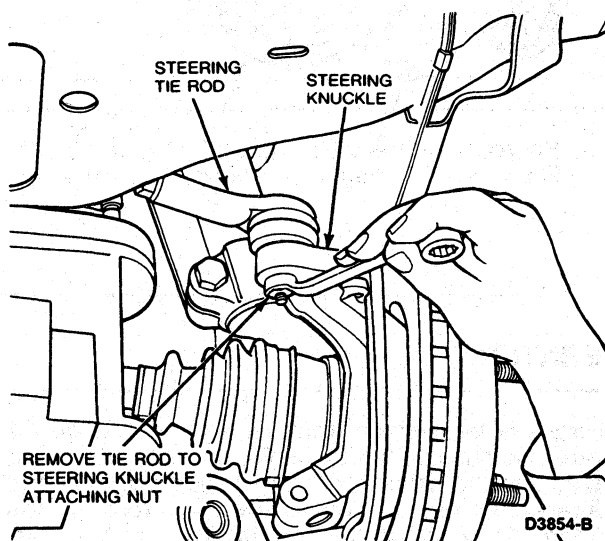


4. Remove bolt attaching brake hose routing clip to suspension strut.



5. Remove steering gear tie rod-to-steering knuckle using a pry bar.

Repeat this Step on remaining side.

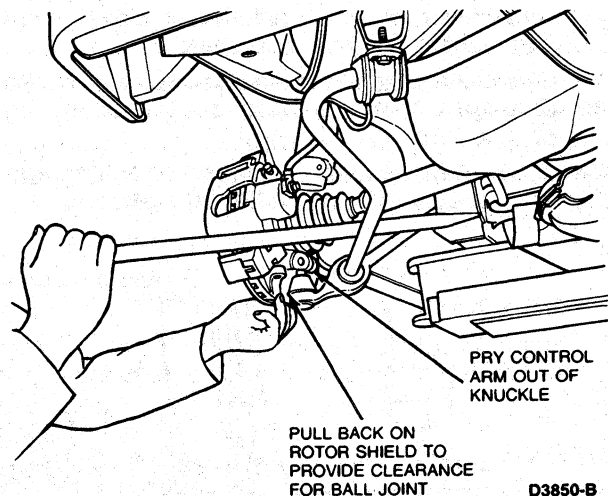


## REMOVAL AND INSTALLATION (Continued)

6. Disengage control arm steering knuckle using a pry bar.

Repeat this Step on remaining side.

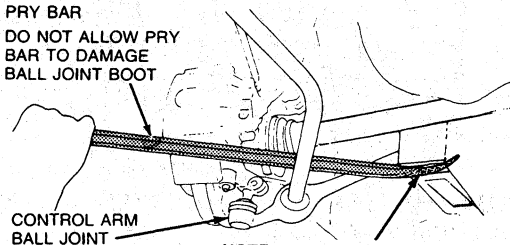
**CAUTION: Do not use a hammer on knuckle to remove ball joints.**



**NOTE:** The plastic shield installed behind the rotor contains a moulded pocket into which the lower control arm ball joint fits. When disengaging the control arm from the knuckle, clearance for the ball joint can be provided by bending the shield back toward the rotor. Failure to provide clearance for the ball joint may result in damage to the shield.

**NOTE:** Exercise care not to damage or cut ball joint boot. Pry bar must not contact lower arm.

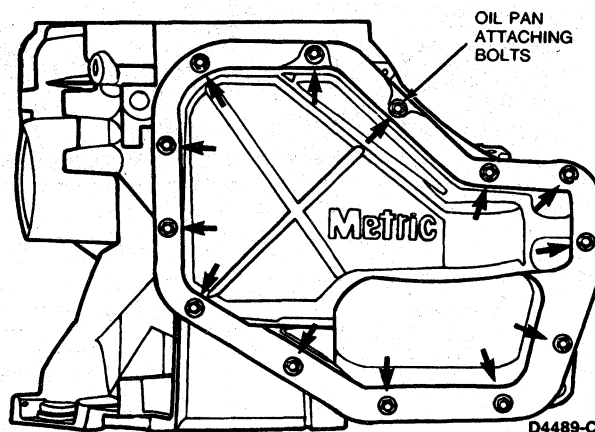
PRY BAR  
DO NOT ALLOW PRY BAR TO DAMAGE BALL JOINT BOOT



**NOTE: EXERCISE CARE NOT TO DAMAGE OR CUT BALL JOINT BOOT. PRY BAR MUST NOT CONTACT LOWER ARM.**

E4309-C

7. Remove 13 transaxle oil pan retaining bolts. Remove pan, drain fluid and discard gasket.

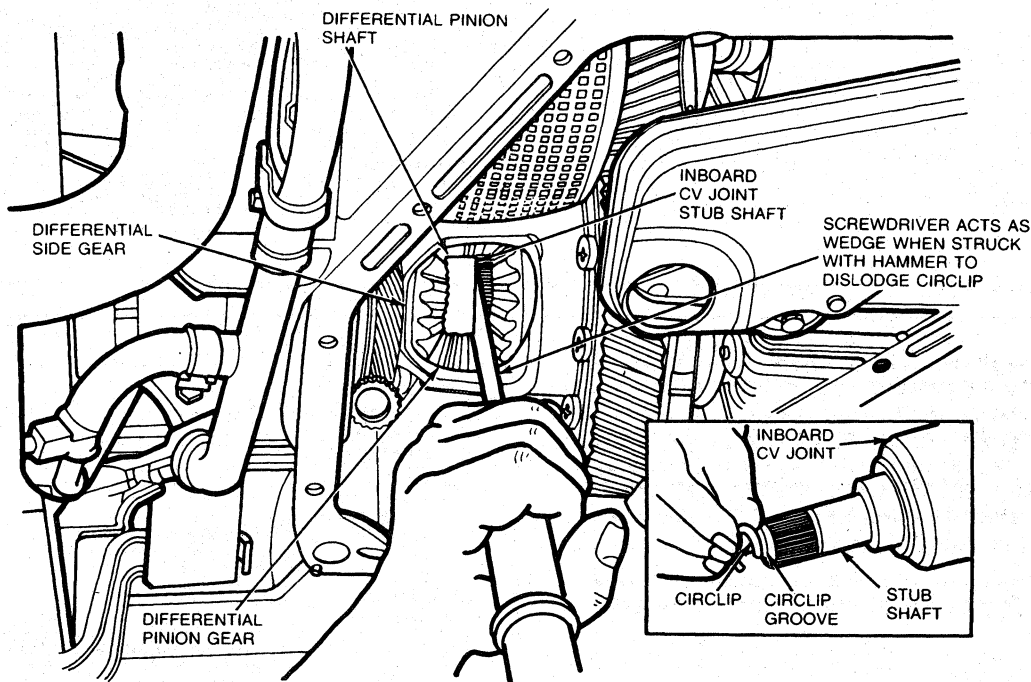


## REMOVAL AND INSTALLATION (Continued)

8. To remove halfshafts, insert a large-blade screwdriver between differential pinion shaft and inboard CV joint stub shaft.

Give a sharp tap to handle end of screwdriver to dislodge circlip from side gear, thus freeing halfshaft from the differential.

**CAUTION:** Care should be taken not to damage differential seals during halfshaft removal.

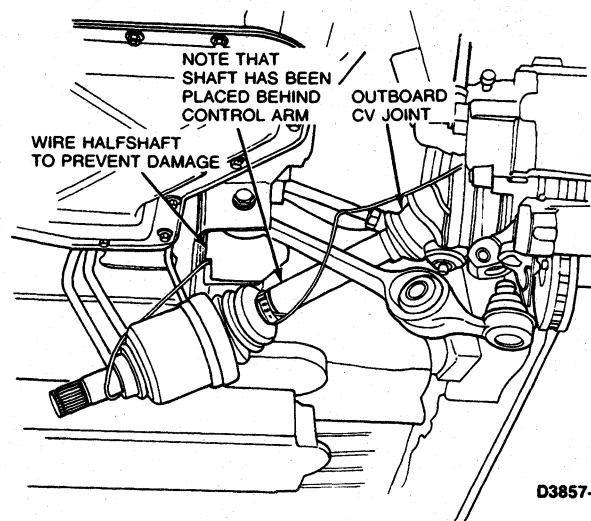


D6407-A

9. Pull halfshaft out of transaxle.

Support end of shaft by suspending from a convenient underbody component with a length of wire.

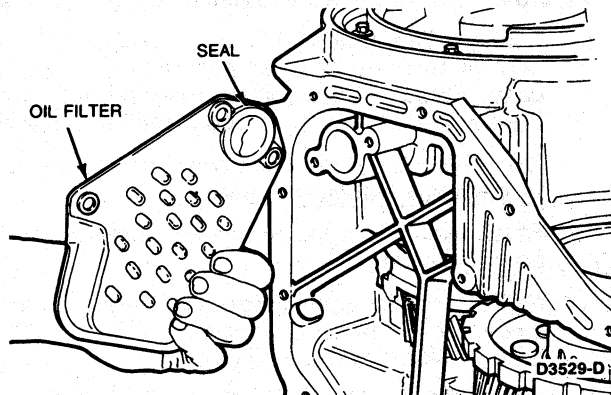
**NOTE:** Do not allow the shaft to hang unsupported as damage to the CV joints may result.



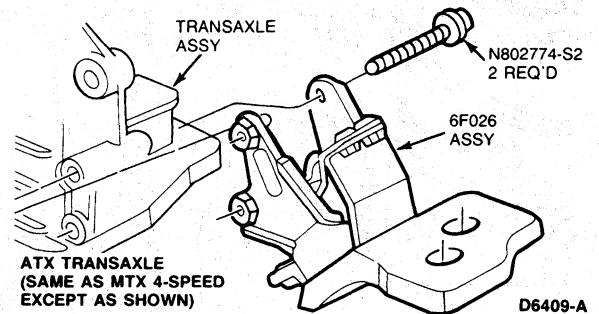
D3857-C

## REMOVAL AND INSTALLATION (Continued)

10. Remove three oil filter attaching bolts and remove filter. Thoroughly clean filter. Discard seal.

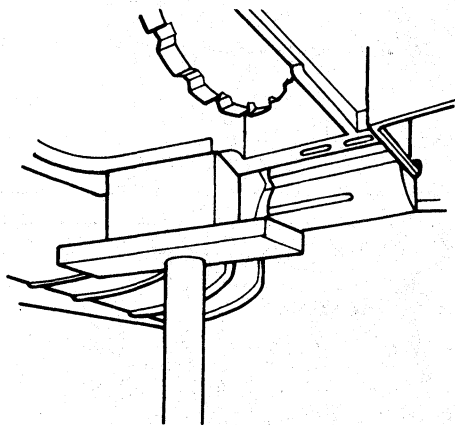


12. With jack supporting transaxle, remove two motor mount-to-transaxle attaching bolts. Remove rear mount assembly.

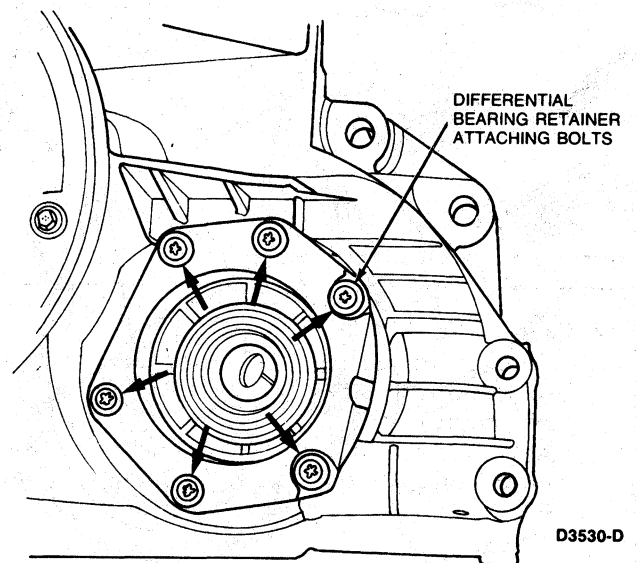


11. Position Rotunda Hi-Lift Jack 014-00210 or equivalent under rear oil pan rail of transaxle case. Place a wood block between jack and case to protect oil pan and case mating surface.

**CAUTION:** Extreme care should be taken not to damage transaxle case.

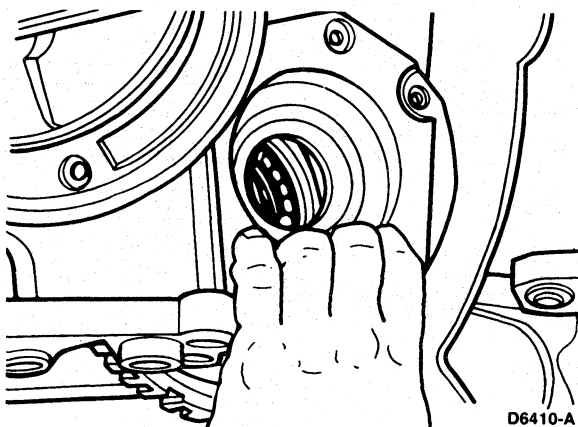


13. Remove six differential bearing retainer attaching bolts.



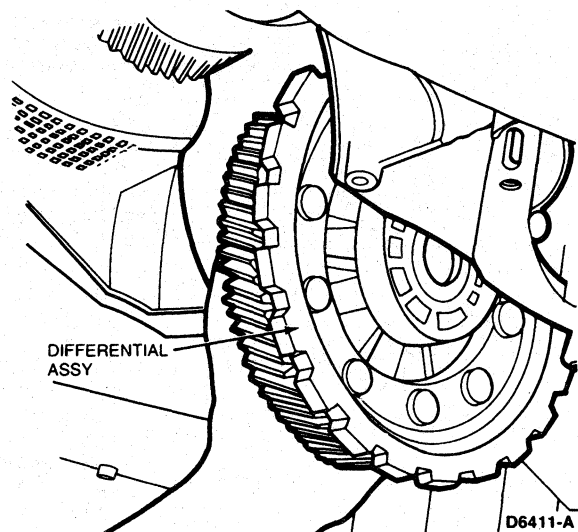
## REMOVAL AND INSTALLATION (Continued)

14. Raise Rotunda Hi-Lift Jack 014-00210 or equivalent to allow clearance for bearing retainer removal. Remove bearing retainer and shims while supporting differential.



D6410-A

15. Move differential assembly to the left to clear differential bearing. Remove from transaxle case.



D6411-A

## Installation

NOTE: If the differential case, bearing retainer, or differential bearing is replaced, reshimming will be required. Refer to Differential Ball Bearing End Play.

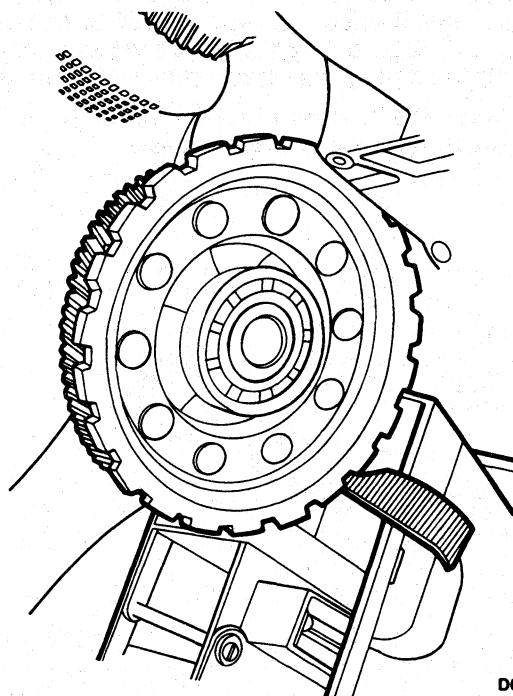
1. Position Rotunda Hi-Lift Jack 014-00210 or equivalent under rear oil pan rail of transaxle case. Place a wood block between jack and case to protect oil pan and case mating surface.

**CAUTION: Extreme care must be taken not to damage transaxle case.**

2. Raise jack high enough to allow installation of bearing retainer.

NOTE: Inspect both differential seals for any evidence of damage. Replace, if necessary, prior to differential installation.

3. Install differential, shims, and bearing retainer using new O-ring seal or gasket.



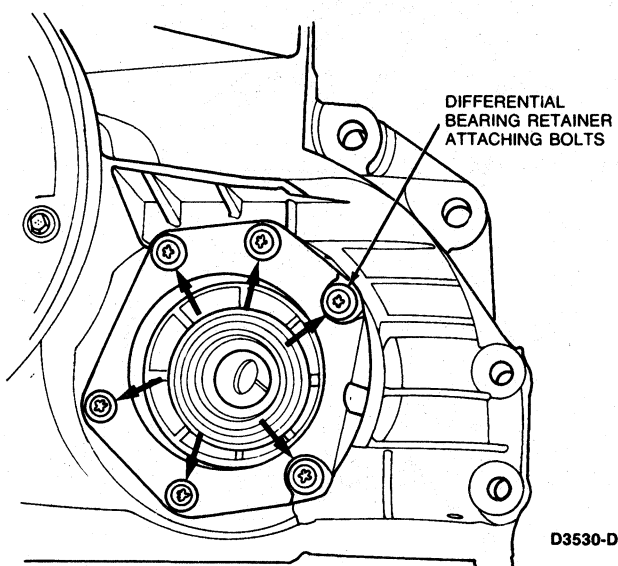
D6412-A



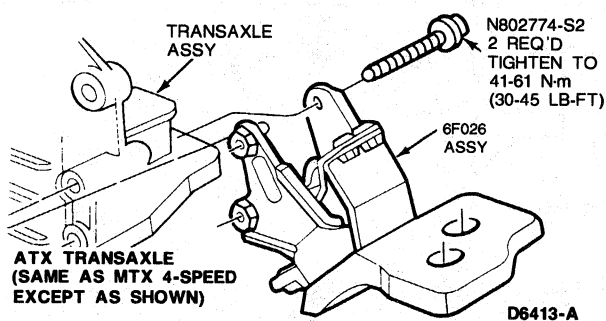
## REMOVAL AND INSTALLATION (Continued)

4. Apply Threadlock and Sealer E0AZ-19554-A or equivalent to threads of bearing retainer attaching bolts.

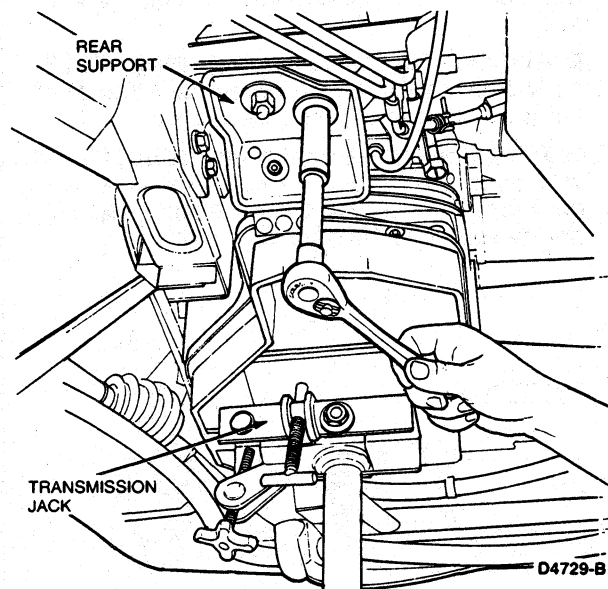
Install bolts. Tighten to 20-26 N·m (15-19 lb-ft).



5. Lower jack far enough to install rear motor mount on transaxle. Install two mount bolts. Tighten to 41-61 N·m (30-45 lb-ft).



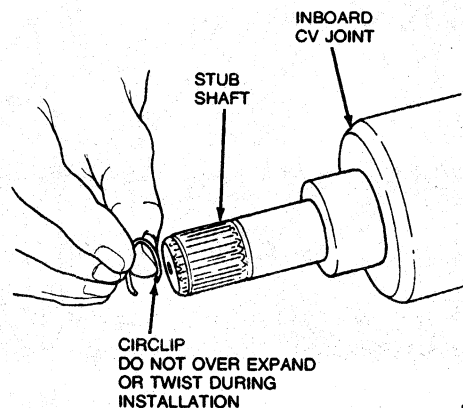
6. Install two support bracket attaching nuts. Tighten nuts to 61-88 N·m (45-65 lb-ft). Remove jack.



7. Install new circlips on inboard CV joint stub shafts.

**NOTE:** To install the circlip properly, start on end in the groove and work the circlip over the stub shaft end and into the groove. This will avoid over-expanding the circlip.

**CAUTION:** The circlip must not be reused. A new circlip must be installed each time the inboard CV joint is installed into the transaxle differential.



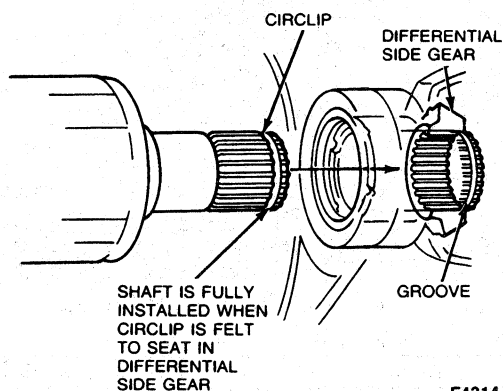
## REMOVAL AND INSTALLATION (Continued)

8. Carefully align splines of inboard CV joint stub shaft with splines in differential. Exerting some force, push CV joint into differential until circlip is felt to seat in differential side gear.

Use care to prevent damage to differential oil seal.

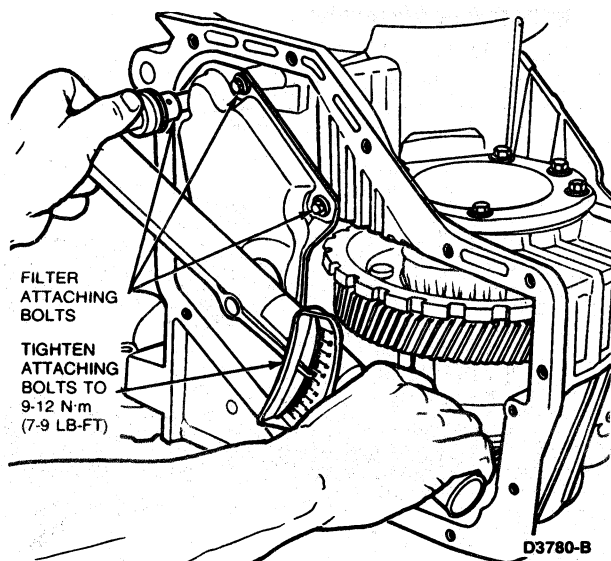
**CAUTION: Install Shipping Plug T81P-1177-B or equivalent to ensure alignment of CV joint stub shaft with side gear.**

**NOTE:** A non-metallic mallet may be used to aid in seating the circlip into the differential side gear groove. If a mallet is necessary, tap only on the outboard CV joint stub shaft.

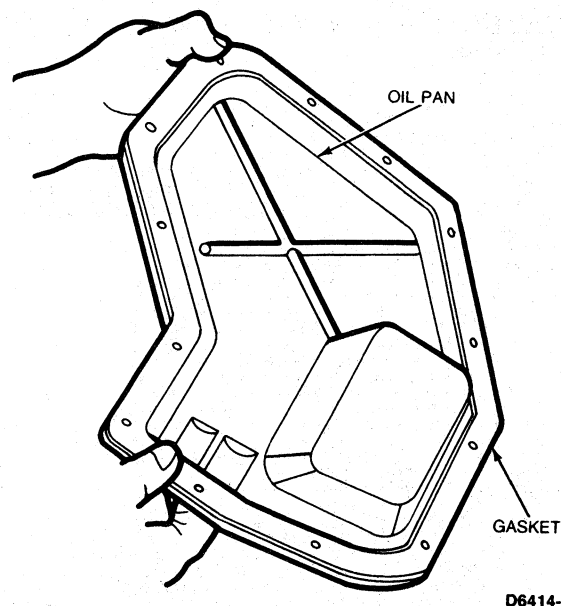


E4314-B

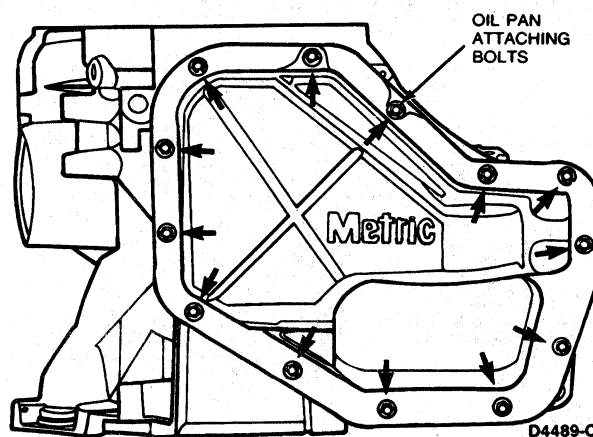
9. Position a new seal on filter and install filter. Install filter attaching bolts. Tighten to 9-12 N·m (7-9 lb-ft).



10. Install new oil pan gasket.



11. Install oil pan and 13 retaining bolts. Tighten alternately to 16-23 N·m (12-17 lb-ft).



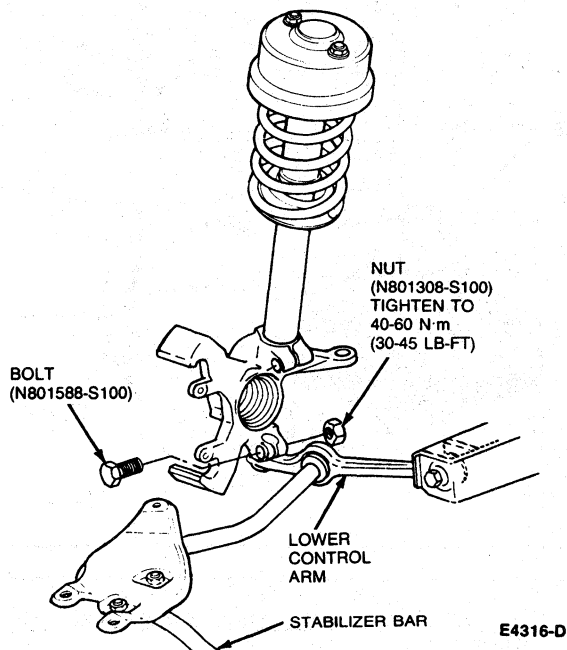
## REMOVAL AND INSTALLATION (Continued)

12. Connect control arm to the steering knuckle and install a new nut and bolt.

Tighten nut to 50-60 N·m (37-44 lb-ft).

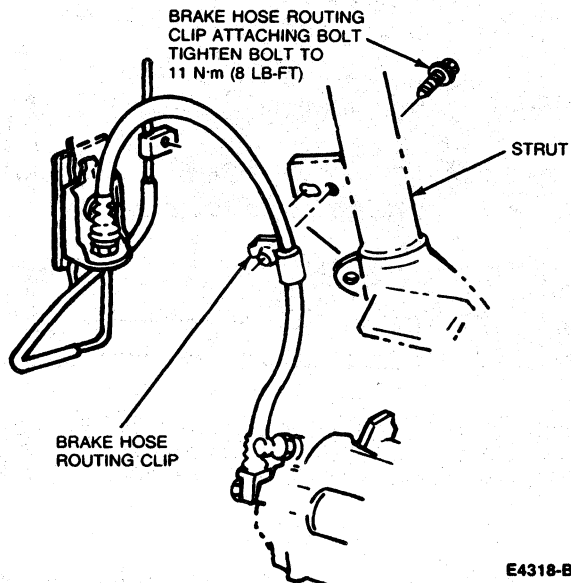
Repeat this Step on remaining side.

**CAUTION: A new bolt and nut must be installed.**



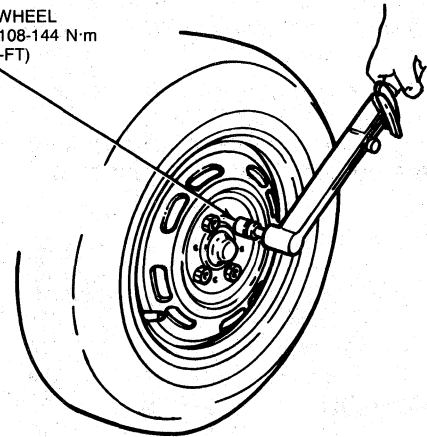
13. Position brake hose routing clip on suspension strut and install attaching bolt.

Tighten bolt to 11 N·m (8 lb-ft).



14. Install steering gear tie rod to steering knuckle using a new nut and cotter pin.  
Repeat this Step on remaining side.
15. Install wheels and tires. Lower vehicle.  
Tighten wheel nuts to 108-144 N·m (80-105 lb-ft).

TIGHTEN WHEEL NUTS TO 108-144 N·m (80-105 LB-FT)



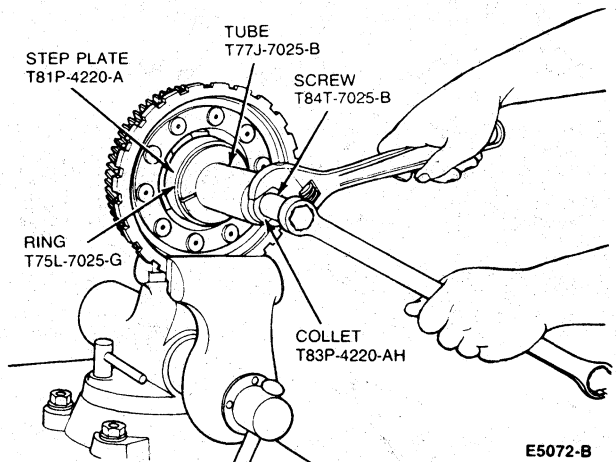
16. Install bolts attaching managed air valve to transaxle valve body cover, if so equipped.  
Install bolt retaining Thermactor hoses.
17. Connect battery ground cable.
18. Fill transaxle to the proper level as outlined.

## DISASSEMBLY AND ASSEMBLY

## Differential

## Disassembly

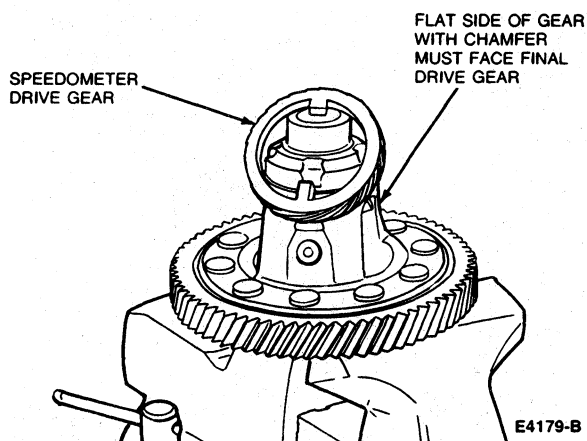
1. Remove both LH and RH differential bearings using the following special tools or equivalents:
- Screw: T84T-7025-B
  - Tube: T77J-7025-B
  - Ring: T75L-7025-G
  - Step Plate: T81P-4220-A
  - Collet: T83P-4220-AH



## DISASSEMBLY AND ASSEMBLY (Continued)

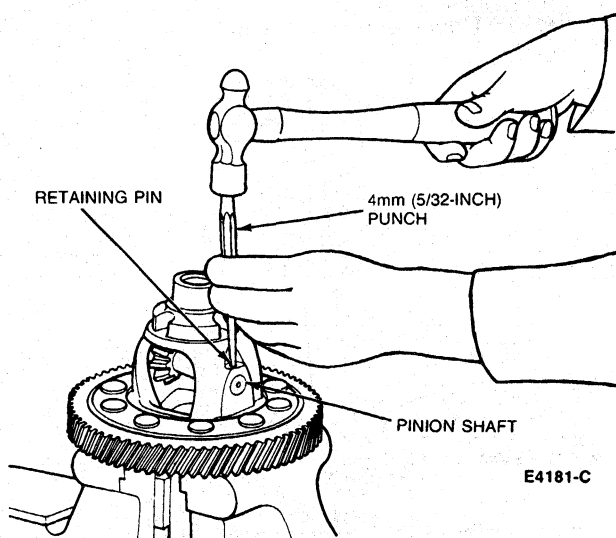
2. Remove speedometer drive gear.

The speedometer drive gear is plastic and is not pressed onto the differential case.

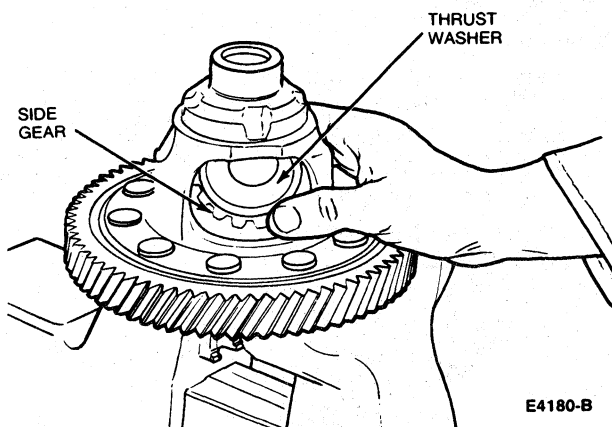


4. Drive out pinion shaft retaining pin using a 4mm (5/32-inch) punch.

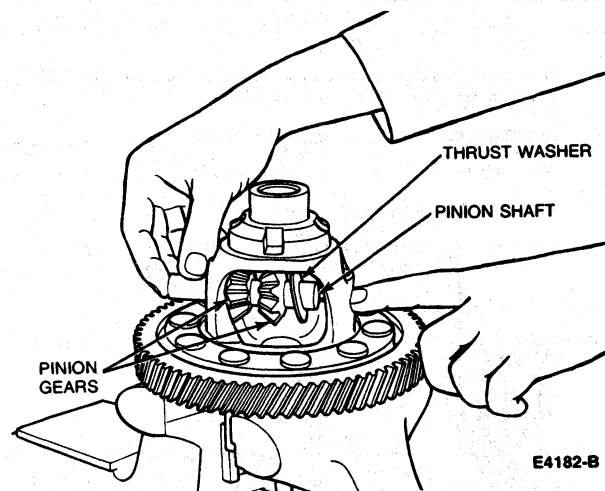
NOTE: Ensure the speedometer gear has been removed before removing the retaining pin.



3. Remove differential side gears by rotating gears toward case window.



5. Remove pinion shaft, pinion gears and thrust washer.

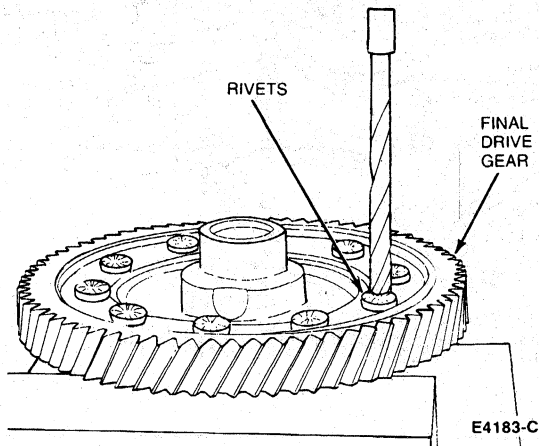


**DISASSEMBLY AND ASSEMBLY (Continued)**

6. If inspection indicates a need for final drive gear replacement, remove rivets using an 8mm (5/16-inch) drill.

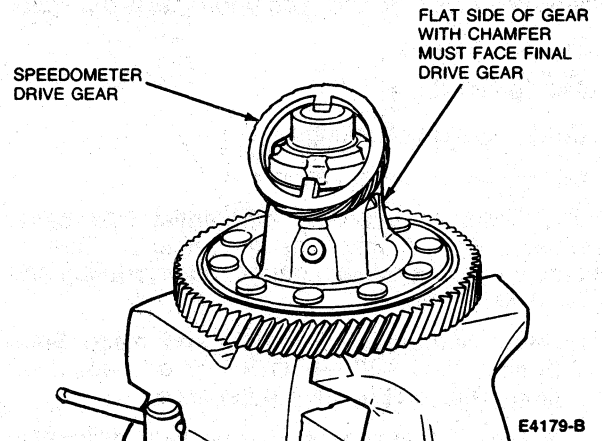
To prevent distortion of the case, drill the preformed side of the rivet only.

7. After drilling, remove head of the rivet using a chisel. Drive remaining rivet shank out using a punch.



4. Install speedometer drive gear.

NOTE: Install the drive gear with the bevel on the inside diameter facing the differential case.

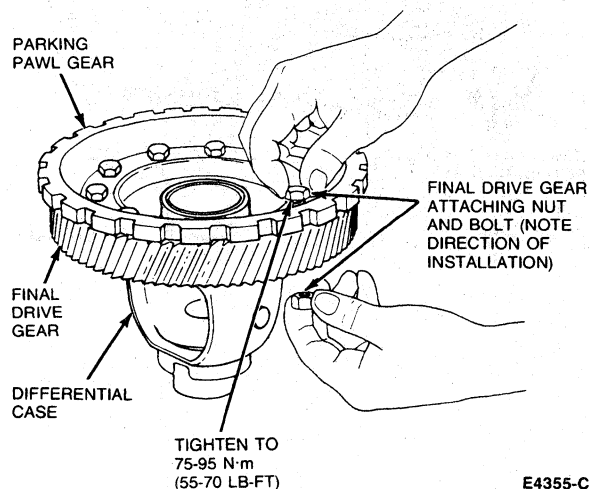
**Assembly**

To assemble the differential, reverse the Disassembly procedure except for the following:

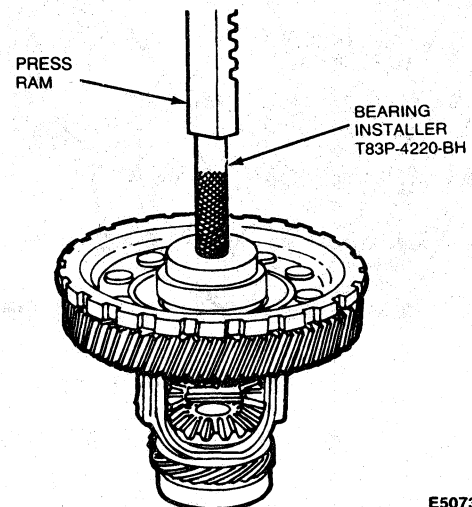
1. Lubricate thrust washer and thrust surfaces on the gears and differential case with automatic transmission fluid.
2. If removed, align and press final drive gear onto differential case.
3. Install gear attaching bolts and nuts. Tighten the bolts to 75-95 N·m (55-70 lb-ft).

Note direction of bolts.

Use only nuts and bolts supplied for service.



5. Install differential ball bearing using Bearing Installer T83P-4220-BH and Driver Handle T80T-4000-W or equivalent.



## MAJOR SERVICE OPERATIONS

### Differential Ball Bearing End Play

NOTE: The following procedures are shown with the transaxle out of the vehicle for illustration purposes only.

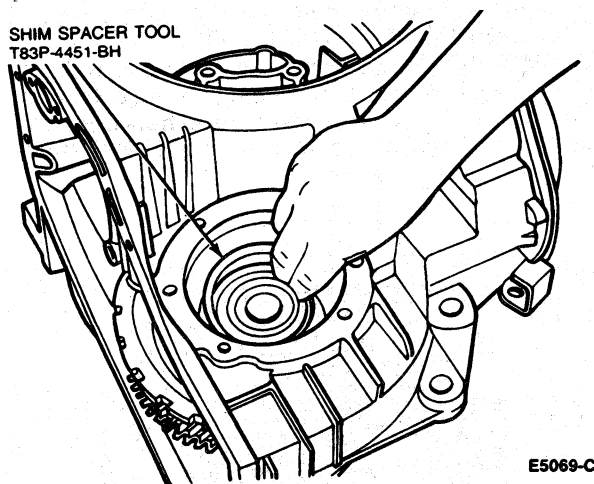
NOTE: The differential end play is set during manufacture and need not be checked or adjusted unless one of the following components is replaced:

- Transaxle Case
- Differential Case
- Differential Ball Bearings
- Differential Bearing Retainer

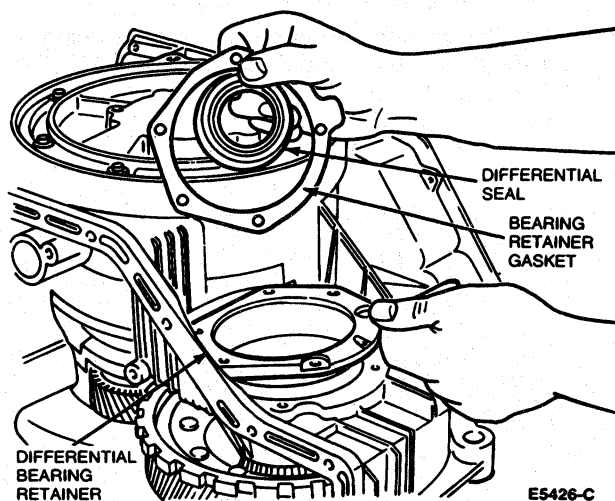
NOTE: Prior to installing differential into case, remove burrs on transaxle mounting surface to ensure an accurate feeler gauge reading during end play measurement.

1. Install differential assembly and place Shim Spacer Tool T83P-4451-BH or equivalent on differential ball bearing outer race.

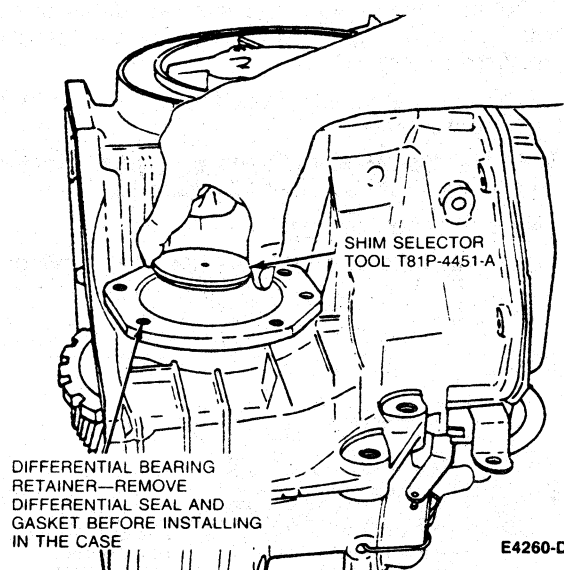
NOTE: To ensure shim selection accuracy, measure the Shim Spacer Tool T83P-4451-BH or equivalent to confirm that its thickness is 1.39-1.41mm (.054-.055 inch).



2. Remove differential bearing retainer oil seal, and gasket. Install bearing retainer back into case.

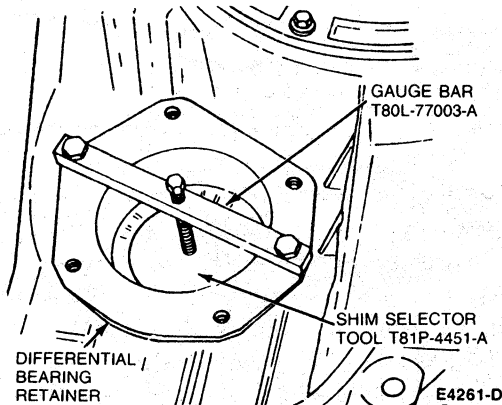


3. Install Shim Selector Tool T81P-4451-A or equivalent in the differential bearing retainer. Ensure tool is centered in the differential seal bore.



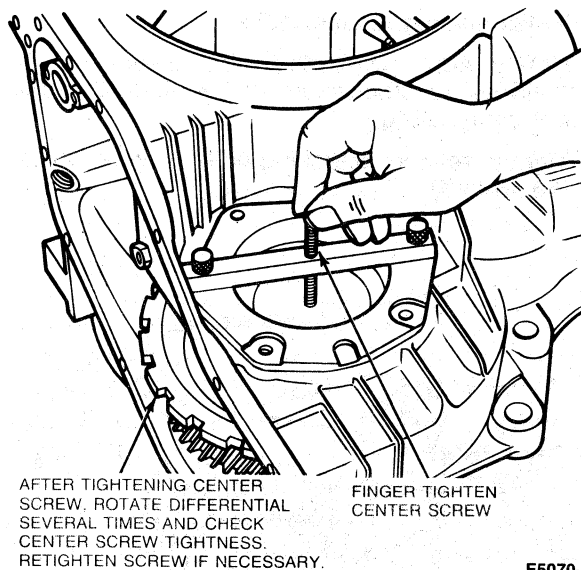
# MAJOR SERVICE OPERATIONS (Continued)

4. Position Gauge Bar T80L-77003-A or equivalent across differential bearing retainer and install two attaching bolts, finger-tight.



5. Tighten center screw on gauge bar finger-tight. After tightening, rotate the differential assembly several times and check tightness of screw.

Rotation of the differential ensures proper seating of bearings.



6. Using a feeler gauge, measure the gap between the bearing retainer and the case.

NOTE: Ensure there are no burrs present on the case mounting surface.

## Example

Obtain measurement from three positions around the tool and take the average of all the readings.

## Readings

.61mm (.024 inch)  
.65mm (.026 inch)  
.63mm (.025 inch)

## Total

1.89mm (.075)

## Average

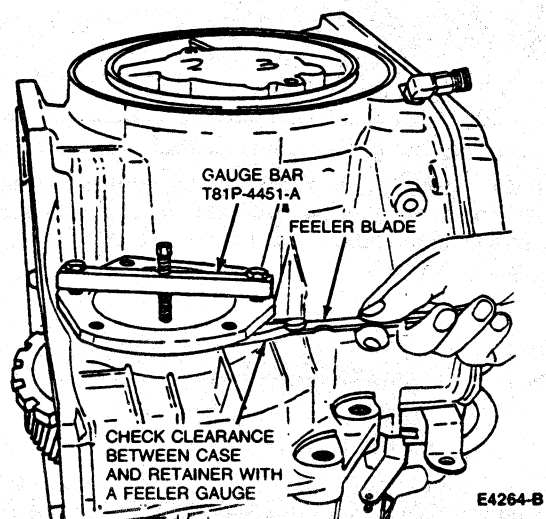
$1.89\text{mm} (.075) \div 3 = .63\text{mm} (.025 \text{ inch})$

To determine the shim needed, subtract the average reading and compressed gasket thickness of 0.29mm (0.011 inch) from 1.35mm (which is a constant based on Shim Spacer Tool T83P-4451-BH or equivalent).

Sample Calculation:

CONSTANT	1.35mm (.053 inch)
AVERAGE READING	.63mm (.025 inch)
GASKET THICKNESS	.29mm (.011 inch)
SHIM REQUIRED	.43mm (.017 inch)

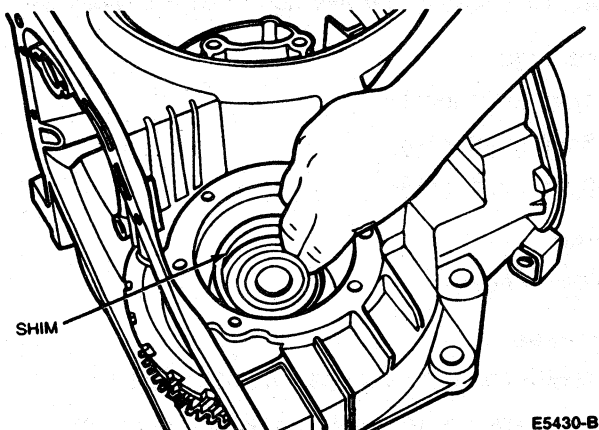
NOTE: Shims are available in thicknesses from 0.30-1.30mm (0.012-0.051 inch). If calculations result in shim thickness which falls between two available thicknesses, always use the thinner shim.



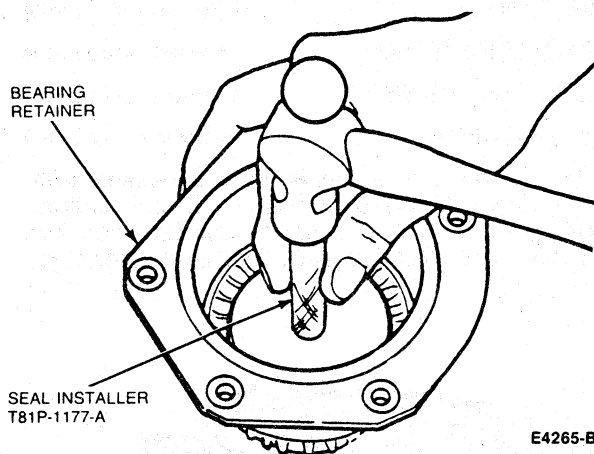
7. Remove gauge bar, shim spacer tool and bearing retainer.

## MAJOR SERVICE OPERATIONS (Continued)

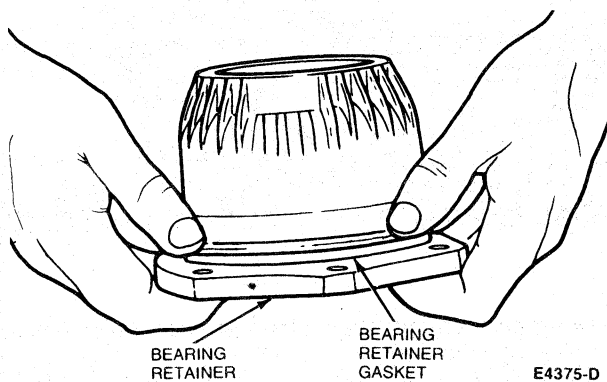
8. Install the new shim onto the differential ball bearing outer race.



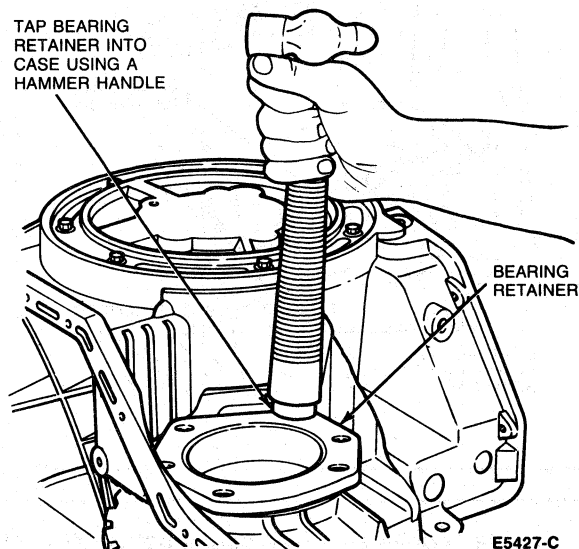
9. Install new seal in differential bearing retainer using seal Installer T81P-1177-A or equivalent.



10. Install new gasket on differential bearing retainer. Dip new gasket in automatic transmission fluid and install on differential bearing retainer.



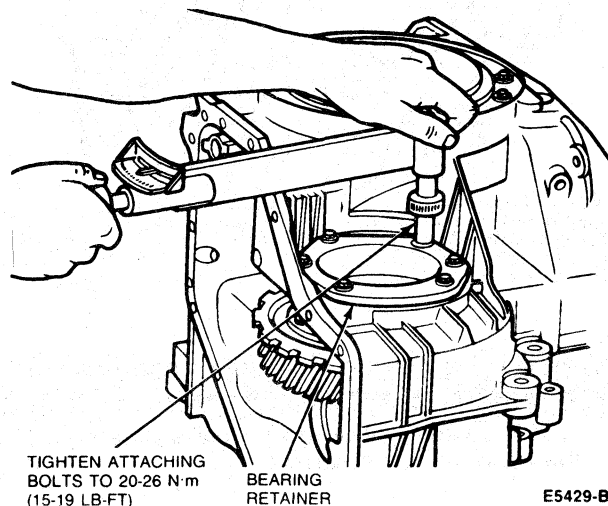
11. Install the bearing retainer by tapping with a hammer handle evenly around the outside edge of the retainer face.



12. Install bearing retainer bolts.

NOTE: Apply Threadlock and Sealer E0AZ-19554-A or equivalent to the bolt threads before installing.

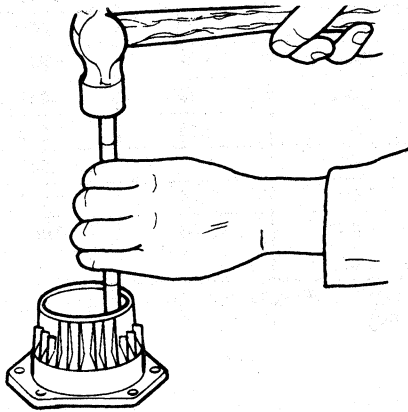
13. Tighten retainer attaching bolts to 20-26 N·m (15-19 lb-ft).





**MAJOR SERVICE OPERATIONS (Continued)****Differential Seals****Removal**

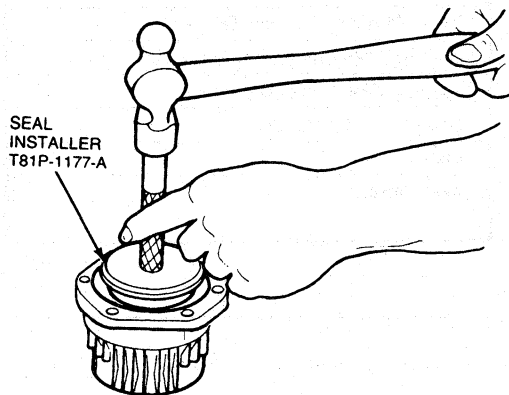
Remove differential seal from bearing retainer and case using a suitable drift.



E6293-A

**Installation**

Install differential seal in bearing retainer and case using Seal Installer T81P-1177-A or equivalent.



E6294-A

**CLEANING AND INSPECTION**

The differential case assembly should be inspected after it is removed from the transaxle. The inspection can determine the cause of the complaint and the action needed. Thoroughly clean all parts ensuring that new solvent is used to clean bearings. Do not spin dry bearings with compressed air. Oil the bearings immediately to prevent corrosion. Inspect the parts for any worn or damaged components. When a scored or chipped gear is replaced, the transaxle housing must be cleaned thoroughly to ensure that all chips are removed. Care should be exercised to avoid directly spraying the differential oil seals with solvent. Carefully wipe clean.

**Gears**

Examine the pinion and side gears for scoring, excessive wear, nicks and chips. Worn, scored and damaged gears cannot be rebuilt and must be replaced.

**Differential Case**

Ensure the differential bearing journals where the bearings mount are smooth. Carefully examine the differential case bearing shoulders, which may have been damaged when the bearings were removed. The bearings will fail if they do not seat firmly against the shoulders. Check the fit (free rotation) of the side gears in their cavities.

**Ball Bearing Assemblies**

Ensure all ball bearings operate smoothly in cages. Replace ball bearing assembly if roughness or excessive play is detected during inspection.

## SPECIFICATIONS

## ATTACHING TORQUE SPECIFICATIONS

Description	N·m	Lb·Ft
Final Drive Gear to Differential Case Attaching Bolts and Nuts (Service Only)	75-95	55-70
Differential Bearing Retainer to Transaxle Case	20-26	15-19
Transaxle Oil Screen Bolts	9-12	7-9
Transaxle Oil Pan Bolts	20-26	15-19

## CLEARANCE AND TOLERANCE SPECIFICATIONS

Description	mm	Inches
Differential Assembly Clearance	0.05	.002
Differential Shim Sizes	0.30-1.30	.012-.051

## LUBRICANT CAPACITIES

Transaxle	Liters	Quarts
Automatic	6.68	8.35①

①Motorcraft XT-2-QDX or DEXRON®-II.

## DIFFERENTIAL SHIM SIZE

mm	Inches	mm	Inches
0.30	0.012	0.85	0.033
0.35	0.014	0.90	0.035
0.40	0.016	0.95	0.037
0.45	0.018	1.00	0.039
0.50	0.020	1.05	0.041
0.55	0.022	1.10	0.043
0.60	0.024	1.15	0.045
0.65	0.026	1.20	0.047
0.70	0.028	1.25	0.049
0.75	0.030	1.30	0.051
0.80	0.032		

The shim is located inside the differential bearing retainer on the top of the ball bearing outer ring

CE4255-F

## SPECIAL SERVICE TOOLS

Tool Number	Description	Tool Number	Description
T57L-500-B	Bench Mounted Holding Fixture	T83P-4451-BH	Shim Spacer Tool
D81L-1002-A	Puller	T75L-7025-G	Ring — Differential Bearing Removal
T81P-1177-A	Differential Seal Replacer	T84T-7025-B	Screw — Differential Bearing Removal
T81P-1177-B	Shipping Plug	T77J-7025-B	Tube — Differential Bearing Removal
T83P-4220-AH	Collet — Differential Bearing Removal	T81P-7902-C	Torque Converter Handles
T83P-4220-BH	Differential Bearing Installer	T80L-19703-E	Installer
T81P-4220-A	Step Plate Differential Bearing Removal	T80T-4000-W	Driver Handle
T81P-4451-A	Shim Selection Tool		

CE4361-F

# SECTION 15-21 Differential—Manual 5-Speed Transaxle

SUBJECT	PAGE	SUBJECT	PAGE
<b>CLEANING AND INSPECTION</b>		<b>MAJOR SERVICE OPERATIONS</b>	
Bearing Cups .....	15-21-10	Differential Bearing Cups .....	15-21-8
Cone and Roller Assemblies .....	15-21-10	Differential Bearing Preload .....	15-21-5
Differential Case .....	15-21-9	Differential Seals .....	15-21-9
Gears .....	15-21-9	<b>SPECIAL SERVICE TOOLS</b> .....	15-21-10
<b>DESCRIPTION AND OPERATION</b> .....	15-21-1	<b>SPECIFICATIONS</b> .....	15-21-10
<b>DISASSEMBLY AND ASSEMBLY</b> .....	15-21-2	<b>VEHICLE APPLICATION</b> .....	15-21-1

## VEHICLE APPLICATION

Taurus/Sable.

## DESCRIPTION AND OPERATION

The 5-speed manual transaxle assembly consists of a transmission and differential, transversely mounted side-to-side in the vehicle. The transmission and differential are housed in a two-part lightweight alloy housing which is bolted to the engine assembly. The differential assembly is supported by two opposed tapered roller bearings and preload is maintained by means of a selected shim. The inboard constant velocity joints are positively connected with the differential side gears by means of splines and secured in the case with two circlips. The final drive gear is riveted to the differential case. Service replacement of the final drive gear or the differential case requires that the rivets be drilled and driven out of the case and service nuts and bolts be installed.

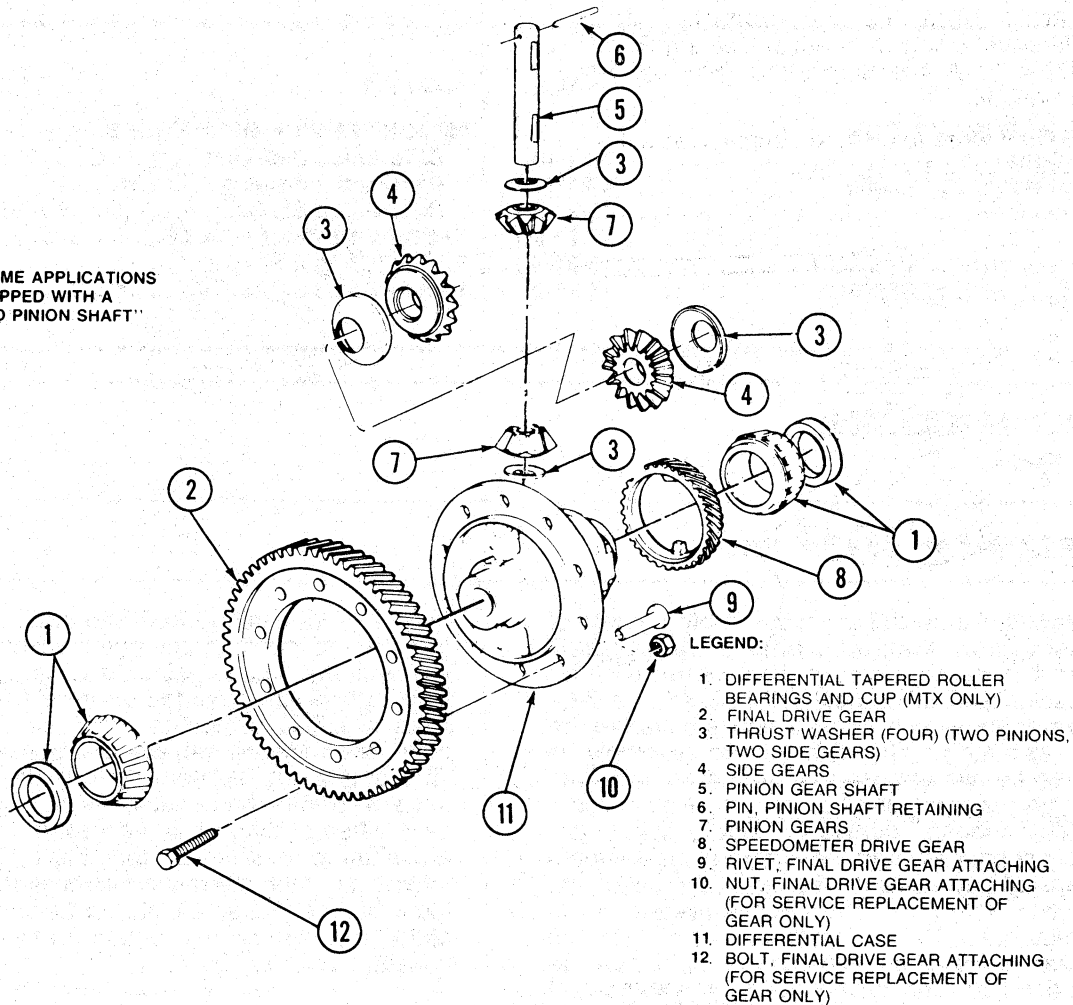
Torque is transmitted from the engine through the transaxle to the final drive gear which is riveted to the differential case. Inside the case, two differential pinion gears are mounted on the differential pinion shaft which is pinned to the case. These pinion gears are engaged with two side gears to which the stub shafts are splined. As the differential case turns, it rotates the constant velocity joints and the front wheels. When it is necessary for one wheel and shaft to rotate faster than the other, such as in turning a corner, the faster turning side gear causes the pinions to roll on the slower turning side gear to allow the differential action between the two constant velocity joints.

## DISASSEMBLY AND ASSEMBLY

Refer to Section 16-37 for Removal and Installation of the differential assembly from the 5-speed manual transaxle.

NOTE: Some applications are equipped with a "flatted" pinion gear shaft.

NOTE: SOME APPLICATIONS ARE EQUIPPED WITH A "FLATTED PINION SHAFT"

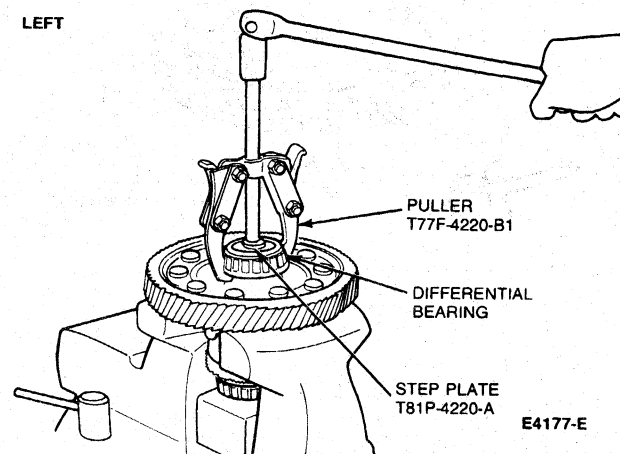


E4176-H

### Disassembly

1. Remove LH differential roller bearing using Differential Bearing Cone Remover T77F-4220-B1 and Step Plate T81P-4220-A or equivalent.

LEFT



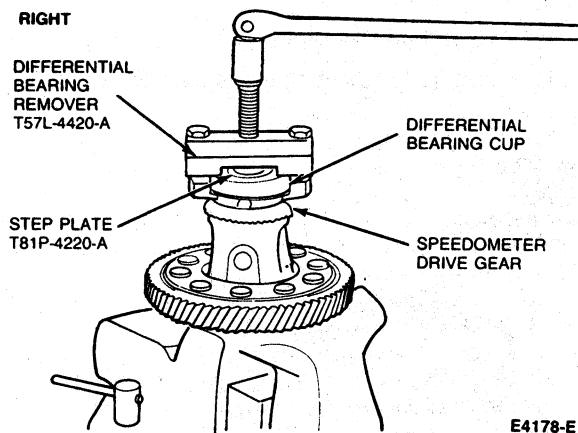
E4177-E

**DISASSEMBLY AND ASSEMBLY (Continued)**

2. Remove RH differential bearing cup from case and install over RH differential bearing.

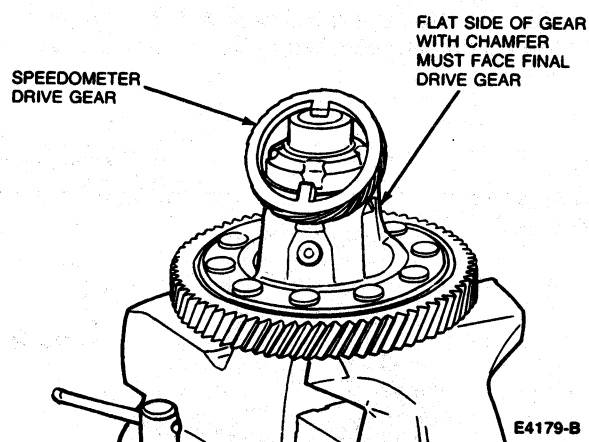
With the bearing cup in position, remove bearing from the speedometer side of differential using Differential Bearing Remover T57L-4220-A and Step Plate T81P-4220-A or equivalent.

**NOTE:** Failure to use the bearing cup will result in damage to the bearing.

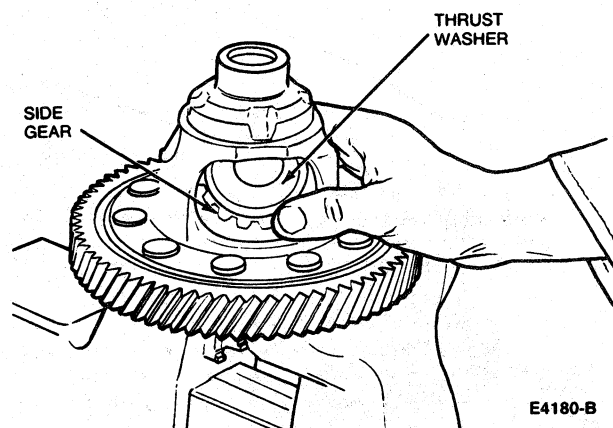


3. Remove speedometer drive gear.

The speedometer drive gear is plastic and is not pressed onto the differential case.

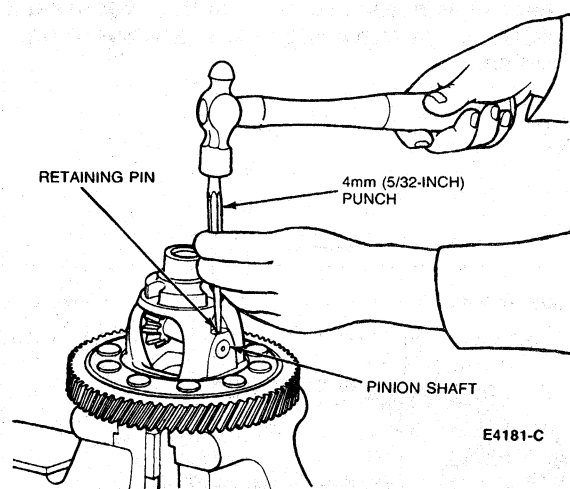


4. Remove differential side gears by rotating gears toward case window.



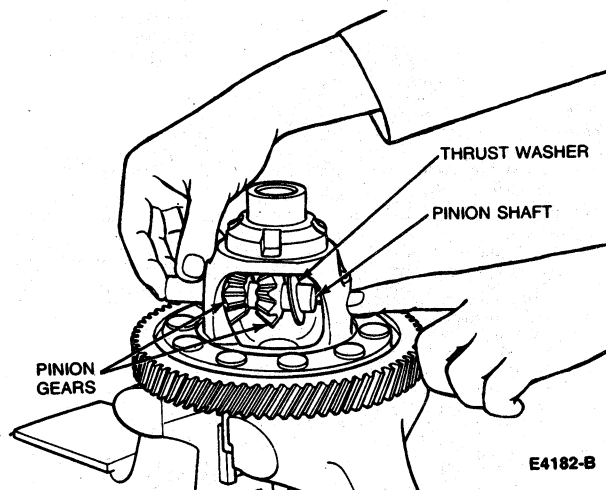
5. Drive out the pinion shaft retaining pin using a 4mm (5/32 inch) punch.

**NOTE:** Make sure the speedometer gear has been removed before removing the retaining pin.



**DISASSEMBLY AND ASSEMBLY (Continued)**

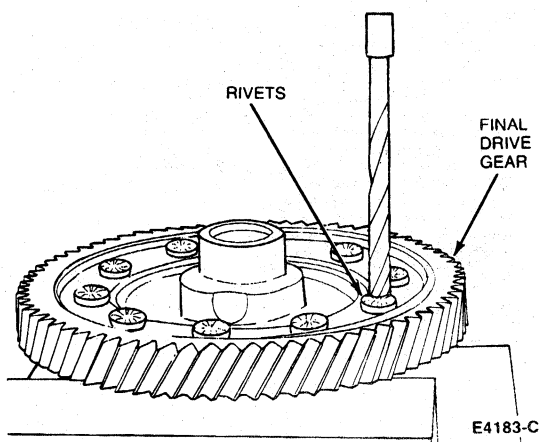
6. Remove pinion shaft, pinion gears and thrust washer.



7. If inspection indicates a need for final drive gear replacement, remove rivets using an 8mm (5/16-inch) drill.

To prevent distortion of the case, drill the preformed side of the rivet only.

After drilling, remove head of the rivet using a chisel. Drive remaining rivet shank out using a punch.

**Assembly**

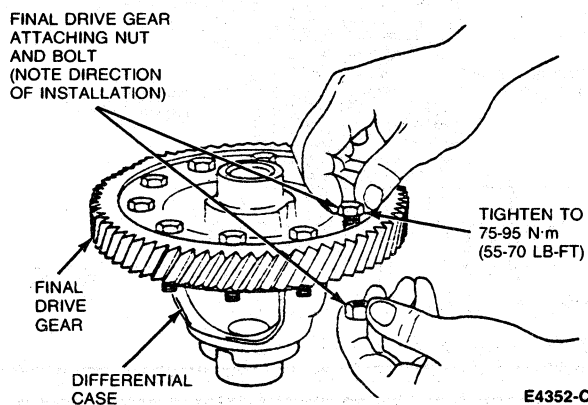
To assemble the differential, reverse the Disassembly procedure except for the following:

1. Lubricate thrust washer and thrust surfaces on the gears and differential case with automatic transmission fluid.
2. If removed, align and press final drive gear onto differential case.

Install gear attaching bolts and nuts. Tighten bolts to 75-95 N·m (55-70 lb-ft).

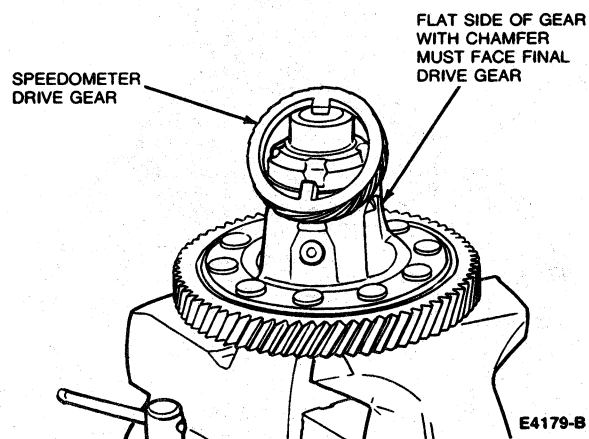
Note direction of bolts.

Use only nuts and bolts supplied for service.



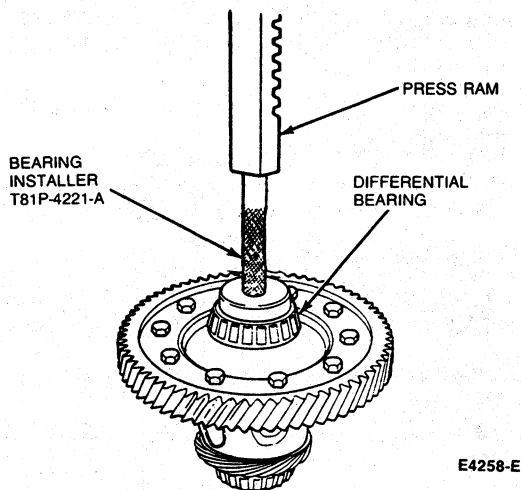
3. Install speedometer drive gear.

NOTE: Install the drive gear with the bevel on the inside diameter facing the differential case.

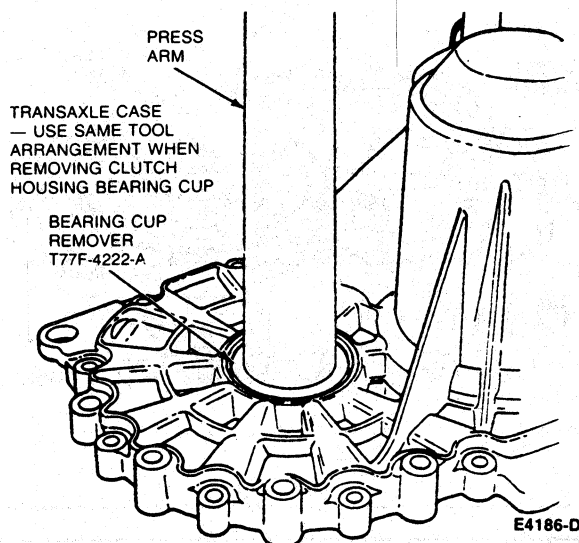


**DISASSEMBLY AND ASSEMBLY (Continued)**

4. Install differential roller bearings using Differential Bearing Cone Replacer T81P-4221-A or equivalent.



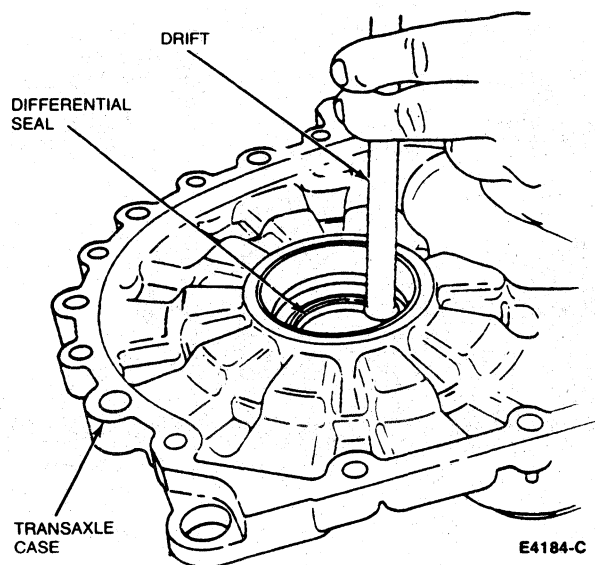
2. Remove the differential bearing cup from the transaxle case using Differential Bearing Cup Remover T77F-4222-A or equivalent.

**MAJOR SERVICE OPERATIONS****Differential Bearing Preload**

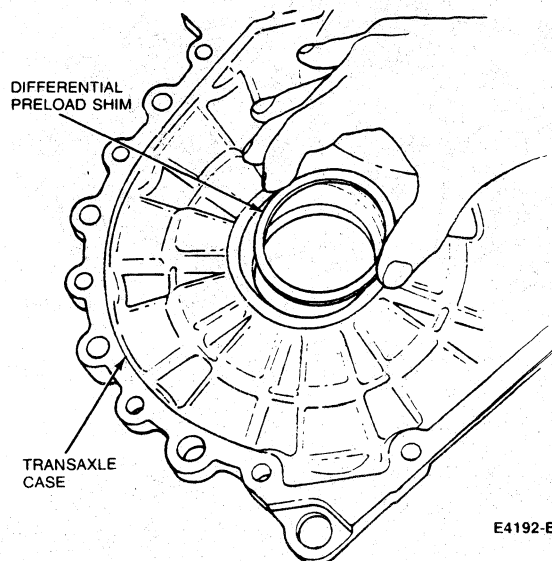
NOTE: The differential preload is set during manufacture and need not be checked or adjusted unless one of the following components is replaced:

- Transaxle Case
- Differential Case
- Differential Bearings
- Clutch Housing

1. Remove the differential seal from the transaxle case using a drift.

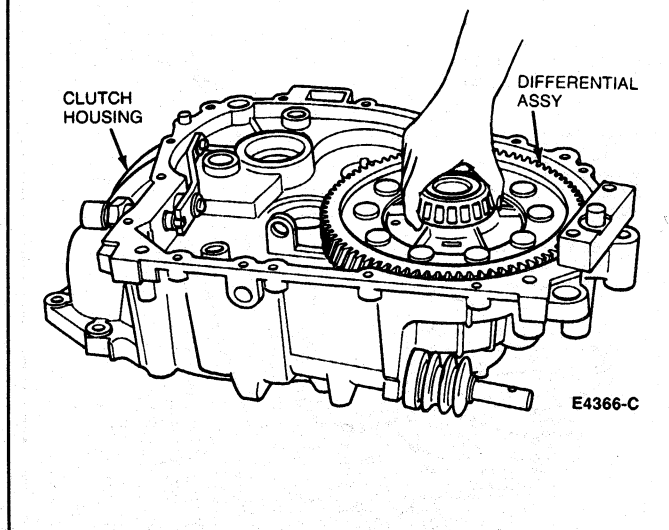


Remove the preload shim which is located under the bearing cup.

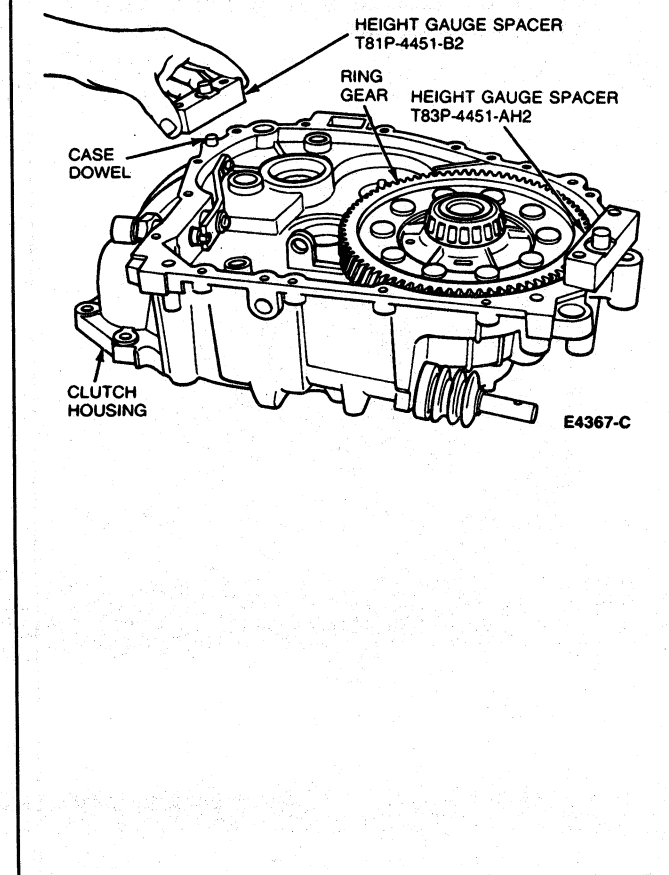


## MAJOR SERVICE OPERATIONS (Continued)

3. If removed, install the differential in the clutch housing.

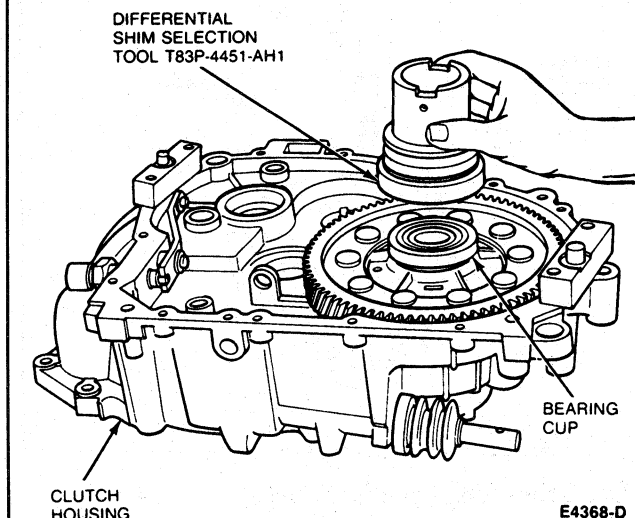


4. Install Height Gauge Spacers T81P-4451-B2 and T83P-4451-AH2 or equivalent on the clutch housing dowels.



5. Position the bearing cup removed from the transaxle case on the differential bearing.

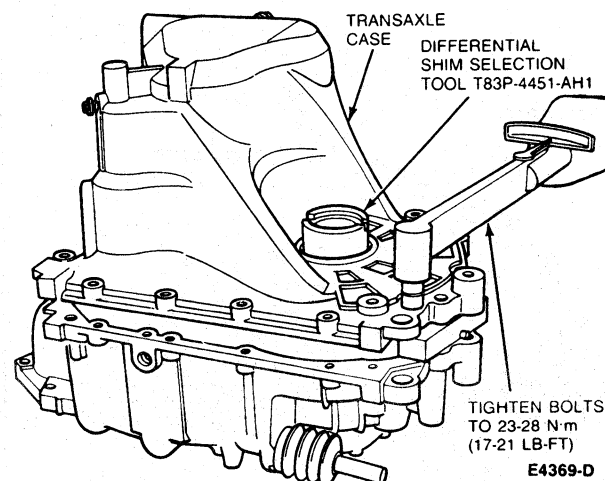
Install Differential Shim Selection Tool T83P-4451-AH1 or equivalent over the differential bearing cup.



6. Position the transaxle case on the height gauge spacer and install the four bolts supplied with the tool.

Tighten the bolts to 23-28 N·m (17-21 lb-ft).

Rotate the differential several times to ensure seating of the differential bearing.

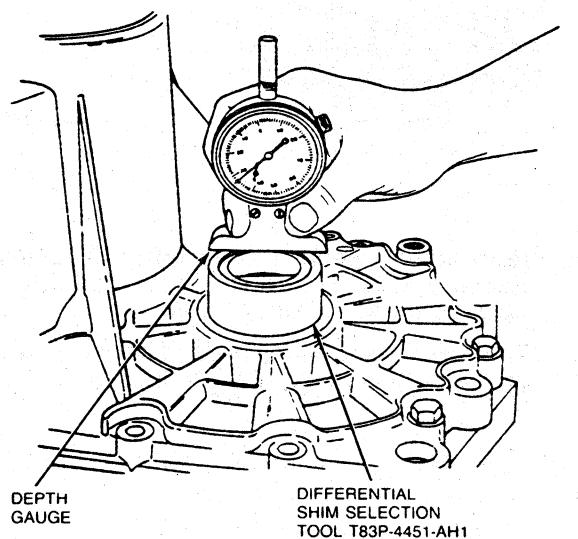
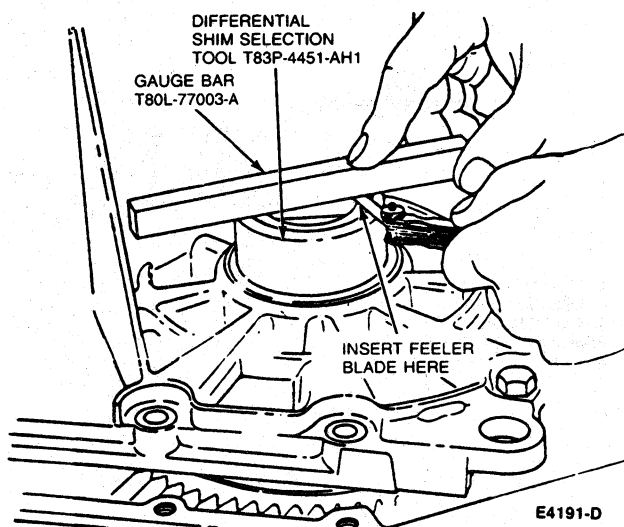




# MAJOR SERVICE OPERATIONS (Continued)

7. Position Gauge Bar T80L-77003-A or equivalent across the shim selection tool.

Using a feeler gauge, measure the gap between the gauge bar and the selector tool gauge surface. This measurement can also be made using a depth micrometer.



## EXAMPLE

Obtain measurements from three positions around the tool, and take the average of the readings.

### Readings:

Inches	mm
.014 inch	.36 mm
.013 inch	.33 mm
.015 inch	.38 mm
<u>.042 inch</u>	<u>1.07 mm</u>

### Average (shim required)

Inches	mm
$3/.042 \text{ inch} = .014 \text{ inch}$	$3/1.07 \text{ mm} = .35 \text{ mm}$

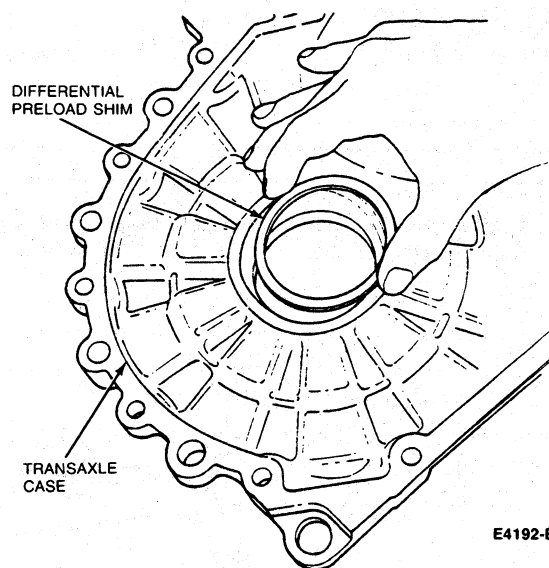
### Shim Required

Inches	mm
.014 inch	.35 mm

NOTE: Shims are available in thicknesses of .30mm -1.25mm (.012-.049 inch). Refer to Specifications. If the shim required is not on the chart, select the next thinner shim.

Before installing the shim, it should be measured with a micrometer to ensure it is the correct thickness.

8. Install the shim in the transaxle case.

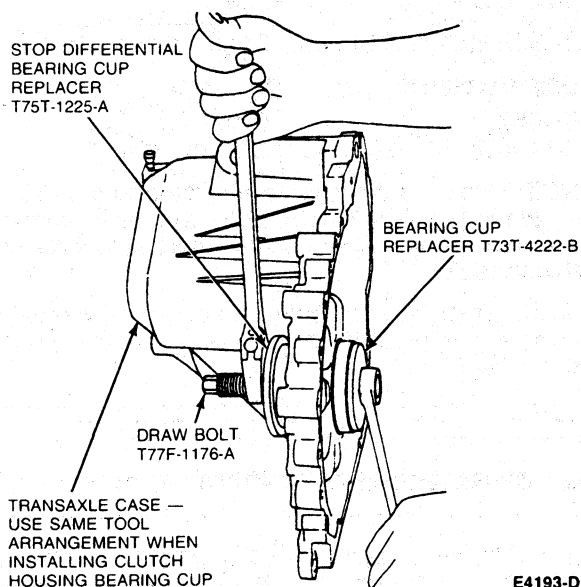


**MAJOR SERVICE OPERATIONS (Continued)**

9. Apply a light film of transmission fluid to the bearing bores in the transaxle case and clutch housing.

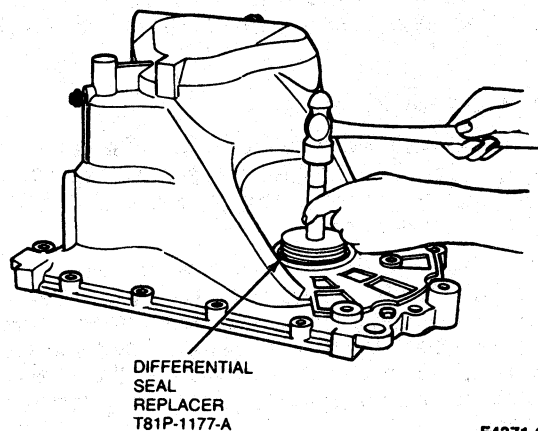
Install the bearing cup in the transaxle case, using Draw Bolt T77F-1176-A, Stop Differential Bearing Cup Replacer T75T-1225-A and Bearing Cup Replacer T73T-4222-B or equivalent.

Ensure the cup is fully seated against the shim in the transaxle case and against the shoulder in the clutch housing.



E4193-D

10. Install the differential seal using Differential Seal Replacer T81P-1177-A or equivalent.



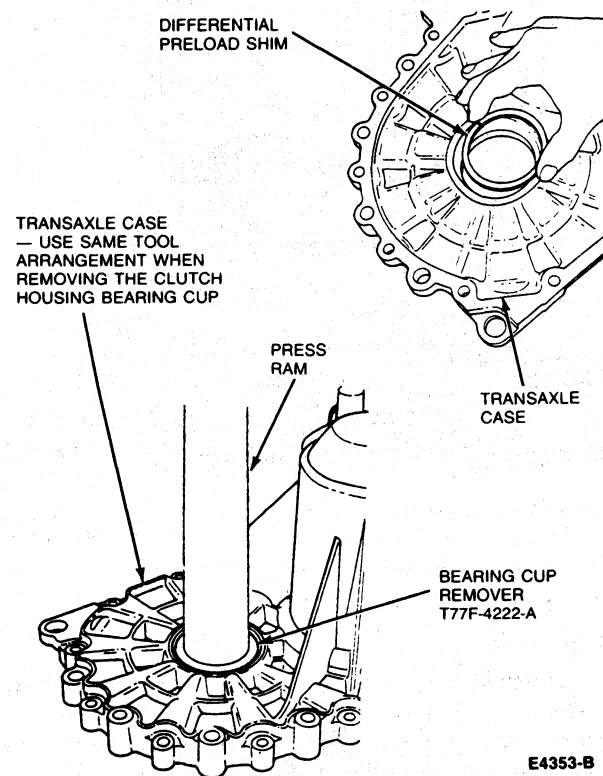
E4371-C

**Differential Bearing Cups**

NOTE: If the differential bearings and cups are being replaced, the bearing preload must be checked and if necessary, adjusted. After installing the bearings, adjust bearing preload as outlined.

**Removal**

1. Remove the differential oil seals as outlined.



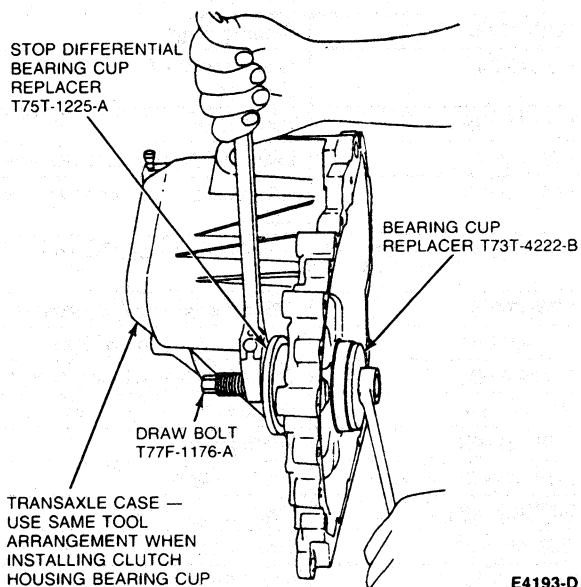
E4353-B

2. Remove the bearing cups using Differential Bearing Cup Remover T77F-4222-A or equivalent and an arbor press.

The differential bearing preload shim is located under the transaxle case bearing cup.

**MAJOR SERVICE OPERATIONS (Continued)****Installation**

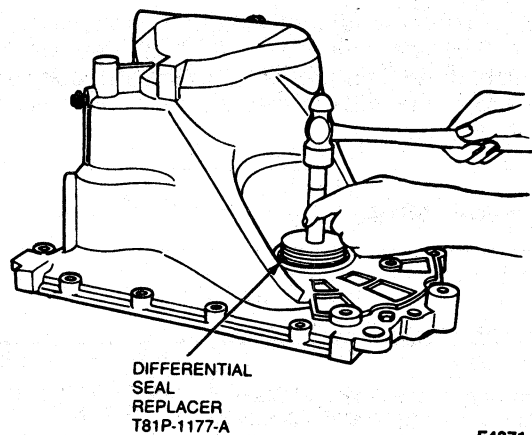
1. Apply a light film of transmission fluid to the bearing bores in the transaxle case.



2. Install the bearing cup using Draw Bolt T77F-1176-A, Stop Differential Bearing T75T-1225-A and Bearing Cup Replacer T73T-4222-B or equivalent.

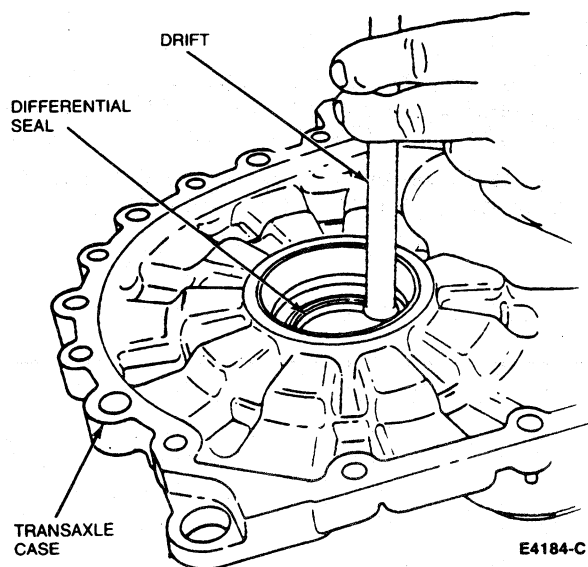
**Installation**

Install the seal using Differential Seal Replacer T81P-1177-A or equivalent.

**Differential Seals****Removal**

From the inside, remove the seal from the transaxle case using a drift.

**NOTE:** Repeat the same procedure for differential seal removal from the clutch housing.

**CLEANING AND INSPECTION**

The differential case assembly should be inspected after it is removed from the transaxle. Thoroughly clean all parts ensuring that new solvent is used to clean bearings. Do not spin dry bearings with compressed air. Oil the bearings immediately to prevent corrosion. Avoid directly spraying the differential oil seals with solvent. Carefully wipe the seals clean.

**Gears**

Examine the pinion and side gears for scoring, excessive wear, nicks and chips. Worn, scored and damaged gears cannot be repaired and must be replaced.

**Differential Case**

The mating surfaces of the differential case halves should be inspected for any nicks and/or burrs that may prohibit proper assembly. Remove nicks or small burrs.

Ensure the differential bearing journals are smooth. Carefully examine the differential case bearing shoulders, which may have been damaged when the bearings were removed. The bearings will fail if they do not seat firmly against the shoulders. Check the fit (free rotation) of the side gears in their cavities.

**CLEANING AND INSPECTION (Continued)****Bearing Cups**

Check bearing cups for scores, galling or spalling. If the bearing cups are not damaged, do not remove them from the transaxle case or the clutch housing. If the bearing cups must be replaced, remove and install them with the appropriate tools.

**Cone and Roller Assemblies**

Bearing rollers must turn without roughness in their cups. Examine the roller ends for step wear. If inspection reveals either a damaged cup or a damaged cone and roller assembly, both parts must be replaced.

**SPECIFICATIONS****ATTACHING TORQUE SPECIFICATIONS**

Description	N-m	Lb-Ft
Final Drive Gear to Differential Case Attaching Bolts and Nuts (Service Only)	108-136	80-100
Transmission Oil Fill Plug	12-20	9-14

CE4362-A

**LUBRICANT CAPACITIES**

Fluid Specification	Capacity	
	Liters	Pints
ESW-M2C33-F or DEXRON®II	2.91	6.1

CE4363-C

**DIFFERENTIAL SHIM SIZE**

mm	Inches	mm	Inches
0.30	0.012	0.80	0.032
0.35	0.014	0.85	0.033
0.40	0.016	0.90	0.035
0.45	0.018	0.95	0.037
0.50	0.020	1.00	0.039
0.55	0.022	1.05	0.041
0.60	0.024	1.10	0.043
0.65	0.026	1.15	0.045
0.70	0.028	1.20	0.047
0.75	0.030	1.25	0.049

The shim is located behind the differential bearing cup in the transmission case.

CE4364-A

**SPECIAL SERVICE TOOLS**

Tool Number	Description
T77F-1176-A	Draw Bolt
T81P-1177-A	Differential Seal Replacer
T81P-1177-B	Shipping Plugs
T75T-1225-A	Stop Differential Bearing Cup Replacer
T83P-4204-A1	Roll Pin Drill
T57L-4220-A	Differential Bearing Cone Remover
T77F-4220-B1	Differential Bearing Cone Remover/Installer
T81P-4220-A	Step Plate Differential Bearing Removal
T73T-4222-B	Differential Bearing Cup Replacer
T77F-4222-A	Differential Bearing Cup Remover
T81P-4451-B	Differential Shim Selection Tool
T80L-77003-A	Gauge Bar
T83P-4220-BH	Bearing Installer
T83P-4220-CH	Bearing Installer
T83P-4451-AH2	Height Gauge Spacer
T83P-4451-AH1	Shim Selector Tool
T81P-4451-B2	Height Gauge Spacer

CE4365-G

# SECTION 15-22 Halfshafts and CV Joints— Front-Wheel Drive

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## VEHICLE APPLICATION

Taurus/Sable.

## DESCRIPTION

The front-wheel drive halfshaft employs constant velocity (CV) joints at both its inboard (differential) and outboard (wheel) ends for vehicle operating smoothness. The CV joints are connected by an interconnecting shaft. The interconnecting shafts (LH and RH) are splined at both ends and are retained in the inboard and outboard CV joints by circlips.

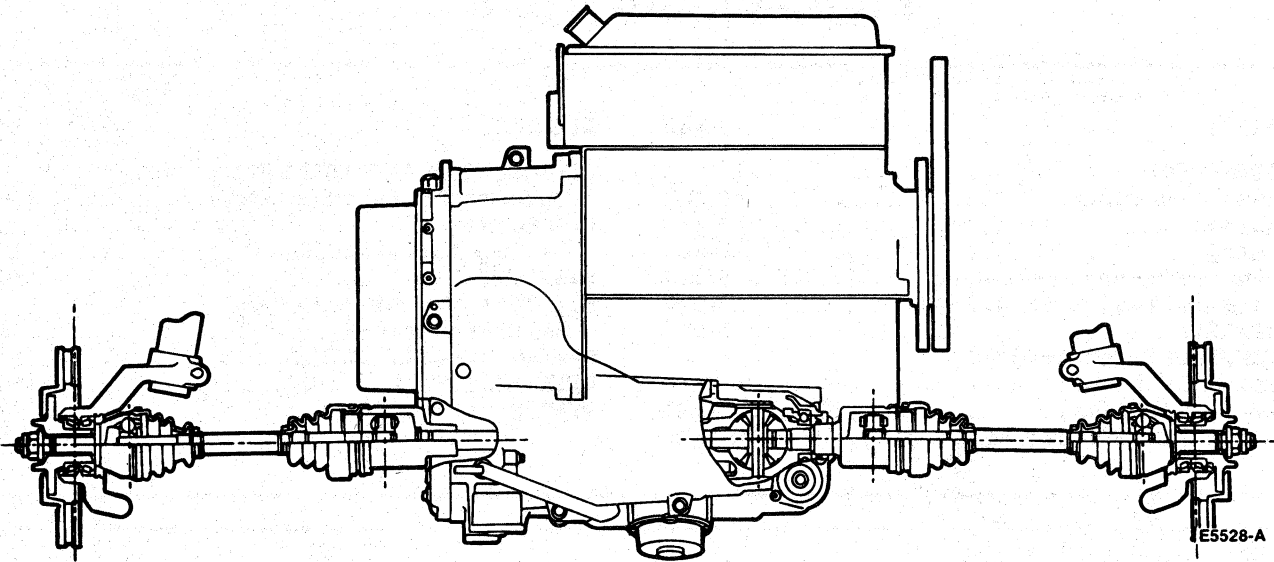
With the exception of the link shaft assembly used on the MTX and ATX transaxles on the RH side, the inboard CV joint stub shaft is splined and held in the differential side gear by a circlip. The link shaft assembly is retained by the support bearing. The outboard CV joint stub shaft is pressed on and secured with a prevailing torque nut. The CV joints are lube-for-life with a special CV joint grease and require no periodic lubrication. The CV joint boots, however, should be periodically inspected and replaced immediately when damage or grease

leakage is evident. Continued operation would result in CV joint failure due to contamination or loss of the CV joint grease.

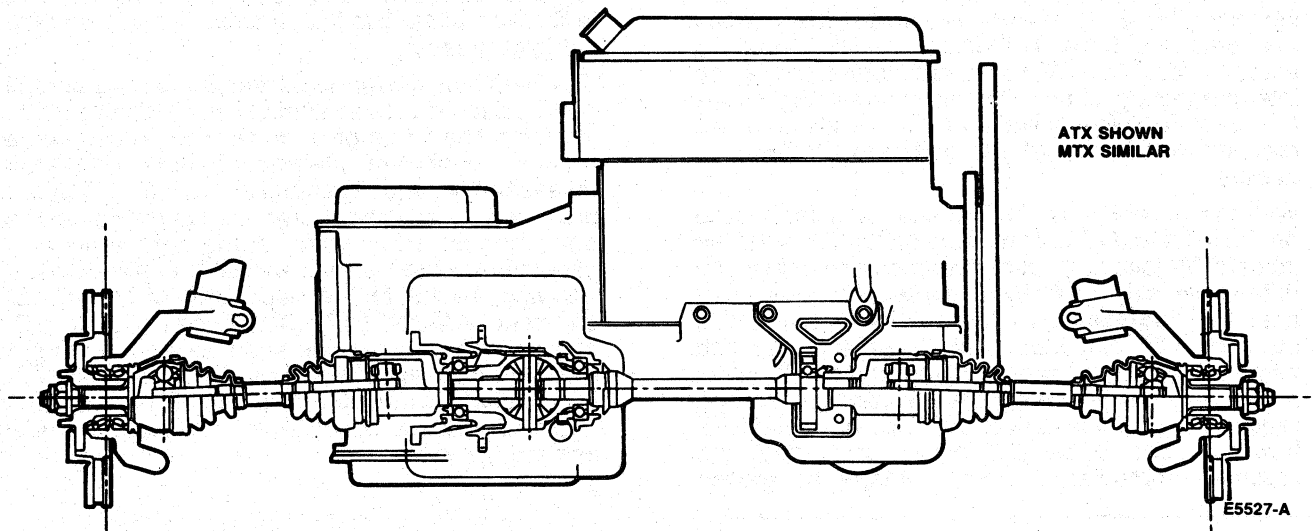
The halfshaft design is similar for both automatic and 5-speed transaxle applications. However, close attention should be given to service procedures as there are significant differences in design that affect disassembly and assembly. Halfshaft removal procedures also differ, however, between automatic and manual transaxles. Halfshaft removal is accomplished (on AXOD and MTX applications) by applying a load to the back face of the inboard constant velocity (CV) joint assembly. On ATX applications, the RH link shaft assembly must be removed from the transaxle in order to remove the LH halfshaft assembly. Performing this procedure in any other manner could result in damage to the LH inboard CV joint.

## DESCRIPTION (Continued)

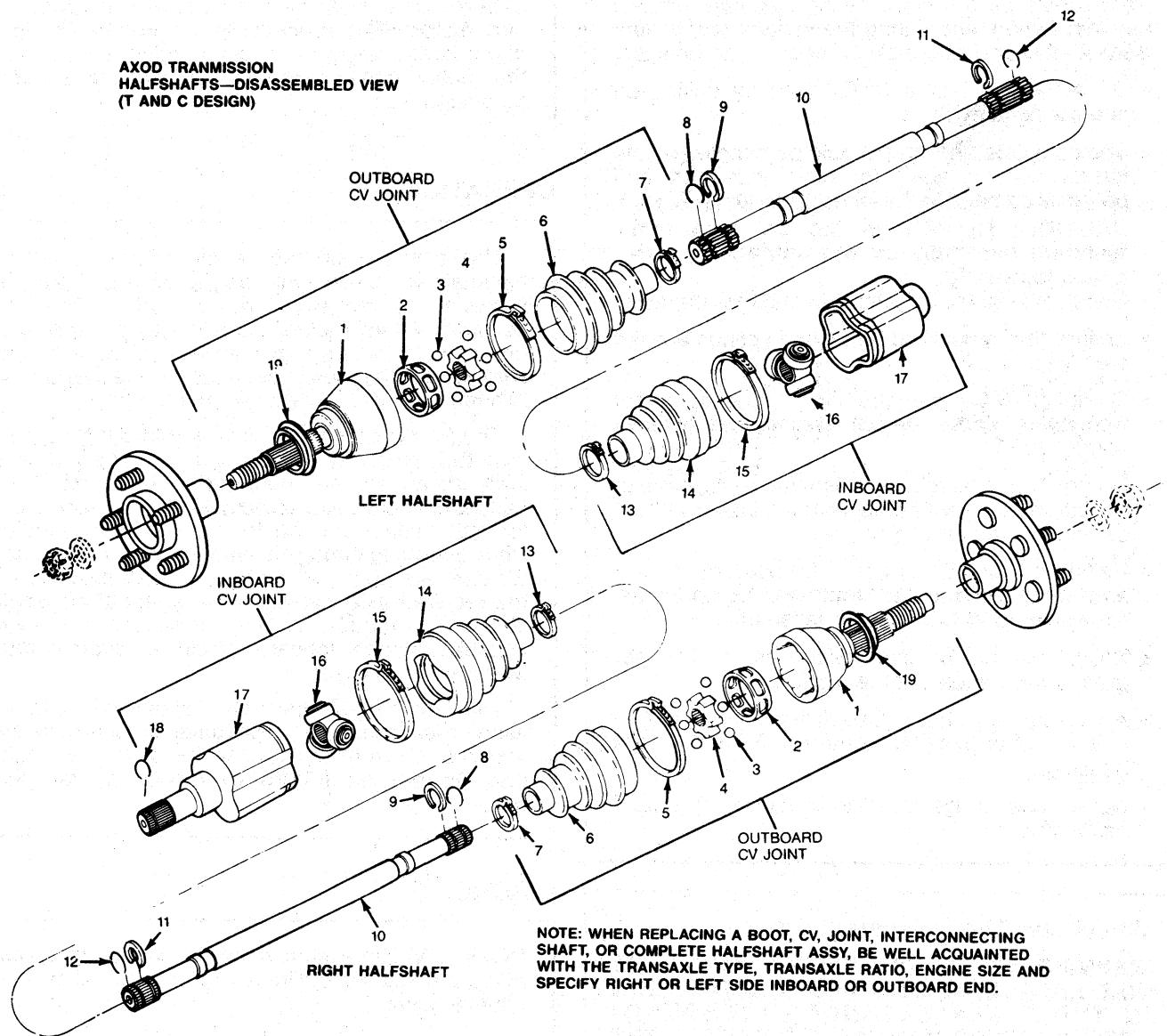
## AXOD



## MTX, ATX



## DESCRIPTION (Continued)



## LEGEND:

- |   |   |
|---|---|
| 1. OUTBOARD JOINT OUTER RACE AND STUB SHAFT | 11. STOP RING                               |
| 2. BALL CAGE                                | 12. CIRCLIP                                 |
| 3. BALLS (SIX)                              | 13. BOOT CLAMP (SMALL)                      |
| 4. OUTBOARD JOINT INNER RACE                | 14. BOOT                                    |
| 5. BOOT CLAMP (LARGE)                       | 15. BOOT CLAMP (LARGE)                      |
| 6. BOOT                                     | 16. INBOARD JOINT TRIPOD ASSY               |
| 7. BOOT CLAMP (SMALL)                       | 17. INBOARD JOINT OUTER RACE AND STUB SHAFT |
| 8. CIRCLIP                                  | 18. CIRCLIP                                 |
| 9. STOP RING                                | 19. DUST SEAL                               |
| 10. INTERCONNECTING SHAFT                   |   |

**DESCRIPTION (Continued)****Halfshaft Handling**

Care should be exercised during halfshaft removal and installation, and during the various component disassembly and assembly procedures as outlined.

- Do not remove inboard CV joint by pulling on interconnecting shaft.
- The complete halfshaft should be handled by the interconnecting shaft to avoid pull-apart and potential damage to the inboard plunging CV joint.  
**CAUTION: Never hold the CV joint and halfshaft assembly by the inboard or outboard joint only.**
- Do not over-angle CV joints beyond their capacity.
- Ensure that ground surfaces and splines are not damaged.
- Do not allow CV joint boots to come into contact with sharp edges or hot engine and exhaust components.
- Do not drop assembled halfshafts, as the impact will cut the CV joint boots from the inside without external evidence of damage.
- Halfshaft assembly is not to be used as a lever arm to position other front end components. Always support free end of halfshaft.
- Ensure internal CV joint cleanliness and proper grease refill when boot is replaced.
- An assembled inboard CV joint may be damaged if it is "over-plunged" outward from the joint housing.
- Never use a hammer to remove or install halfshafts.

**Undercoating and Rustproofing**

Extreme care must be taken during undercoating and rustproofing procedures to protect CV joint boots from coating materials. Foreign materials on the rubber boot convolutions will cause extreme advanced wear.

**OPERATION**

The primary purpose of the front-wheel drive halfshaft is to transmit engine torque from the transaxle to the front wheels. Additionally, the constant velocity joints used must be capable of operating at varying angles and provide a means for shaft length changes to allow for vertical suspension (wheel) and engine dynamic movement.

These requirements are satisfied by using constant velocity (CV) joints at the inboard (differential) end and outboard (wheel) end of the halfshaft. A constant velocity joint is a mechanism for transmitting uniform torque and rotary motion while operating through its angle range. The inboard CV joint is a "plunge" type joint which provides for the required axial movement to affect shaft length changes. The outboard CV joint has a higher angle capability than the inboard CV joint to accommodate wheel turning angles.

The front-wheel drive CV joints and halfshaft assemblies rotate at approximately one-third the speed of conventional rear wheel drive driveshafts and do not contribute to rotational vibration disturbances.

**Wheel and Tire Balancing, Front**

**WARNING: ON-VEHICLE FRONT WHEEL AND TIRE BALANCING WITH FRONT SUSPENSION IN THE FULLY EXTENDED (REBOUND) POSITION MAY OVERHEAT AND DAMAGE THE CV JOINTS. PROPER BALANCING REQUIRES THAT THE FRONT WHEEL(S) AND TIRE(S) BE LIFTED OFF THE GROUND BY PLACING A JACK UNDER THE FRONT SUSPENSION LOWER ARM.**

**ANOTHER METHOD IS TO REMOVE THE FRONT WHEEL(S) AND TIRE(S) FROM THE VEHICLE FOR BALANCING.**

**Hoisting**

Never raise vehicle using the halfshafts as lift points. Refer to the Pre-Delivery manual, Section 50-04.

**Towing**

Never tow vehicle using the halfshafts as anchor points for tow truck cable chains.

**DIAGNOSIS**

**NOTE:** CV joints should not be replaced unless disassembled as outlined and inspection reveals unusual wear.

**Noise and Vibration in Turns**

Clicking, popping or grinding noises while turning may be caused by the following:

1. Inadequate or contaminated lube in outboard or inboard CV joints.
2. Loose CV joint boot clamps.
3. Another component contacting halfshaft assembly.
4. Worn, damaged or improperly installed wheel bearing.

**Vibration at Highway Speeds:**

1. Out of balance front wheels or tires.
2. Out of round front tires.

**NOTE:** Halfshafts are not balanced and do not contribute to rotational vibration disturbances.



**DIAGNOSIS (Continued)****Shudder or Vibration During Acceleration:**

1. Excessively worn or damaged inboard or outboard CV joint.
2. Excessively high CV joint operating angles caused by improper ride height. Check ride height, verify proper spring rate and check items 1, 2 and 3 under Halfshaft or CV Joint Pullout.

**Halfshaft or CV Joint Pullout**

1. Engine/transaxle assembly mispositioned. Check engine mounts for proper location, damage or wear.
2. Frame rail or strut tower out of position or damaged.
3. Front suspension components worn or damaged. Check for worn bushings or bent components (stabilizer bar, control arm, etc.).
4. Inboard CV joint circlip missing or not properly seated in transaxle side gear.

**INSPECTION**

1. Inspect boots for evidence of cracks, tears or splits.

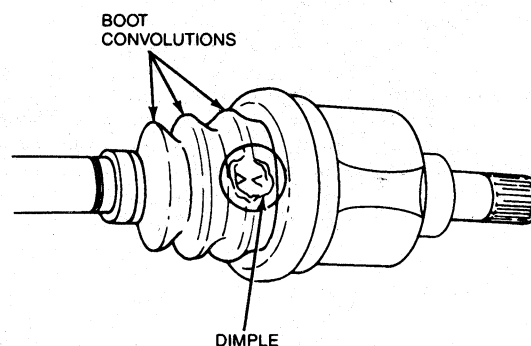
NOTE: While inspecting the boots, watch for indentations ("dimples") in the boot convolutions. If an indentation is observed, it must be removed. Refer to CV Joint Boot Indentation Removal procedure.

2. Inspect underbody for any indication of grease splatter in vicinity of CV joint boots, outboard and inboard locations, which is an indication of boot and/or clamp damage.
3. A boot vent is used on the RH inboard silicone boot on AXOD. The tri-lobe boot uses a pinhole vent inboard of the small clamp. The conventional boot uses a keyway vent between the interconnecting shaft and the boot under the small clamp. A small amount of grease leakage at the vent is normal.
4. Inspect for differential oil seal leakage at inboard CV joint.
5. Ensure wheel hub retainer nut is the correct prevailing torque type.
6. The silicone boot will sweat during operation, causing a light film of grease to show on the outside of the boot. This condition is normal.

**CV Joint Boot Indentation****Removal**

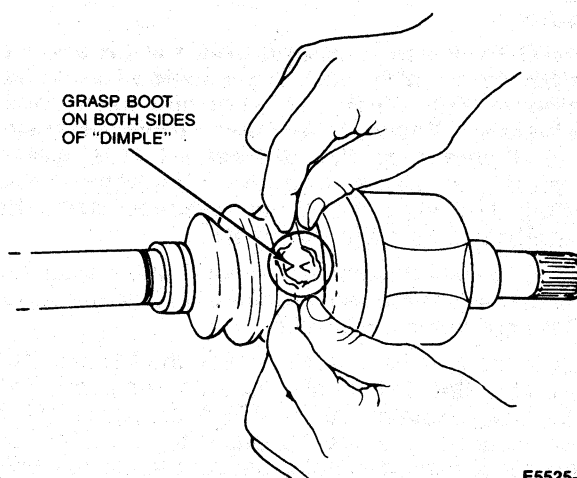
Indentations or "dimples" in the inboard and/or outboard CV joint boots may occur due to improper handling during storage or service of the halfshafts. If, during inspection, a boot is observed to be "dimpled," perform the following procedure.

1. Inspect the boot(s) for any sign of grease leakage in the dimple which would indicate a cut. Replace the boot if a cut exists or if there is evidence of other damage.



E5524-A

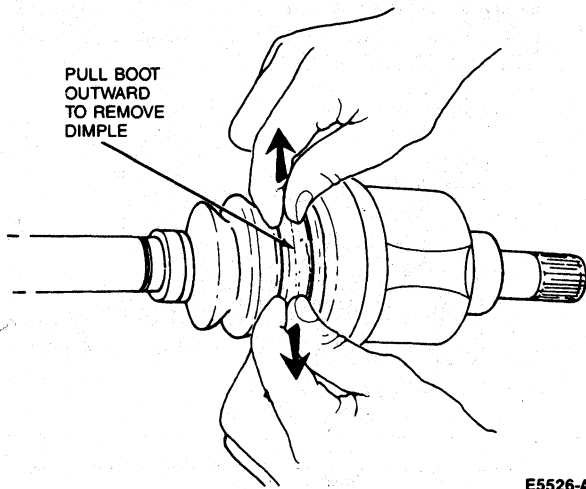
2. If the boot is in good condition, the dimple can be removed as follows:
  - a. Grasp the dimpled convolution on either side of the dimple using the forefinger and thumb of each hand.



E5525-A

## INSPECTION (Continued)

- b. While grasping boot, pull the convolution by moving hands in opposite directions. The dimple should "pop out." If the dimple does not invert or if it dimples again, one clamp should be removed and the internal and external air pressure equalized. Refer to Boot Installation for the necessary procedure.



E5526-A

Extreme care should be taken not to allow CV joint boots to come in forceful contact with foreign objects that may cause the external boot convolutions to become indented.

## REMOVAL AND INSTALLATION

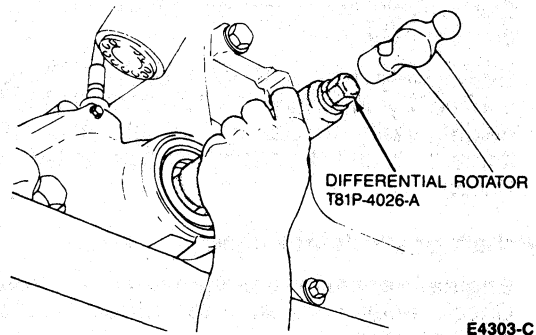
## Halfshaft Assembly

## Removal

**CAUTION:** When removing both the LH and RH halfshafts on MTX and ATX equipped vehicles, Shipping Plugs T81P-1177-B or equivalent must be installed. Failure to use these tools can result in dislocation of the differential side gears. Should the gears become misaligned, the differential will have to be removed from the transaxle to re-align the gears.

**NOTE:** Halfshaft assembly removal and installation procedures are the same for ATX applications as for MTX applications, EXCEPT:

Due to the ATX case configuration the RH halfshaft assembly and link shaft must be removed first. Differential Rotator T81P-4026-A or equivalent is then inserted into the transaxle to drive the LH inboard CV joint assembly from the transaxle. If only the LH halfshaft assembly is to be removed for service, remove the RH halfshaft assembly from the transaxle first. After removal, support it with a length of wire, then drive the LH halfshaft assembly from the transaxle.



E4303-C

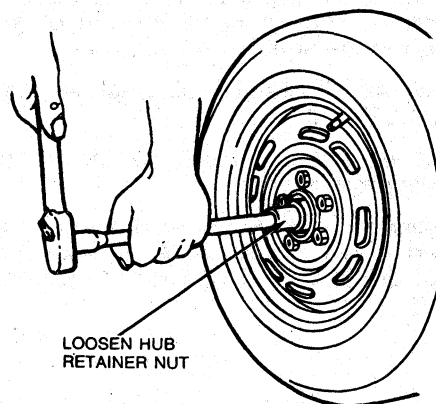
**CAUTION:** Do not begin this removal procedure unless the following parts are known to be available:

- A new hub retainer nut assembly (Step 1).
- A new lower control arm-to-steering knuckle attaching bolt and nut (Step 4).
- A new inboard CV joint stub shaft circlip.
- A new link shaft snap ring (ATX and MTX transaxles only).

Once removed, these parts must not be reused during assembly. Their torque holding ability or retention capability is destroyed during removal.

1. Remove wheelcover/hub cover from wheel and tire assembly and loosen wheel nuts. Remove hub retainer nut and washer. The nut must be discarded after removal.

**NOTE:** The nut is tightened to 245-270 N·m (180-200 lb-ft).

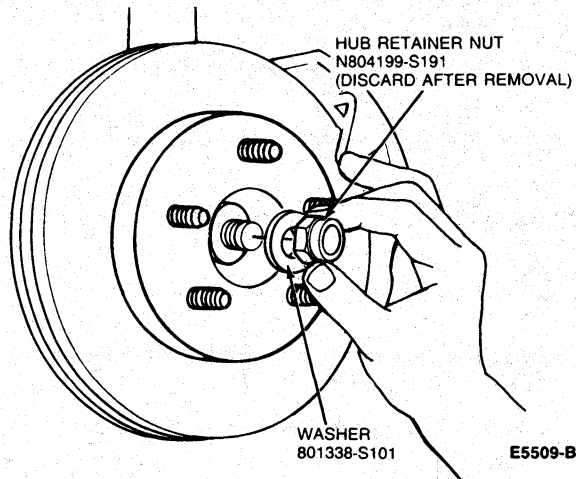


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## REMOVAL AND INSTALLATION (Continued)

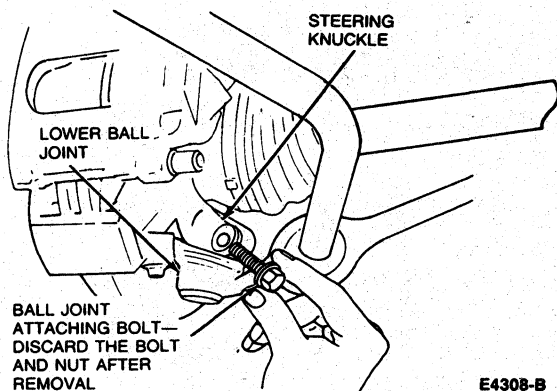
2. After raising the vehicle and removing the wheel and tire assembly, remove the hub retainer nut and washer.

**CAUTION: Discard the hub retainer nut. It is a torque prevailing design and cannot be reused.**



3. Remove nut from the ball joint-to-steering knuckle attaching bolt.
4. Drive bolt out of steering knuckle using a punch and hammer.

**CAUTION: Discard the bolt and nut. They are of a torque prevailing design and cannot be reused.**

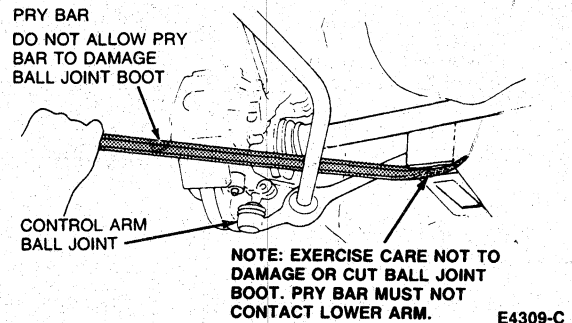


5. Separate ball joint from steering knuckle using a pry bar.

Position the end of the pry bar outside of bushing pocket to avoid damage to bushing.

Use care to prevent damage to the ball joint boot.

Remove stabilizer bar link at stabilizer bar.

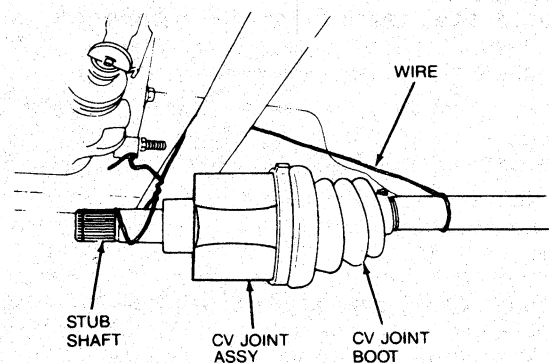


The remaining removal procedures for the RH and LH halfshafts are different depending on application. Refer to the appropriate procedure for the vehicle you are working on.

## Halfshaft/Link Shaft—ATX and MTX, RH

6. Remove two bolts attaching bearing support to bracket. Slide link shaft out of transaxle.
7. Support end of shaft by suspending from a convenient underbody component with a length of wire.

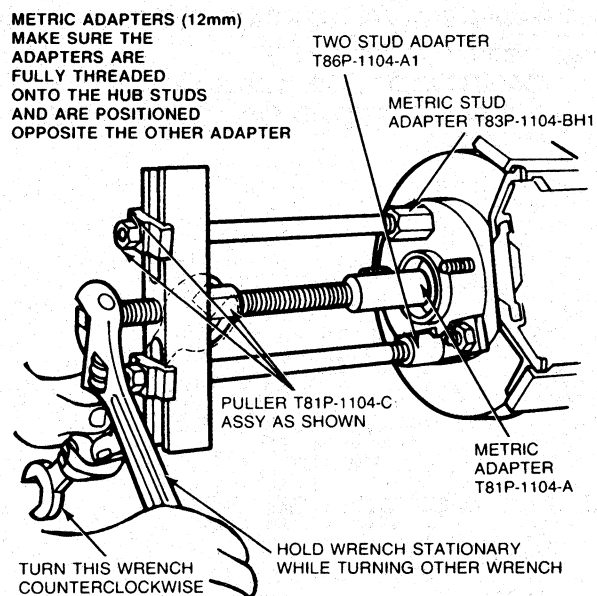
**CAUTION: Do not allow the shaft to hang unsupported, damage to the outboard CV joint may result.**



## REMOVAL AND INSTALLATION (Continued)

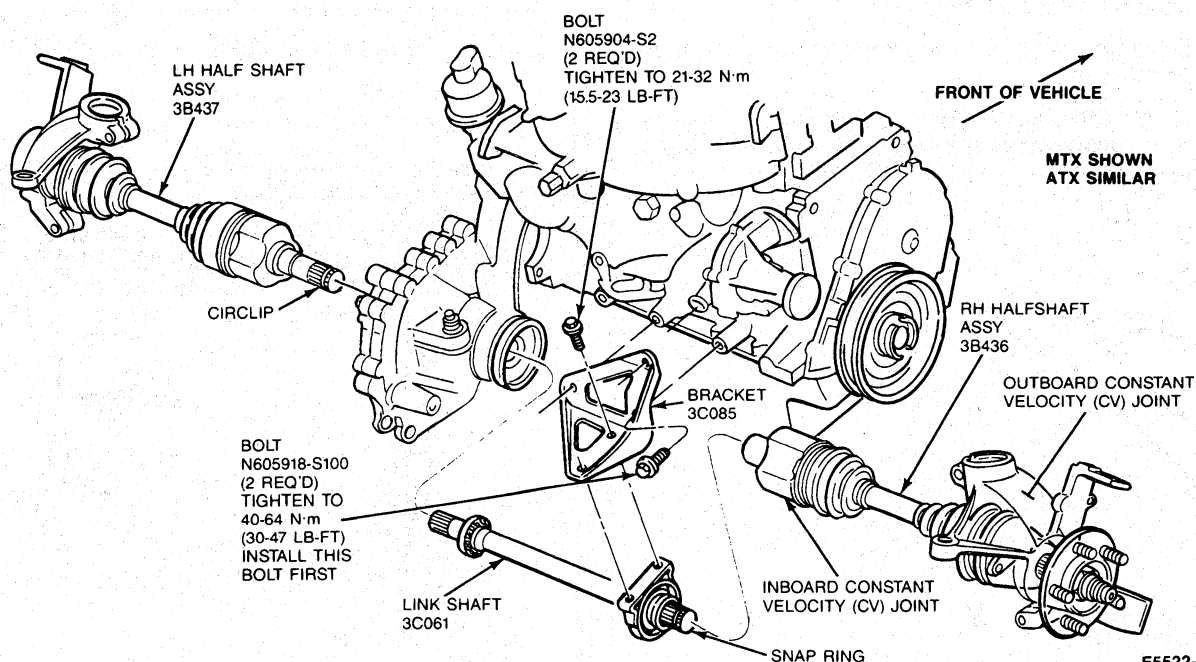
8. Separate the outboard CV joint from the hub using Front Hub Remover T81P-1104-C, Metric Adapters T83P-1104-BH, T86P-1104-A1 and T81P-1104-A or equivalent.

**CAUTION:** Never use a hammer to separate the outboard CV joint stub shaft from the hub. Damage to the CV joint threads and internal components may result.



F3869-A

**NOTE:** The RH link shaft and halfshaft assembly is removed as a complete unit. Refer to Disassembly and Assembly to separate link shaft and halfshaft.

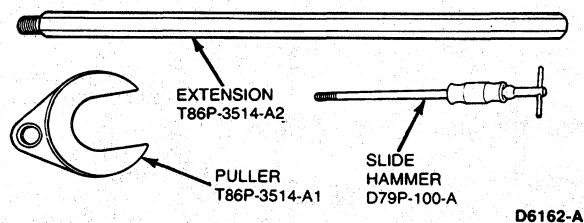


E5522-A

## REMOVAL AND INSTALLATION (Continued)

**Halfshaft—AXOD, RH and LH; MTX, LH**

NOTE: The following tools are required to remove the inboard CV joints.



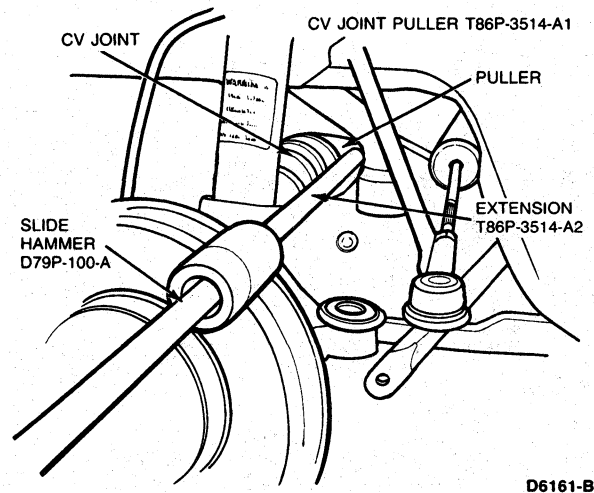
6. Install CV Joint Puller T86P-3514-A1 or equivalent between CV joint and transaxle case.

NOTE: Turn steering hub and/or wire strut assembly out of the way.

7. Screw Extension T86P-3514-A2 or equivalent, into CV joint puller and hand tighten.

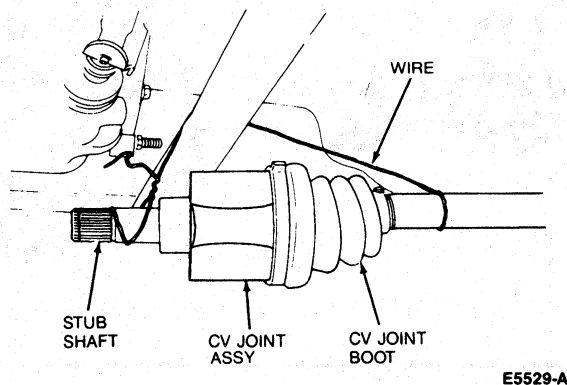
Screw Impact Slide Hammer D79P-100-A or equivalent onto extension.

8. Remove CV joint from transaxle.



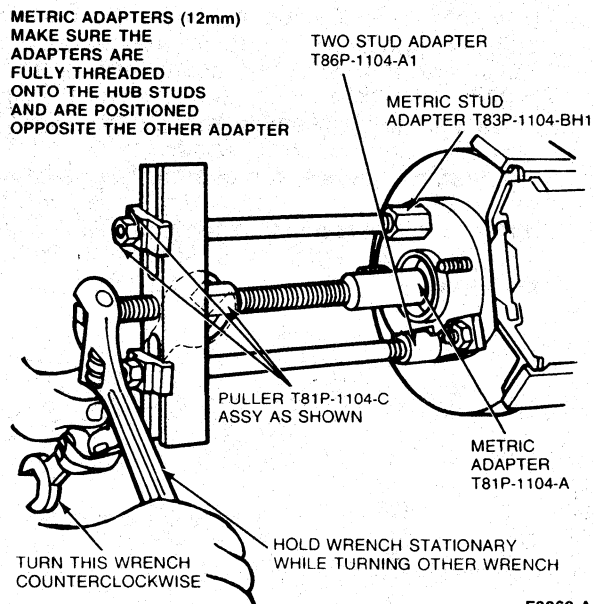
9. Support the end of the shaft by suspending from a convenient underbody component with a length of wire.

**CAUTION:** Do not allow shaft to hang unsupported, damage to the outboard CV joint may result.



10. Separate the outboard CV joint from the hub using Front Hub Remover T81P-1104-C, Metric Adapters T83P-1104-BH, T86P-1104-A1 and T81P-1104-A or equivalent.

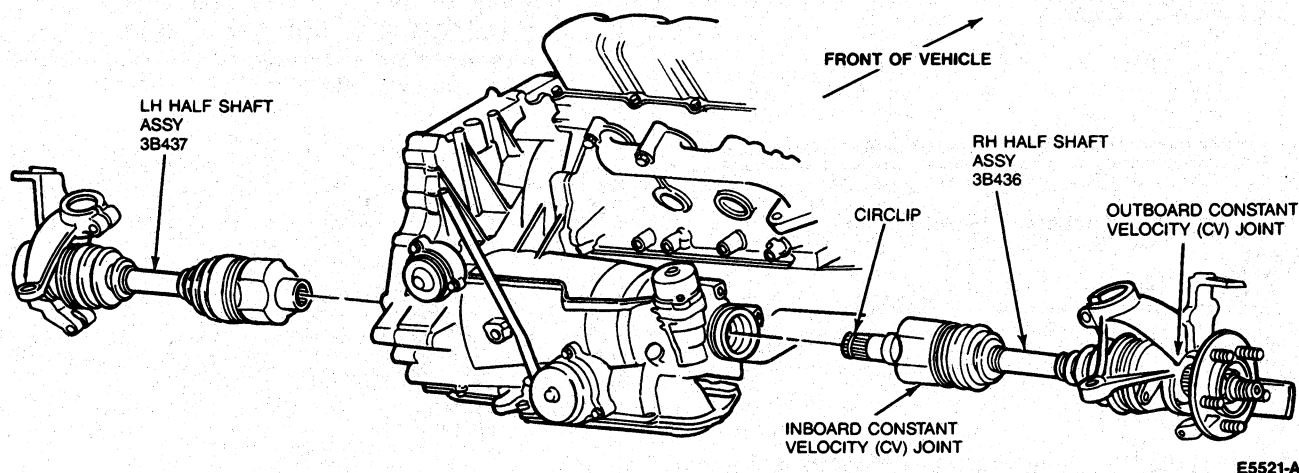
**CAUTION:** Never use a hammer to separate the outboard CV joint stub shaft from the hub. Damage to the CV joint threads and internal components may result.



11. Remove halfshaft assembly from vehicle.

## REMOVAL AND INSTALLATION (Continued)

## AXOD

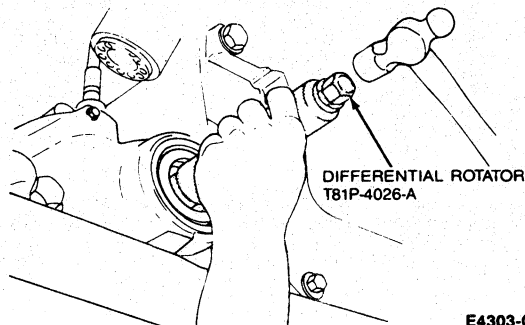


Refer to illustration under Step 8 of Halfshaft/Link Shaft ATX and MTX, RH for MTX.

## Halfshaft—ATX, LH

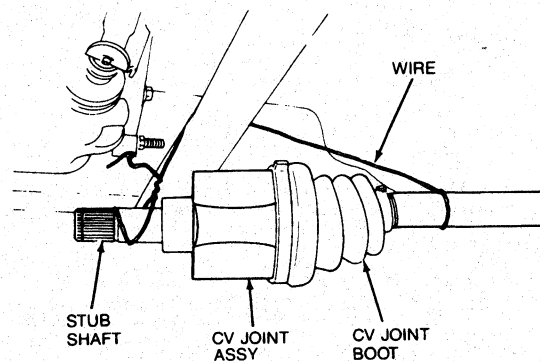
**CAUTION:** When removing both the LH and RH halfshafts, Shipping Plugs T81P-1177-B or equivalent must be installed. Failure to use these tools can result in dislocation of the differential side gears. Should the gears become misaligned, the differential will have to be removed from the transaxle to re-align the gears.

6. Due to the ATX case configuration the RH halfshaft assembly must be removed first. Driver T81P-4026-A or equivalent is then inserted into the transaxle to drive the LH inboard CV joint assembly from the transaxle. If only the LH halfshaft assembly is to be removed for service, remove the RH halfshaft assembly from the transaxle first. After removal, support it with a length of wire, then drive the LH halfshaft assembly from the transaxle.



7. Support the end of the shaft by suspending from a convenient underbody component with a length of wire.

**CAUTION:** Do not allow the shaft to hang unsupported, damage to the outboard CV joint may result.



## REMOVAL AND INSTALLATION (Continued)

8. Separate the outboard CV joint from the hub using Front Hub Remover T81P-1104-C, Metric Adapters T83P-1104-BH, T86P-1104-A1 and T81P-1104-A or equivalent.

**CAUTION:** Never use a hammer to separate the outboard CV joint stub shaft from the hub. Damage to the CV joint threads, and internal components may result.

METRIC ADAPTERS (12mm)  
MAKE SURE THE  
ADAPTERS ARE  
FULLY THREADED  
ONTO THE HUB STUDS  
AND ARE POSITIONED  
OPPOSITE THE OTHER ADAPTER

TWO STUD ADAPTER  
T86P-1104-A1

METRIC STUD  
ADAPTER T83P-1104-BH1

PULLER T81P-1104-C  
ASSY AS SHOWN

METRIC  
ADAPTER  
T81P-1104-A

TURN THIS WRENCH  
COUNTERCLOCKWISE

HOLD WRENCH STATIONARY  
WHILE TURNING OTHER WRENCH

F3869-A

9. Remove halfshaft assembly. Refer to illustration under Halfshaft/Link Shaft ATX and MTX, RH.

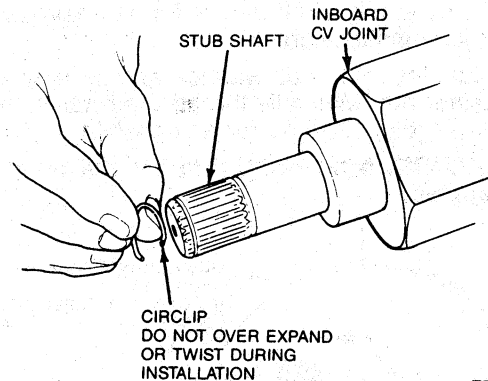
## Installation

1. Install a new circlip on the inboard CV joint stub shaft and/or link shaft.

The outboard CV joint stub shaft does not have a circlip.

**NOTE:** To install the circlip properly, start one end in the groove and work the circlip over the stub shaft end and into the groove. This will avoid over expanding the circlip.

**CAUTION:** The circlip must not be reused. A new circlip must be installed each time the inboard CV joint is installed into the transaxle differential.

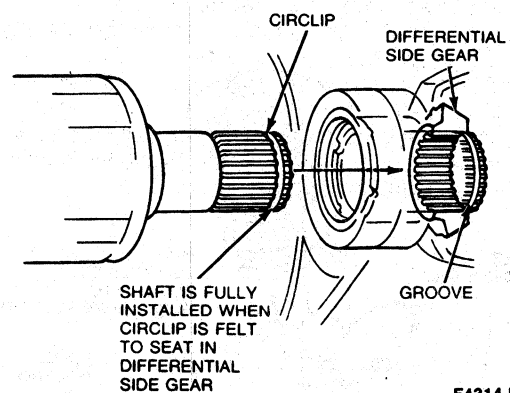


E5530-A

2. Carefully align splines of inboard CV joint stub shaft or link shaft with the splines in the differential. Exerting some force, push CV joint into differential until the circlip is felt to seat in the differential side gear. On ATX or MTX equipped vehicles, tighten link shaft bearing attaching bolts to 21-32 N·m (16-23 lb-ft).

Use care to prevent damage to the differential oil seal.

**NOTE:** A non-metallic mallet may be used to aid in seating the circlip into the differential side gear groove. If a mallet is necessary, tap only on the outboard CV joint stub shaft.

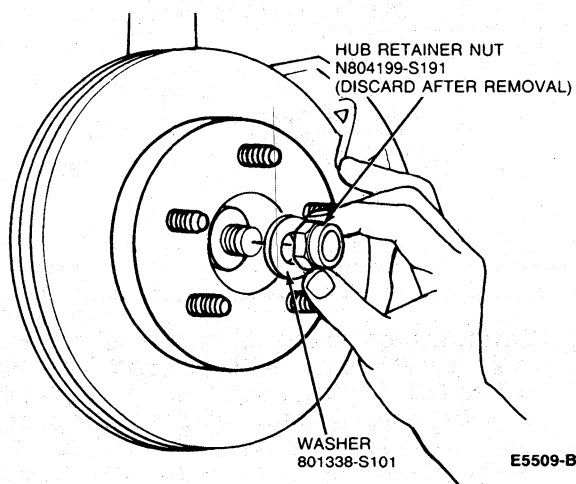


E4314-B

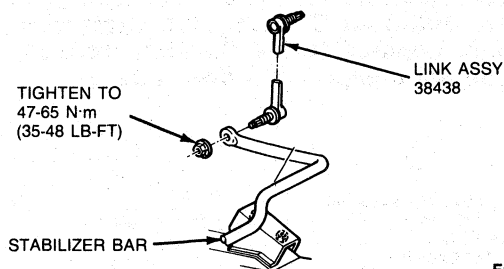
**REMOVAL AND INSTALLATION (Continued)**

3. Carefully align splines of outboard CV joint stub shaft with splines in hub and push the shaft into the hub as far as possible.
4. Temporarily fasten rotor to hub with washers and two wheel lug nuts. Insert a steel rod into the rotor and rotate clockwise to contact the knuckle to prevent the rotor from turning during CV joint installation.
5. Install the hub nut washer and a new hub retainer nut. Manually thread the retainer onto the CV joint shaft as far as possible.

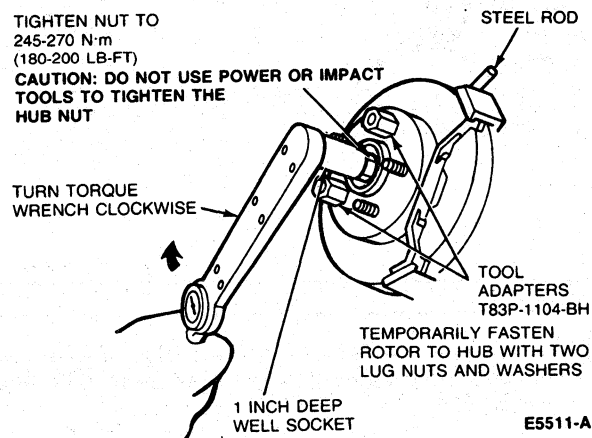
**CAUTION: A new hub retainer nut must be installed.**



7. Connect stabilizer bar link to stabilizer bar. Tighten to 47-65 N·m (35-48 lb-ft).

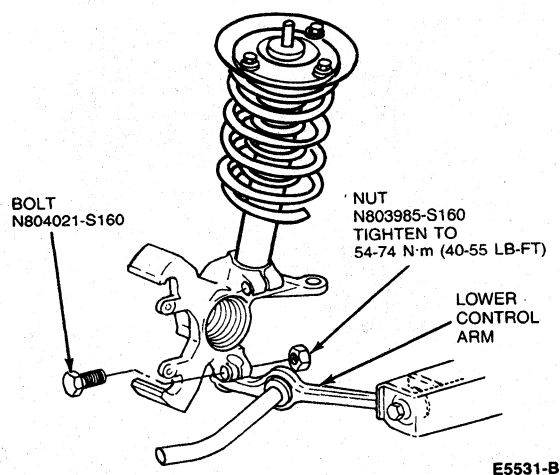


8. Tighten hub retainer nut to 245-270 N·m (180-200 lb-ft).



6. Connect control arm to the steering knuckle and install a new nut and bolt. Tighten nut to 54-74 N·m (40-55 lb-ft).

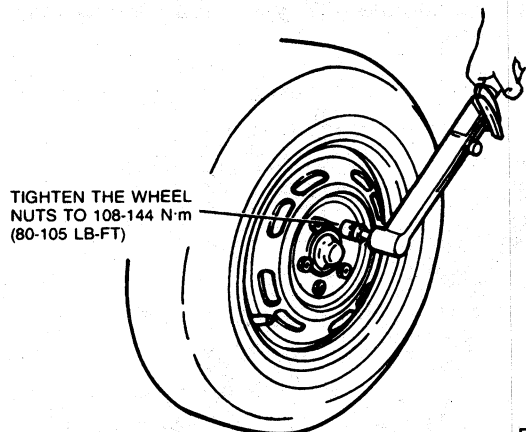
**CAUTION: A new bolt and nut must be installed.**





**REMOVAL AND INSTALLATION (Continued)**

9. Install wheel and tire assembly and lower vehicle.
10. Tighten wheel nuts to 108-144 N·m (80-105 lb-ft).



E5512-A

11. Fill transaxle to proper level with specified lubricant.

**AXOD—Motorcraft Type H XT-4-H**

Refer to Section 17-15.

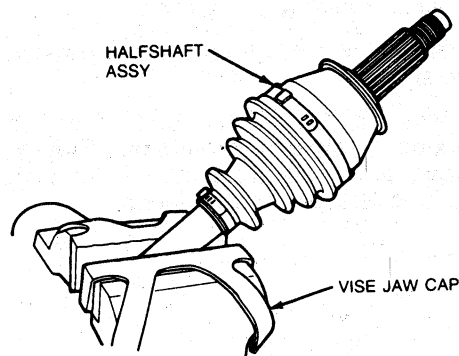
**ATX—DEXRON® II**

Refer to Section 17-25 for the Transaxle Fluid Level Check.

**MTX—ESW-M2C33F or DEXRON® II**

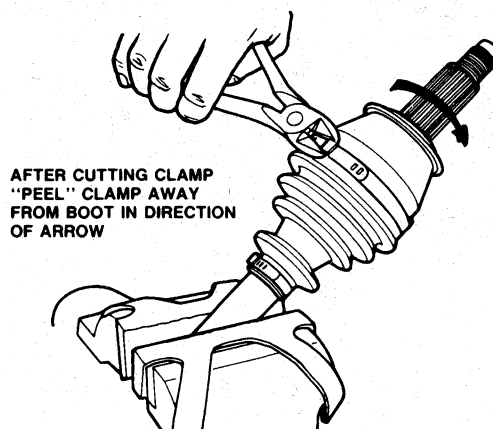
Refer to Section 16-37 for the Transaxle Fluid Level Check.

1. Clamp halfshaft in a vise. Do not allow vise jaws to contact the boot or its clamp.  
The vise should be equipped with jaw caps to prevent damage to any machined surfaces.



E5518-A

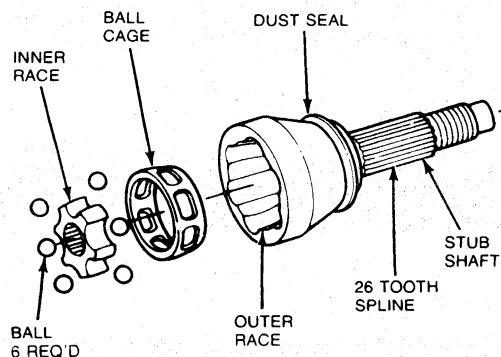
2. Cut the large boot clamp using side cutters and "peel" away from the boot.  
After removing the clamp, roll boot back over shaft.



E5519-A

**DISASSEMBLY AND ASSEMBLY****Outboard CV Joint and Boot****Disassembly**

NOTE: The CV joint components are matched during manufacture and therefore cannot be interchanged with components from another CV joint. Extreme care should be taken not to mix or substitute like components between CV joints.



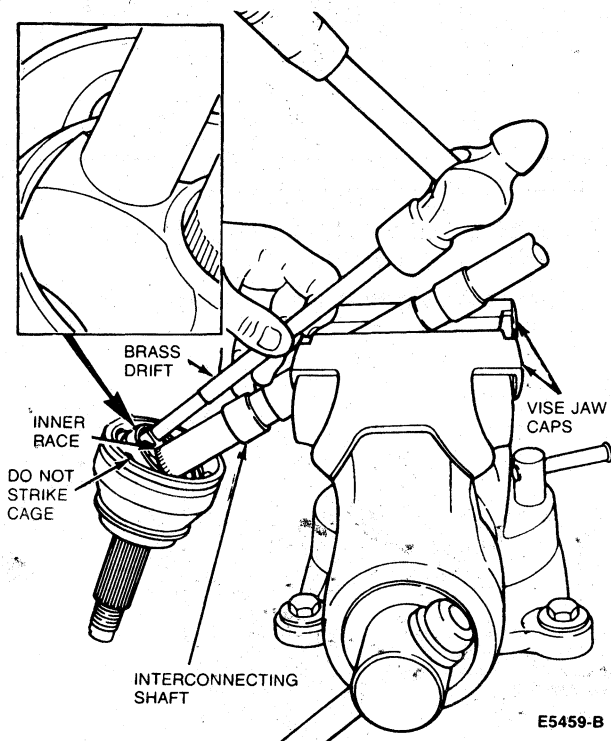
E4266-D

**DISASSEMBLY AND ASSEMBLY (Continued)**

3. Support interconnecting shaft in a soft jaw vise and angle the CV joint to expose the inner bearing race.
4. Using a brass drift and hammer, give a sharp tap to the inner bearing race to dislodge the internal circlip and separate the CV from the interconnecting shaft. Care should be taken not to drop the CV joint at separation.

The boot (not shown), can now be removed from the shaft.

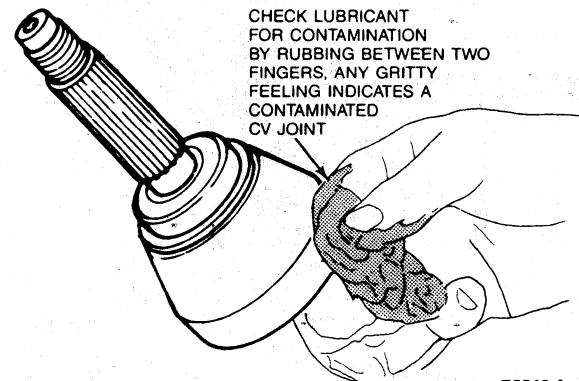
**NOTE:** Vise jaw caps are made of copper, brass, wood or other soft material. They are slipped over the steel jaws of the vise so as not to scratch or nick finished surfaces.



E5459-B

5. Inspect CV joint grease for contamination. If the CV joints are operating satisfactorily, and the grease does not appear to be contaminated, add grease and replace boot.

If the lubricant appears contaminated, proceed with a complete CV joint disassembly and inspection.

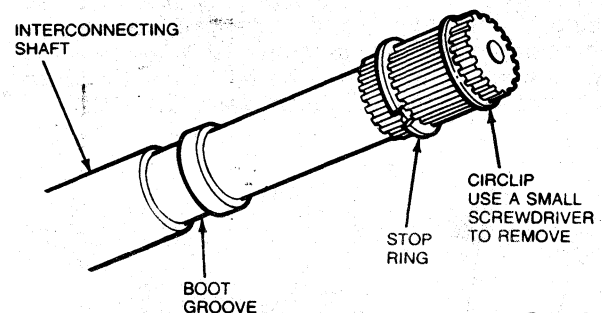


E5549-A

6. Remove circlip located near the end of the shaft. Discard the circlip. A new clip is supplied with both the boot replacement kit and CV joint.

The stop ring, located just below the circlip, should be removed only if it is damaged, worn or otherwise unserviceable.

**CAUTION:** Circlip cannot be reused. Replace used circlip with a new circlip before assembly.

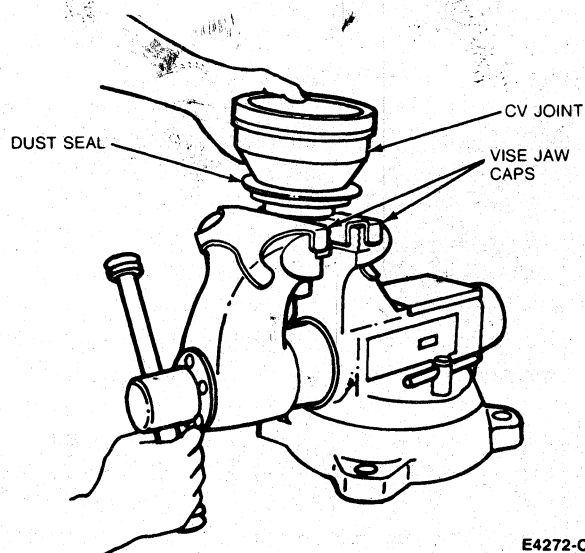


E4351-B

**DISASSEMBLY AND ASSEMBLY (Continued)**

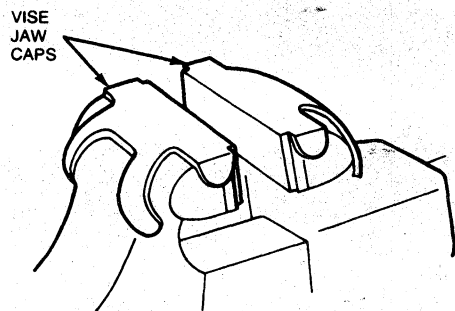
7. Clamp CV joint stub shaft in a vise with the outer face facing up. Care should be taken not to damage dust seal.

The vise must be equipped with jaw caps to prevent damage to the shaft splines.



E4272-C

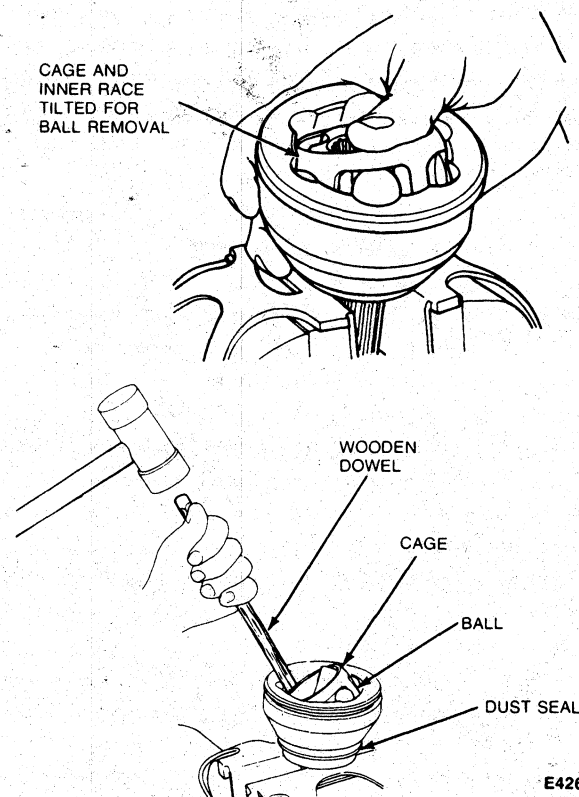
**NOTE:** Vise jaw caps are made of copper, brass, wood or other soft material. They are slipped over the steel jaws of the vise so as not to scratch or nick finished surfaces.



E4267-B

8. Press down on inner race until it tilts enough to allow removal of the ball.

A tight assembly can be tilted by tapping the inner race with wooden dowel and hammer. Do not hit the cage.



E4268-C

**DISASSEMBLY AND ASSEMBLY (Continued)**

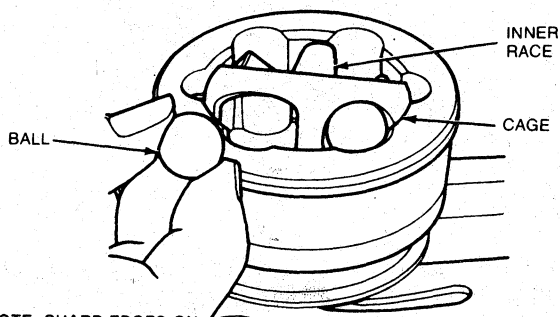
9. With the cage sufficiently tilted, remove ball from cage.

Repeat this Step until all six balls are removed.

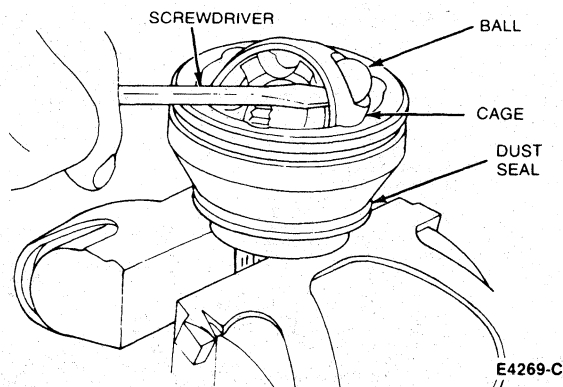
If balls are tight in the cage, use a screwdriver to pry the balls from cage.

If a screwdriver is necessary, use an old screwdriver and blunt any sharp edges on the blade on a grinder or with a file.

**NOTE:** Exercise care to prevent scratching or other damage to the inner race or cage spheres.



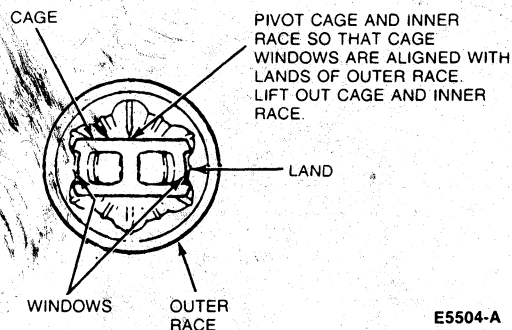
**NOTE:** SHARP EDGES ON SCREWDRIVER SHOULD BE BLUNTED TO PREVENT SCRATCHING OF FINISHED SURFACES.



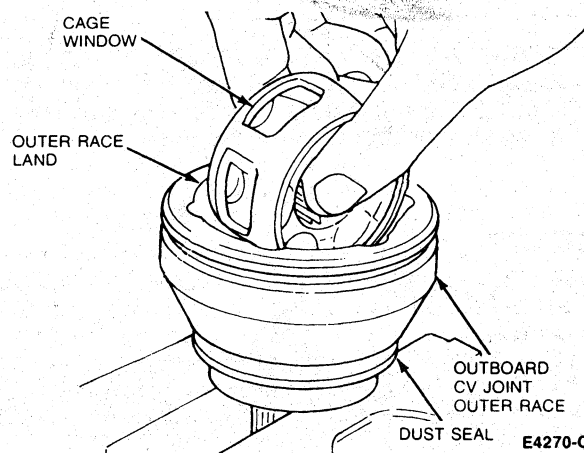
E4269-C

10. Pivot cage and inner race assembly until it is straight up and down in the outer race. Align cage windows with outer race lands while pivoting the bearing cage.

With the cage pivoted and aligned, lift assembly from the outer race.



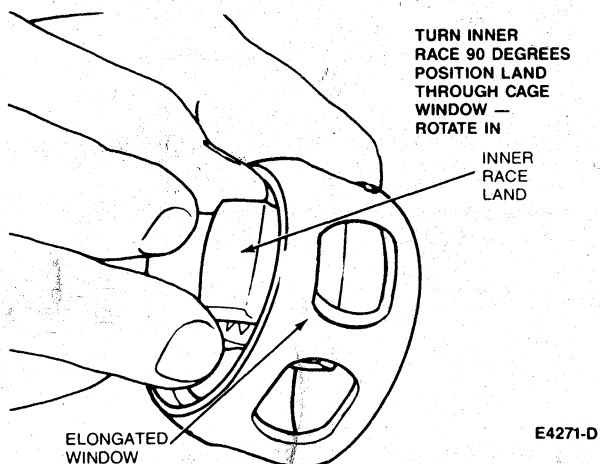
E5504-A



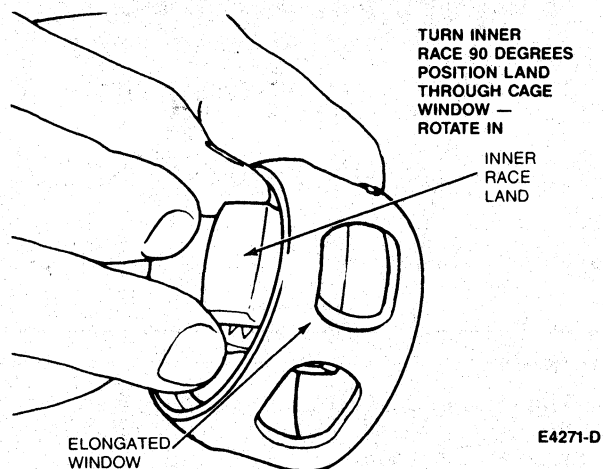
E4270-C

**DISASSEMBLY AND ASSEMBLY (Continued)****11. Rotate inner race up and out of the cage.**

Pivot the inner race until it is straight up and down in the cage. Align one of the inner race lands with one of the elongated windows and position the race through the window. Rotate the inner race up and out of the cage.

**1. Apply a light coating of grease on inner and outer ball races.**

Install the inner race in the bearing cage.



**CAUTION:** Use only Ford Constant Velocity Joint Grease E2FZ-19590-A or equivalent.

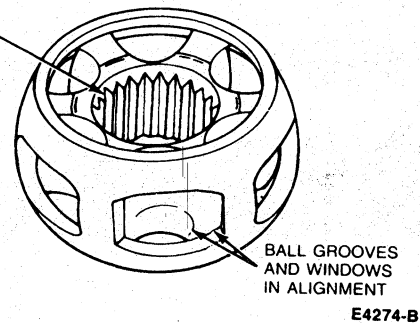
**Assembly**

**NOTE:** Because CV joint components are matched during assembly, individual components are not available for service. If inspection determines a part to be unserviceable the CV joint must be replaced as an assembly.

Do not replace a joint merely because the parts appear polished. Shiny areas in ball races and on the cage spheres are normal. A CV joint should be replaced **ONLY** if inspection determines a component(s) to be cracked, broken, severely pitted, worn or otherwise unserviceable.

**2. Install inner race and cage assembly in the outer race.**

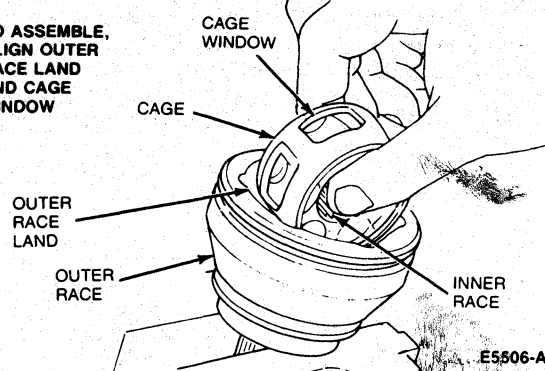
THE CHAMFER IN INNER RACE MUST FACE UPWARD AFTER ASSEMBLY IS INSTALLED IN OUTER RACE



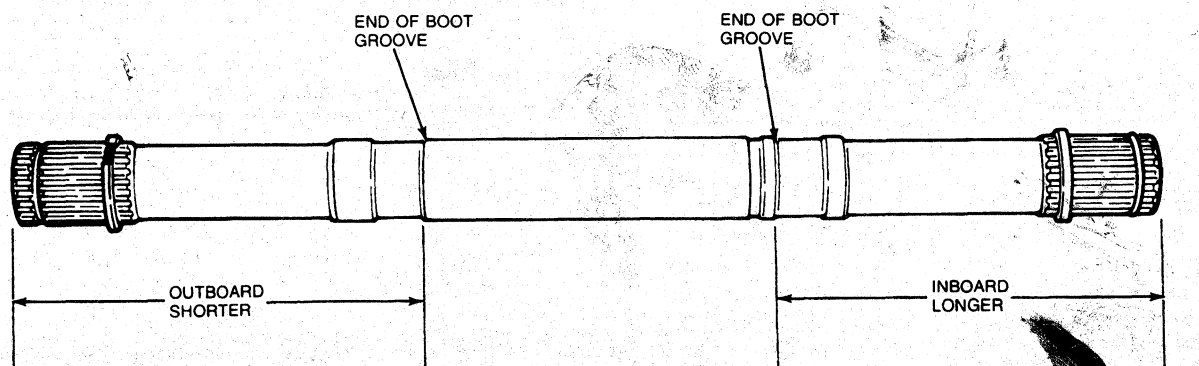
**DISASSEMBLY AND ASSEMBLY (Continued)**

3. Install the assembly vertically and pivot 90 degrees into position.
4. Align bearing cage and inner race with outer race.  
Tilt the inner race and cage and install a ball.  
Repeat this Step until six balls are installed.

TO ASSEMBLE,  
ALIGN OUTER  
RACE LAND  
AND CAGE  
WINDOW



5. The LH and RH interconnecting shafts are not the same end for end. The outboard end is shorter from end of shaft to end of boot groove than the inboard end. Take a measurement to ensure correct inboard and outboard CV joint to shaft installation.

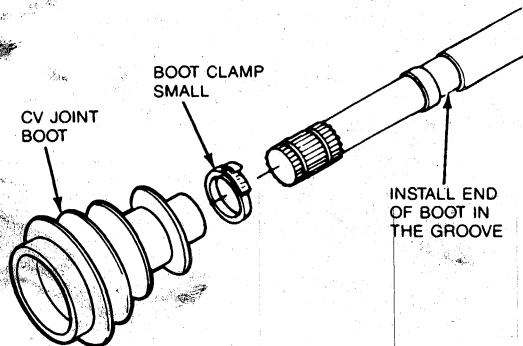


**DISASSEMBLY AND ASSEMBLY (Continued)**

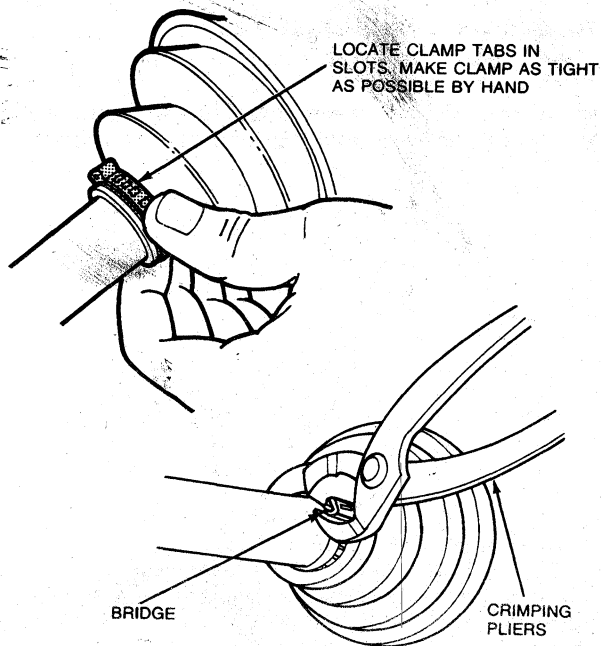
6. If removed, install CV joint boot after removing stop ring.

Ensure the boot is seated in its groove and clamp in position using crimping pliers.

**NOTE:** Tighten the clamp securely, but not to the point where the clamp bridge is cut or the boot is damaged.



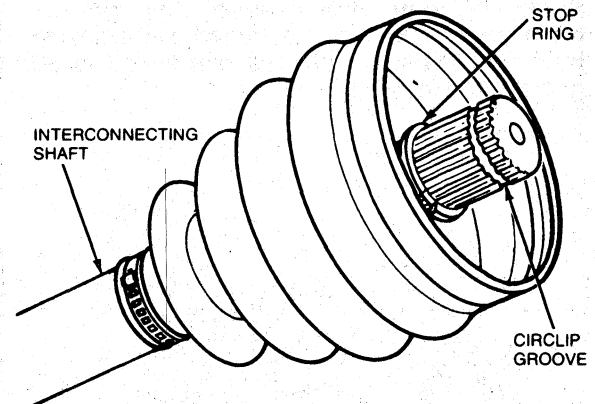
E5550-A



E4298-D

7. If removed, install the stop ring.

If not removed, ensure stop ring is properly seated in its groove.

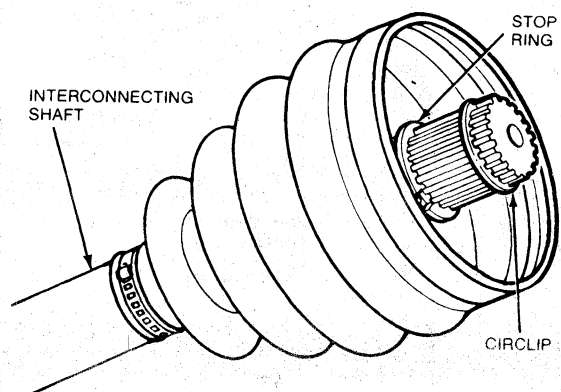


E4296-B

8. Install a new circlip, supplied with the service kit, in the groove nearest the end of the shaft.
- Do not over expand or twist the circlip during installation.

**NOTE:** To install circlip, start one end in the groove and work the circlip over the stub shaft end and into the groove. This will avoid over expanding the circlip.

**CAUTION:** Circlips must not be reused. Replace circlips before assembly.



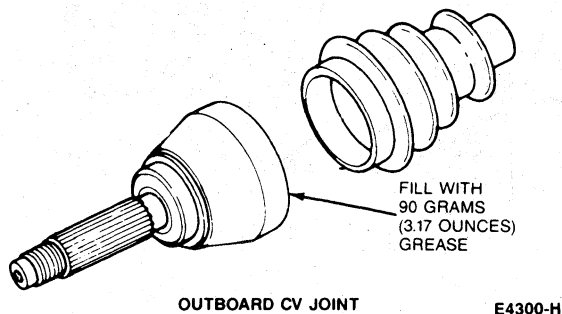
E4293-B

**DISASSEMBLY AND ASSEMBLY (Continued)**

9. Before positioning boot over CV joint, pack CV joint and boot with the grease supplied in the service kit as follows:

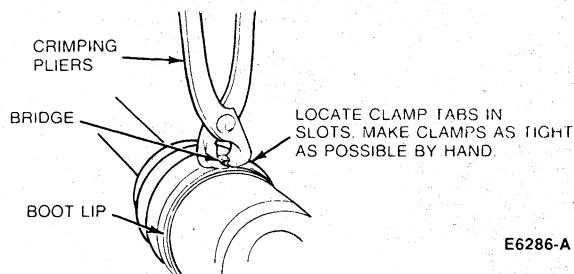
**NOTE:** Use Ford Constant Velocity Joint Grease E2FZ-19590-A or equivalent on all inboard and all outboard CV joints.

Pack CV joint with grease. Any grease remaining in tube is to be spread evenly inside boot. Total amount of grease required is 90 grams (3.17 ounces).



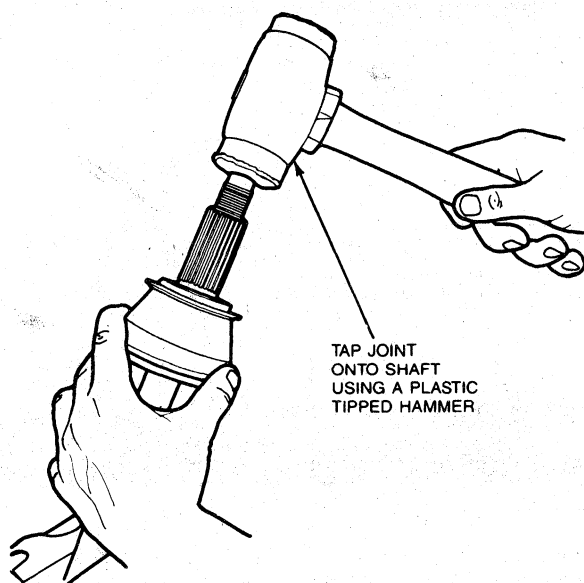
11. Remove all excess grease from the CV joint external surfaces.
12. Position boot over CV joint.
13. Ensure the boot is seated in its groove and clamp in position using crimping pliers.

**NOTE:** Tighten the clamp securely, but not to the point where the clamp bridge is cut or the boot is damaged.

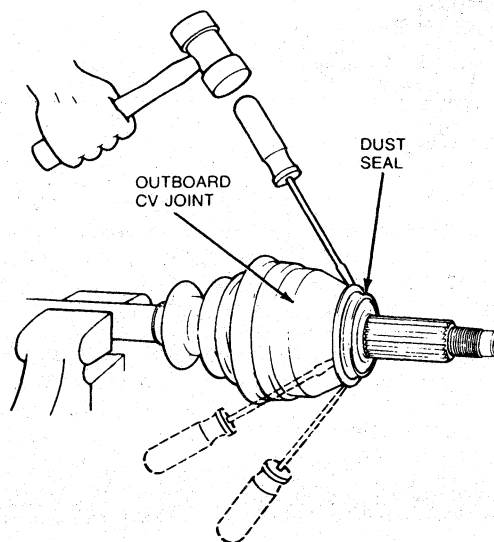


10. With the boot "peeled" back, position CV joint on shaft and tap into position using a plastic tipped hammer.

The CV joint is fully seated when the circlip locks in the groove cut into the CV joint inner race. Check for circlip seating by attempting to pull the joint from the shaft.

**Outboard CV Joints Dust Seal****Disassembly**

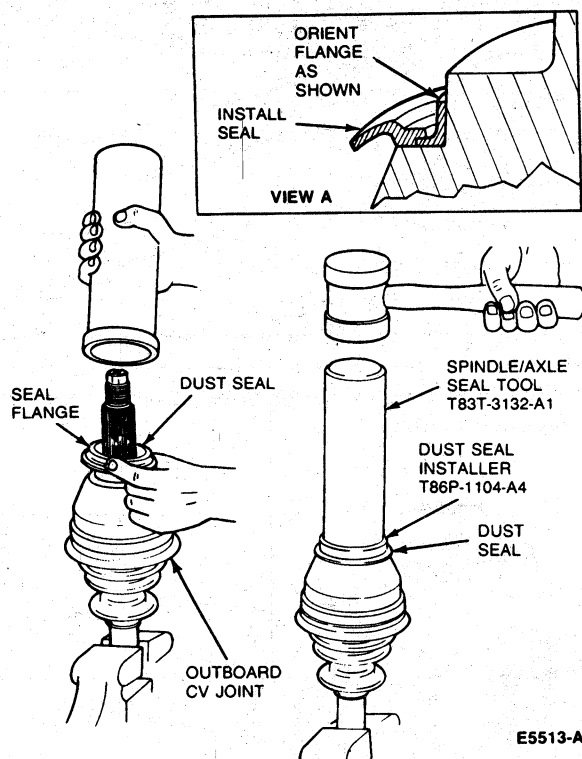
Using a light duty hammer and screwdriver, tap uniformly around seal until it becomes unseated.





**DISASSEMBLY AND ASSEMBLY (Continued)****Assembly**

Using Spindle/Axle Seal Tool T83T-3132-A1 and Dust Seal Installer T86P-1104-A4 or equivalent, install the dust seal. The dust seal flange must face outboard.

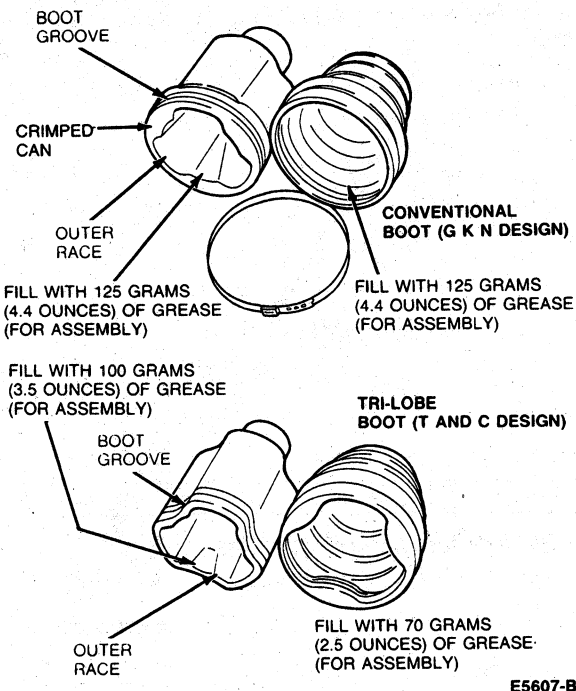


E5513-A

**Inboard CV Joint****Disassembly**

Two different types of inboard CV joints and boots are used. The conventional style uses a crimped can on the large end. The tri-lobe style CV joint does not require a crimped can on the large end.

**CAUTION:** Although the designs are similar, there is not interchangeability of parts between the two designs. The CV joint tripod, outer race, boot and interconnecting shaft are unique for each style.



E5607-B

1. Cut and remove both boot clamps and slide boot back on shaft.



E5608-A

**CAUTION:** On all vehicles the RH inboard CV joint requires a reusable, low profile large boot clamp. A special tool is required to remove and install the clamp. The tool is available from:

Oetiker, Inc.

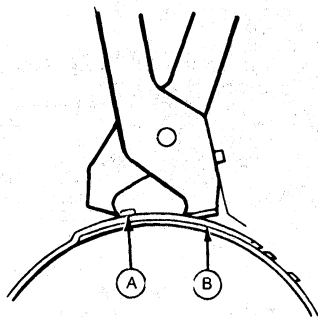
3305 Wilson St.

Marlette, MI 48453

Tool Part No.—1090

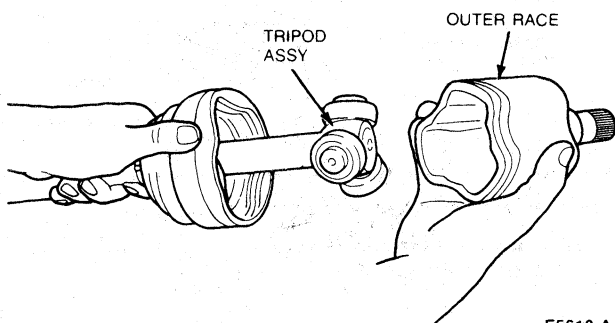
**DISASSEMBLY AND ASSEMBLY (Continued)**

Remove clamp by engaging pincer jaws in closing hooks (A and B) and drawing hooks together. Disengage windows and locking hooks and remove clamp.



E5609-A

2. Slide outer race off of tripod.

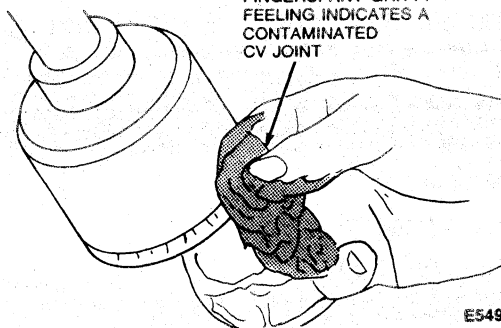


E5610-A

3. When replacing damaged CV joint boots, the grease should be checked for contamination. If the CV joints are operating satisfactorily, and the grease does not appear to be contaminated, add grease and replace the boot.

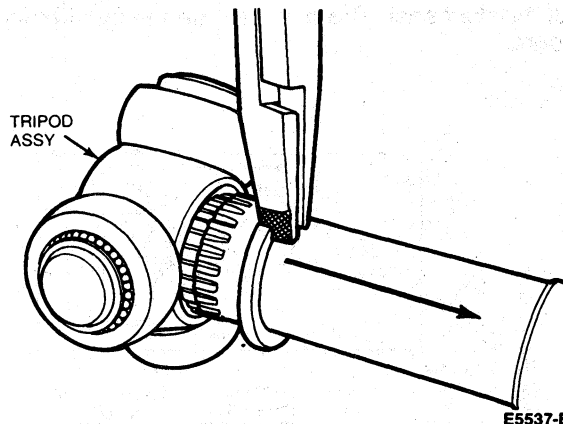
If the grease appears contaminated, proceed with a complete CV joint disassembly and inspection.

CHECK LUBRICANT  
FOR CONTAMINATION  
BY RUBBING BETWEEN TWO  
FINGERS. ANY GRITTY  
FEELING INDICATES A  
CONTAMINATED  
CV JOINT



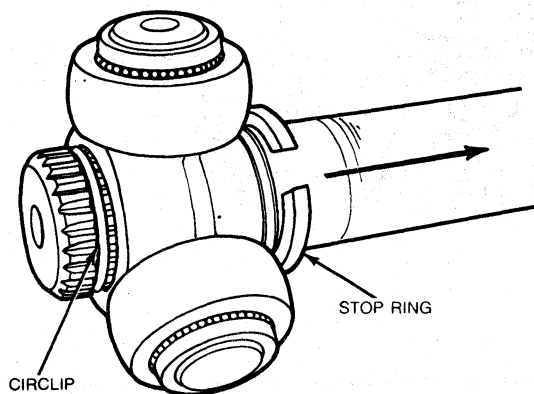
E5492-B

4. Move stop ring back on shaft using snap-ring pliers.



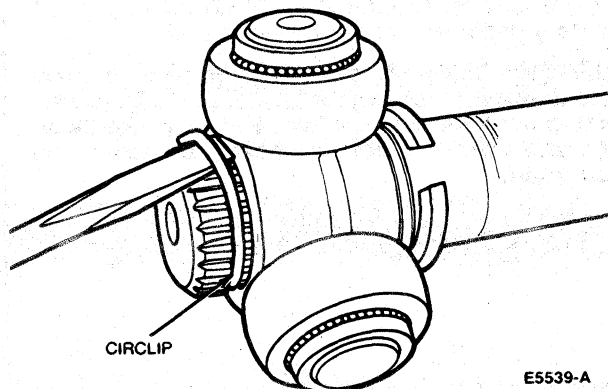
E5537-B

5. Move tripod assembly back on shaft to allow access to circlip.



E5538-B

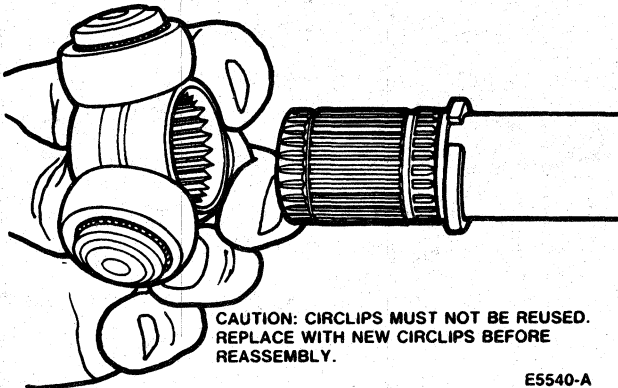
6. Remove circlip from shaft.



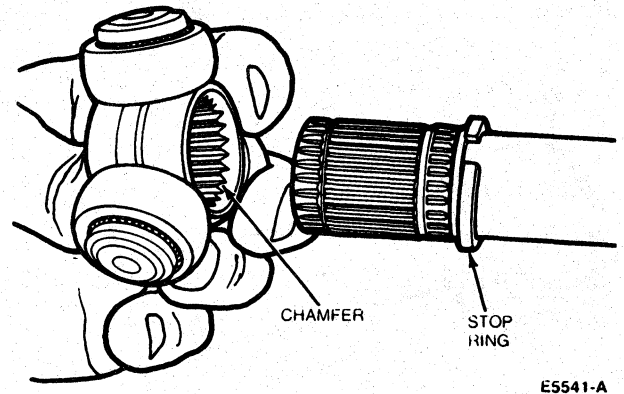
E5539-A

**DISASSEMBLY AND ASSEMBLY (Continued)**

7. Remove tripod assembly from shaft. Remove boot if necessary.

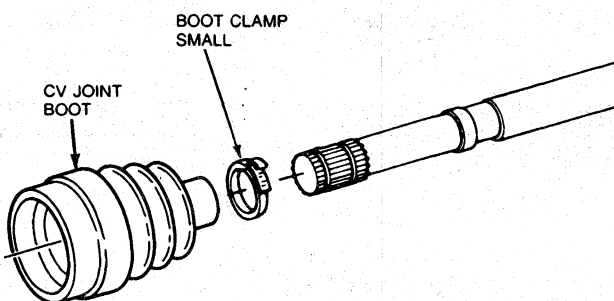


2. Install tripod assembly on shaft with chamfered side toward stop ring.

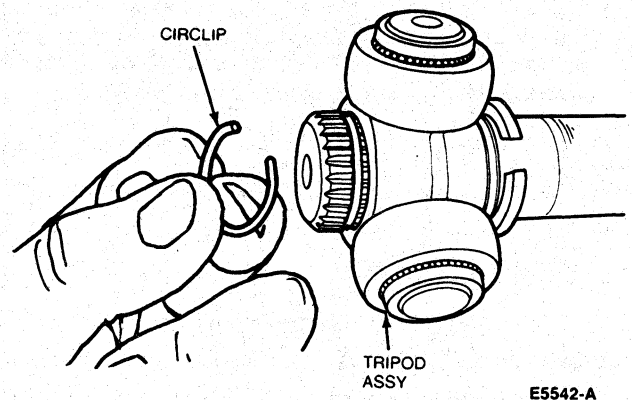
**Assembly**

1. Install CV joint boot on shaft, if removed during disassembly. Ensure boot is seated in boot groove on shaft. Tighten clamp using crimping pliers.

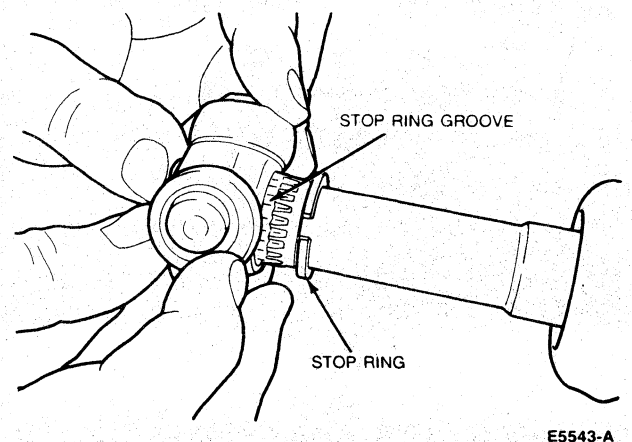
**CAUTION: Tighten clamp securely, but not to the point where clamp bridge is cut or boot is damaged.**



3. Install new circlip.

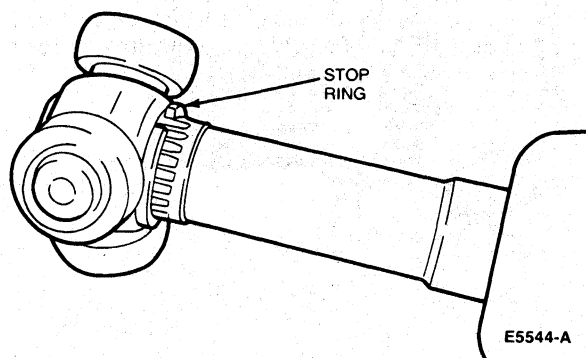


4. Compress circlip and slide tripod assembly forward over circlip to expose stop ring groove.

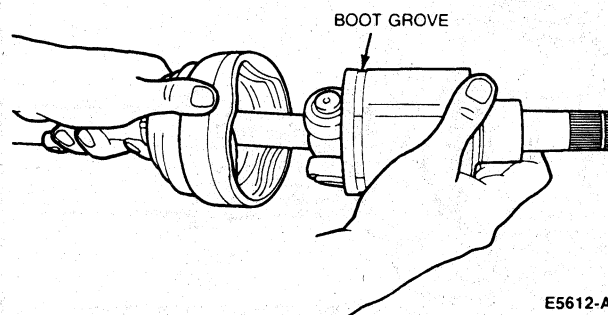


**DISASSEMBLY AND ASSEMBLY (Continued)**

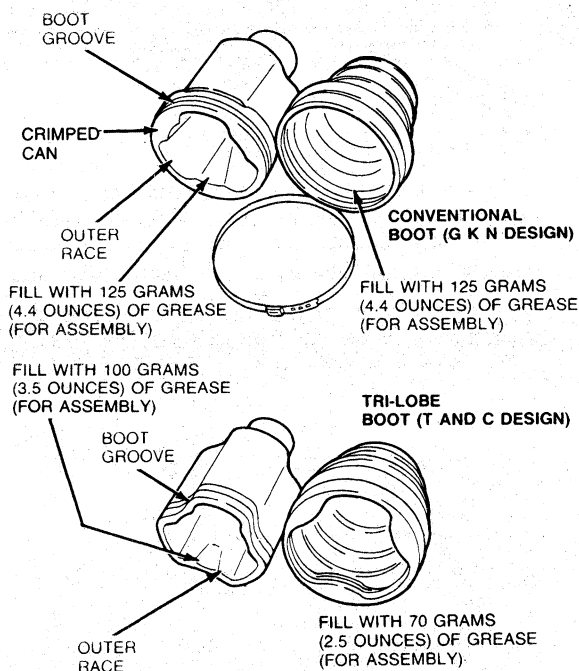
5. Move stop ring into groove using snap-ring pliers, ensuring it is fully seated in groove.



7. Install outer race over tripod assembly and position boot over outer race ensuring boot is properly seated in its groove.

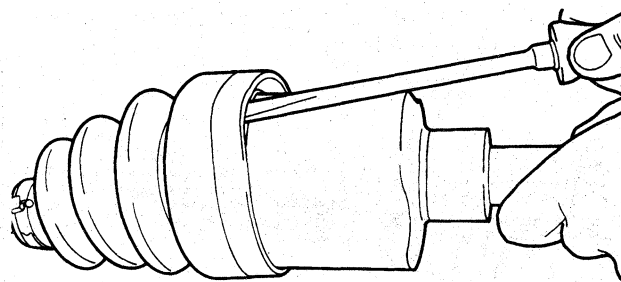


6. Fill CV joint outer race and CV boot with grease as shown. Use Ford Constant Velocity Joint Grease High Temperature E43Z-19590-A or equivalent.



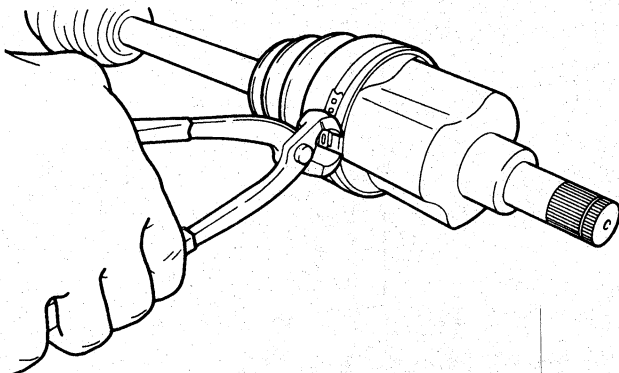
8. Remove all excess grease from CV joint external surfaces. Position boot over CV joint. Move CV joint in and out, as necessary, to adjust to length shown in Specifications.

**NOTE:** Before installing boot clamp, ensure any air pressure which may have built up in boot is relieved. Insert a dulled screwdriver blade between boot and outer bearing race to allow trapped air to escape from boot. The air should be released from the boot only after adjusting to dimension shown in Specifications.



## DISASSEMBLY AND ASSEMBLY (Continued)

9. Seat boot in groove and clamp in position using crimping pliers.

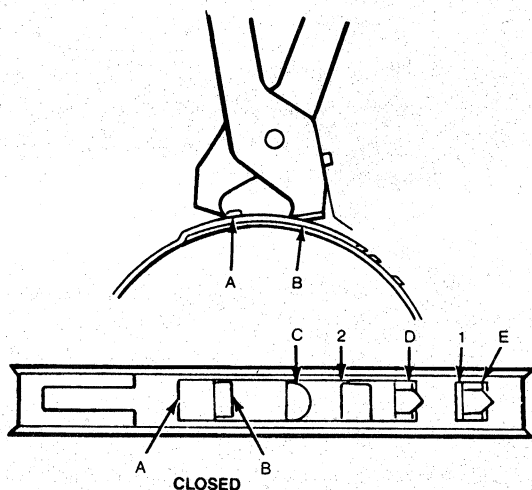


E5614-A

**CAUTION:** All vehicles require a reusable low profile large clamp on the RH inboard CV joint.

Install clamp as follows:

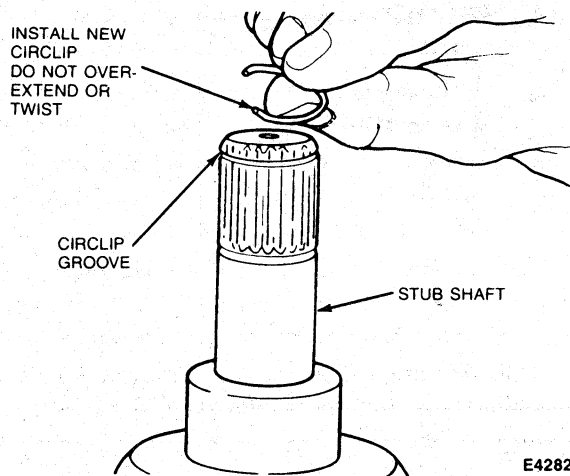
- With boot seated in groove, place clamp over boot.
- Engage hook (C) in window.
- Place pincer jaws in closing hooks (A and B).
- Secure clamp by drawing closing hooks together. When windows (1 and 2) are above locking hooks (D and E) spring tab will press windows over locking hooks and engage clamp.



E5615-A

10. Install a new circlip, supplied with service kit, in groove nearest end of shaft by starting one end in groove and working circlip over stub shaft end and into groove.

**CAUTION:** Do not over expand or twist circlip during installation. Circlips must not be reused. Replace with new circlips before assembly.

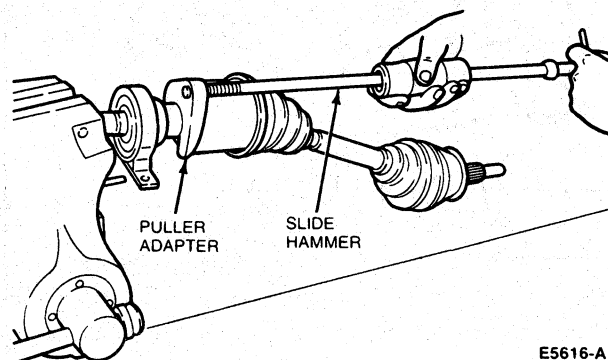


E4282-D

## Link Shaft/Halfshaft

## Disassembly and Assembly

1. Clamp link shaft in vise with halfshaft supported on work bench. Using Puller Adapter T86P-3514-A and Slide Hammer D79P-100-A or equivalent, separate link shaft from halfshaft.

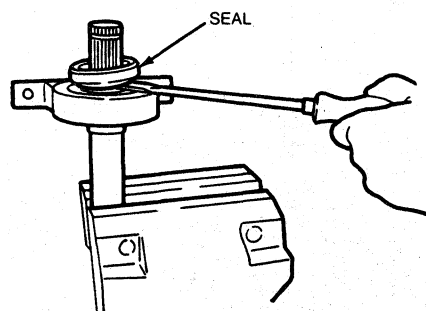


E5616-A

**DISASSEMBLY AND ASSEMBLY (Continued)**

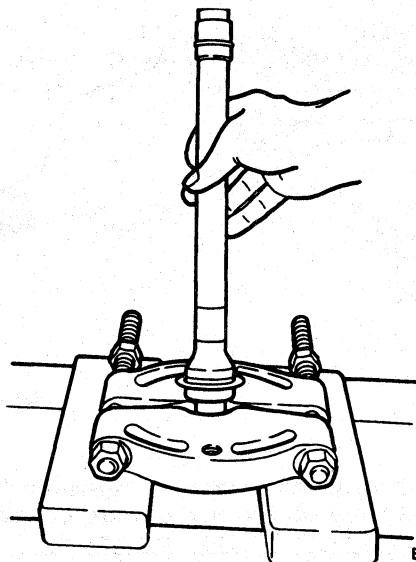
2. Remove seal from link shaft by prying it off with a screwdriver.

**CAUTION:** Use care to prevent damage to bearing dust shield.



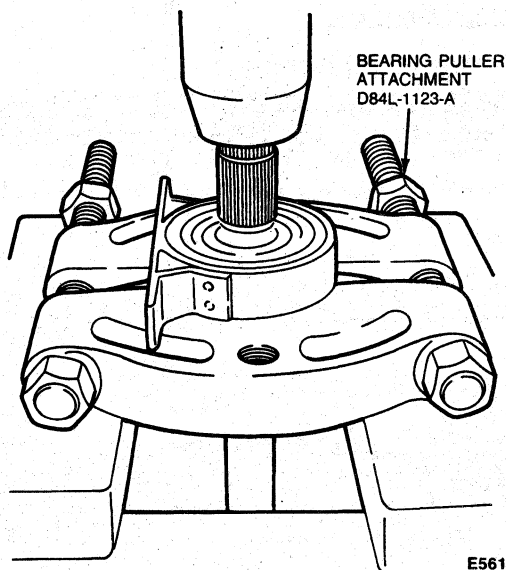
E5617-A

4. Support link shaft in press fixture with step in shaft.



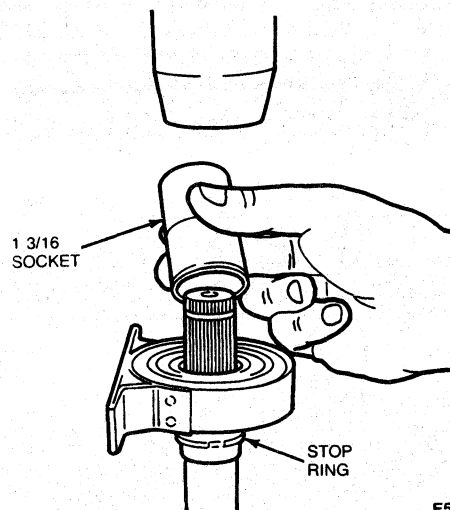
E5619-A

3. Place shaft assembly in arbor press, using Bearing Puller Attachment D84L-1123-A or equivalent, with bearing supported and press out link shaft.



E5618-B

5. Place bearing on shaft and press bearing onto shaft using a 1-3/16 inch deep-well socket until it contacts stop ring.

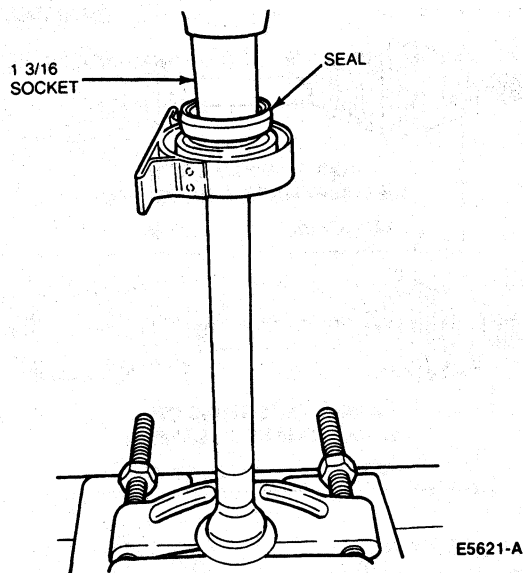


E5620-A

**DISASSEMBLY AND ASSEMBLY (Continued)**

6. Place seal on shaft and press seal onto shaft using a 1-3/16 inch deep-well socket until it contacts bearing.
7. Assemble halfshaft and link shaft.

NOTE: Before assembly, coat link shaft spline, seal lip and seal cavity with Constant Velocity Joint Grease E2FZ-19590-A or equivalent.

**SPECIFICATIONS****ATTACHING TORQUE SPECIFICATIONS**

Description	N-m	Lb-Ft
Front Hub Retainer Assembly	245-270	180-200
Control Arm To Knuckle Nut	54-74	40-55
Stabilizer Link to Stabilizer Bar	47-65	35-48
Wheel Nuts	108-142	80-105
Linkshaft Bearing Attaching Bolts (2)	21-32	16-23

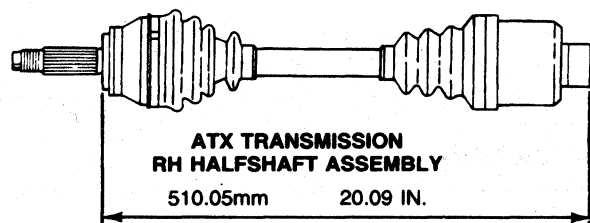
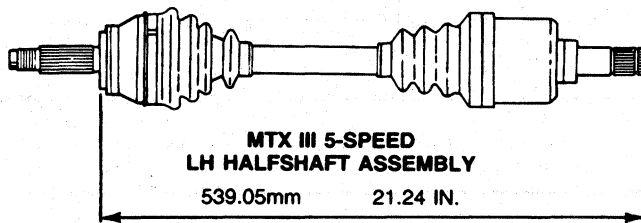
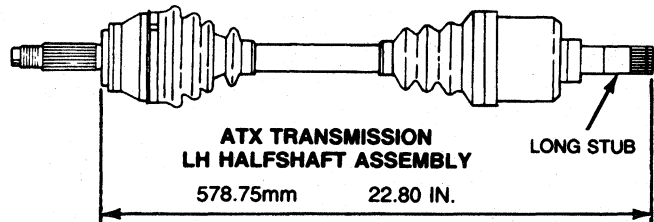
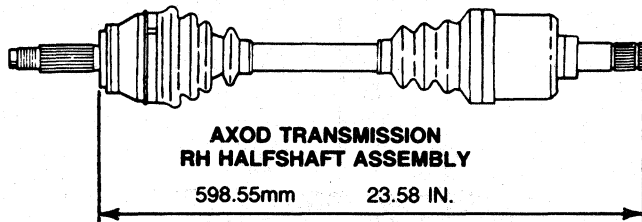
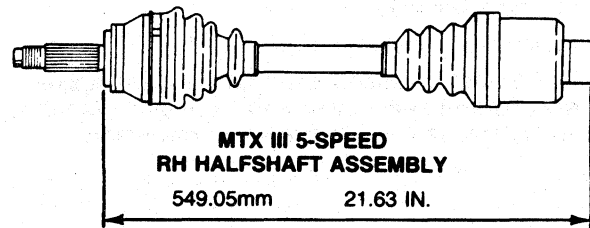
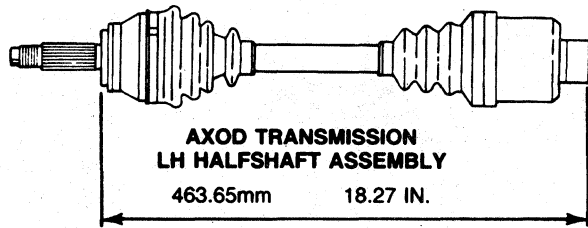
**LUBRICANT SPECIFICATIONS — HALFSHAFT ASSEMBLIES**

Vehicle	CV Joint Location	Specification	Total Fill	
			Grams	Ounces
Taurus/Sable	Outboard	ESP-M1C187-A, Ford Part No. E2FZ-19590-A	90	3.17
	Inboard	ESP-M1C207A, Ford Part No. E43Z-19590-A	170 (T and C)	6.00
			250 (GKN)	

CE5605-B

## SPECIFICATIONS (Continued)

## HALFSHAFT ASSEMBLED LENGTHS



CE5606-A

## SPECIAL SERVICE TOOLS

Tool Number	Description
T81P-1104-A	Metric Adapter
T83P-1104-BH1	Wheel Bolt Adapters (12mm)
T81P-1104-C	Front Hub Remover
T81P-1177-B	Shipping Plug
D83P-4026-A	Halfshaft Remover
T81P-4026-A	Differential Rotator
T86P-1104-A4	Dust Seal Installer
T83T-3132-A1	Spindle/Axle Seal Tool
T86P-1104-A1	Wheel Stud Adapter
T86P-3514-A1	CV Joint Puller Adapter
T86P-3514-A2	Puller Extension
D84L-1123-A	Bearing Puller Attachment
D79P-100-A	Slide Hammer

CE5604-B



# MANUAL TRANSAXLE

# GROUP 16

(7000)

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## SECTION 16-02 Clutch

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### VEHICLE APPLICATION

Taurus/Sable.

### OPERATION

The primary function of the clutch system is to couple and uncouple engine power to the transaxle upon driver command.

The clutch system cutaway is in the engaged (pedal released) position and identifies the individual components and their functions. In this position, engine output is coupled to the transaxle input shaft by virtue of the friction existing between the clutch disc facings and the flywheel/pressure plate assembly. The extent of this friction is directly related to the composition of the facing material and the magnitude of the clamping forces exerted by the pressure plate and flywheel on the facings. These are the factors that limit the amount of torque that can be transmitted without slippage. The clamping force is obtained from a Belleville spring contained within the pressure plate assembly.

This force is developed during the attachment of the pressure plate assembly to the flywheel, the Belleville spring being flattened between the pressure plate and the cover.

Disengagement of the clutch (pedal depressed) is accomplished when the release fingers are fully displaced toward the flywheel. This displacement removes the Belleville spring load from the pressure plate and thus eliminates the coupling friction between the engine and the transaxle. The release fingers are moved by the release bearing, which receives its motion through a linkage/cable system from the clutch pedal. It should be noted that partial finger displacement does not release the clutch but results in lower coupling friction which can cause slippage under load.

**OPERATION (Continued)**

The secondary function of the pressure plate and disc assemblies is to aid in isolating engine power pulses from the rest of the powertrain. The weight of the plate assembly adds to that of the flywheel and thus improves its function as a vibration damper. Contained within the disc assembly are several coil springs. These springs, along with a controlled amount of friction between the hub and the drive plates, also absorb engine pulsations. The spring and friction characteristics are tailored to each engine/powertrain/vehicle application. Therefore, only specified discs should be used for replacement.

Since the release bearing in this system is constant-running, transaxle neutral rollover noise can be detected as such only by disengaging the release bearing from the clutch release fingers. This is best accomplished by disconnecting the cable from the release lever and moving the lever away from the cable. If neutral noise is evident under this condition, it is emanating from the transaxle.

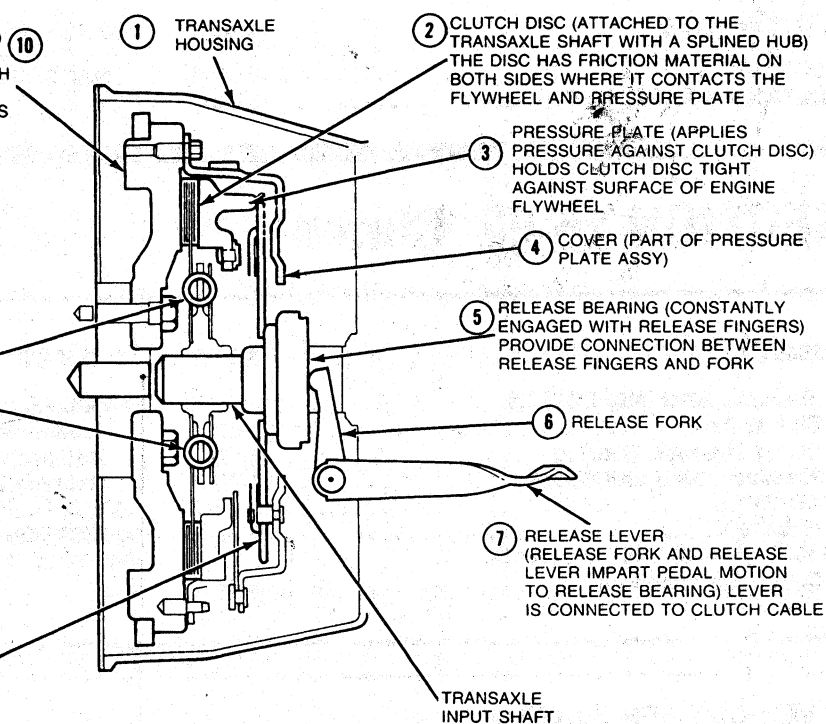
**NOTE:** Lift clutch pedal to the upmost position when connecting or disconnecting the clutch cable.

ENGINE FLYWHEEL (BOLTED TO ENGINE CRANKSHAFT AND ROTATES WITH THE CRANKSHAFT) MACHINED TO PROVIDE A FRICTION SURFACE WHICH MEETS WITH THE FRICTION SURFACE OF THE CLUTCH DISC WHEN THE CLUTCH IS ENGAGED, THIS FORMS A CONTINUOUS SYSTEM BY WHICH ENGINE POWER IS CONNECTED TO THE TRANSAXLE

DAMPER SPRINGS (PART OF THE DISC ASSY) AID IN ABSORBING ENGINE PULSES

**NOTE: THIS SYSTEM REQUIRES NO PILOT BEARING**

RELEASE FINGERS (PART OF THE BELLEVILLE LOAD SPRING) MOVEMENT TOWARD FLYWHEEL REMOVES CLAMP LOAD FROM CLUTCH DISC



C4031-D

**REMOVAL AND INSTALLATION****Clutch Components****Transaxle Removed**

Refer to Section 16-37 for transaxle removal.

**Release Bearing****Removal**

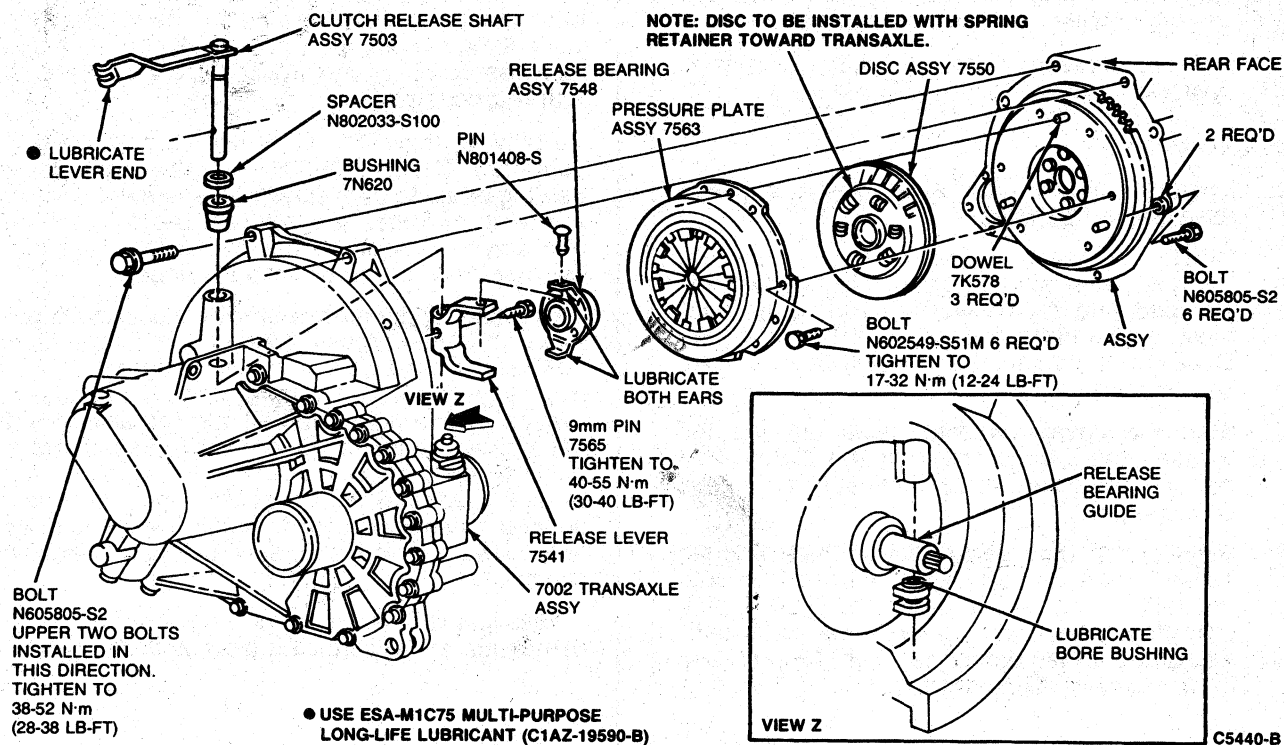
1. Remove release lever to release bearing retaining pin.
2. Slide bearing from transaxle extension.

## REMOVAL AND INSTALLATION (Continued)

### Installation

1. Apply a light film of Multi-Purpose Long-Life Lubricant C1AZ-19590-B or equivalent to entire outer surface of transaxle bearing retainer and the tips of the release lever where they contact the bearing. Fill bearing groove with same.
2. Slide bearing onto bearing retainer and attach to release lever with retaining pin.

NOTE: This pin is used only as an assembly aid. Any other suitable means of retaining the bearing during transaxle installation is acceptable.



### Release Fork and Lever

#### Removal

Refer to illustration under Release Bearing Installation.

1. Remove release lever-to-clutch release shaft assembly attaching bolt or pin.
2. Slide clutch release shaft assembly from transaxle housing.

#### Installation

1. Lubricate clutch release shaft pivot surfaces in clutch housing with a light film of Multi-Purpose Long-Life Lubricant C1AZ-19590-B or equivalent.
2. Position lever in housing with large screw hole to engine side. Slide clutch release shaft assembly through felt washer, upper bushing and fork, and then into housing lower bushing.
3. Align lever and clutch release shaft assembly holes. Install attaching bolt or pin. Tighten to 40-55 N·m (30-40 lb-ft).

## REMOVAL AND INSTALLATION (Continued)

## Pressure Plate and Disc

## Removal

Refer to illustration under Release Bearing Installation.

1. Loosen the six pressure plate cover attaching bolts evenly to release spring tension gradually and avoid distorting cover. If the same pressure plate and cover are to be installed, mark the cover and flywheel so that the pressure plate can be installed in its original position.
2. Remove pressure plate and clutch disc from flywheel.

## Installation

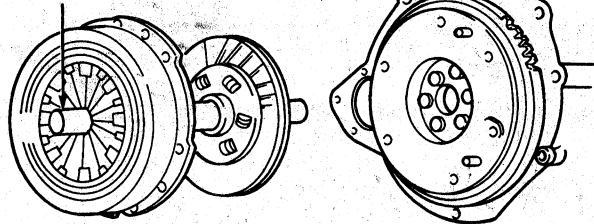
1. Position clutch disc and pressure plate assembly on flywheel.

NOTE: The clutch disc must be assembled so that the flatter side is toward the flywheel, as stamped. The three dowel pins and the flywheel must be properly aligned with the pressure plate. (Bent, damaged or missing dowels must be replaced.)

Start the cover attaching bolts but do not tighten them. Avoid touching the clutch disc face, dropping parts or contaminating parts with oil or grease.

2. Align clutch disc using Clutch Plate Aligner T81P-7550-A or equivalent inserted in the crankshaft. To avoid pressure plate cover distortion, alternately tighten cover bolts until fully seated, then tighten to 17-32 N·m (12-24 lb-ft). Remove alignment tool.

CLUTCH ARBOR  
TOOL  
T81P-7550-A



C6384-A

## CLEANING AND INSPECTION

## Clutch Release Bearing

Wipe all oil and dirt off the release bearing. **The bearing is prelubricated and should not be cleaned with solvent.**

Hold the bearing inner race and rotate the outer race while applying pressure. If rotation is rough or noisy, replace the bearing.

Inspect the release bearing assembly for burrs which may cause the assembly to drag on the transmission bearing retainer. If burrs are found, inspect the transmission input shaft bearing retainer for evidence of scoring. Polish out burrs and scoring with a crocus pad.

Apply a thin film of Multi-Purpose Long-Life Lubricant C1AZ-19590-B or equivalent to the bearing retainer, both sides of the release lever fork where it contacts the release bearing hub and retaining springs, and to the release bearing surface that contacts the pressure plate fingers.

Carefully fill the grease groove inside the bearing hub with Multi-Purpose Long-Life Lubricant C1AZ-19590-B or equivalent (no polyethylene). Clean all excess grease from the bore of the bearing hub as excess grease will be forced into the spline by the transmission input shaft bearing retainer and will contaminate the clutch disc. Also, care must always be exercised when applying lubricants to the release bearing, release bearing hub and the release lever fork, as excessive lubricant would contaminate the clutch disc.

Misalignment between the engine and transaxle can cause release bearing wear and damage.

## CLEANING AND INSPECTION (Continued)

### Clutch Disc

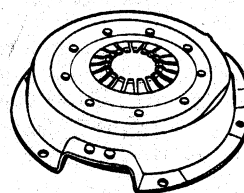
Inspect the clutch disc facings for oil or grease. Eliminate the source of any oil or grease before replacing the disc.

Any excessive amount of lubricant on the release bearing hub will find its way to the disc facings. Too much lubricant in the transmission or a plugged transmission vent will force the transmission lubricant out the input shaft and onto the disc facings. Also, engine rear main bearing oil seal leaks or oil leaks from the flywheel mounting bolts can contaminate the clutch disc.

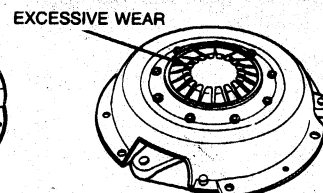
Inspect the clutch disc for worn or loose facings, distortion, loose rivets at the hub, and for broken springs. **Replace the disc assembly if any of these conditions are present. Springs loose enough to rattle will not cause noise when the vehicle is operating. Be especially careful when installing a new disc to avoid dropping it or contaminating it with oil or grease.**

### Pressure Plate and Cover

Inspect surface of pressure plate for burn marks, scores, ridges, and warpage. Generally, pressure plate resurfacing is not recommended, but minor burn marks or scores can be removed with a crocus pad. If it is badly heat checked, warped or deeply scored, replace pressure plate and cover assembly. Clean pressure plate and flywheel surfaces with a suitable solvent, such as alcohol to be sure surfaces are free from any oil film. **Do not use cleaners with petroleum base, and do not immerse the pressure plate in the solvent.**



NORMAL FINGER WEAR

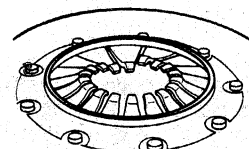


EXCESSIVE FINGER WEAR

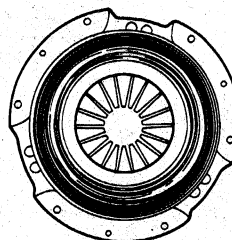


EXCESSIVE WEAR

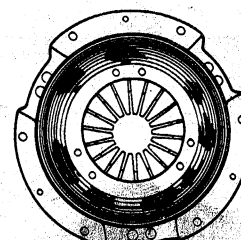
EXCESSIVE FINGER WEAR



BROKEN OR BENT FINGERS



EXCESSIVE SCORING



CLUTCH CHATTER

C3943-D

## DIAGNOSIS

## CLUTCH DIAGNOSIS

CONDITION	POSSIBLE SOURCE	ACTION
• Chirp or squeal when pedal is "up"	a Insufficient preload on release bearing.	a Service or replace linkage parts (cable, release lever, tension spring, pedal assembly). Lubricate with Multi-Purpose Long-Life Lubricant C1AZ-19590-B (ESA-M1C75-B) or equivalent, all linkage pivot points to clutch release shaft and lower bushings.
• Clutch chatters during engagement	a Loose engine mounts, roll restrictor or stiffener brace bolts. b Oil on clutch disc burned or glazed.	a Service as required. Tighten bolts and nuts to specification. b Install new clutch disc and correct leak. (Section 16-02).
• Clutch does not disengage properly	a Improper clutch pedal travel. b External linkage worn or damaged. c Clutch components inside clutch housing worn or damaged.	a, b Service or replace linkage parts as required. (Section 16-03). c1 Remove transaxle. Verify torque of pressure plate bolts. c2 Check for damaged or worn clutch, pressure plate, release bearing, release lever or release shaft pivot. c3 Check for warped or contaminated clutch disc. c4 Verify clutch disc hub spline free movement on input shaft spline — lubricate sparingly. Service or replace as required.
• Clutch is noisy when pedal is depressed. Noise continues as long as the pedal is held down.	a Damaged release bearing. b Flywheel housing out of alignment	a Remove transaxle and replace release bearing. Inspect the release fingers and replace the pressure plate assembly as required. b Align housing.
• Clutch slips after the pedal is fully released	a Release linkage inside flywheel housing binding or damaged. b Clutch facing excessively worn.	a Lubricate with Multi-Purpose Long-Life Lubricant C1AZ-19590-B, (ESA-M1C75-B) or equivalent. Service or replace linkage parts as required. (Section 16-03). b Remove transaxle. Check pressure plate and clutch disc for wear and contamination. Replace as required.
• Clutch "squeaks" or "scrubs" when the pedal is in motion	a Clutch release linkage and/or cable — lack of lubrication, binding, interference, worn or kinked. b Lack of lubrication on the clutch release shaft bushing, lower bosses and lever to release bearing contact. c Lack of lubrication in the clutch release bearing bore and the transaxle release bearing guide. d Flywheel housing out of alignment.	a Lubricate with Multi-Purpose Long-Life Lubricant C1AZ-19590-B, (ESA-M1C75-B) or equivalent. Service or replace as required. b Remove transaxle and release bearing. Lubricate with Multi-Purpose Long-Life Lubricant C1AZ-19590-B (ESA-M1C75-B) or equivalent, on bushing and other areas. c Lubricate with Multi-Purpose Long-Life Lubricant C1AZ-19590-B (ESA-M1C75-B) or equivalent, accordingly. d Align housing.

CC5441-B

## DIAGNOSIS (Continued)

## CLUTCH DIAGNOSIS (Continued)

CONDITION	POSSIBLE SOURCE	ACTION
• Noise when clutch pedal is depressed	<b>a</b> Clutch interlock switch. <b>b</b> Self adjuster ratchet noise. <b>c</b> Speed control interlock switch.	<b>a</b> Inspect interlock switch activating rod for binding or excessive noise. Replace switch if necessary. <b>b</b> Refer to Section 16-03 for diagnosis and service. <b>c</b> Refer to Section 37-05 Body, Chassis and Electrical manual.
• Vehicle will not start with clutch pedal fully depressed	<b>a</b> Improper adjustment of interlock switch, damaged switch or open or short-circuited wiring.	<b>a</b> Refer to Section 16-03 for diagnosis and service.

CC4188-A

## RELEASE BEARING NOISE

Chirp, squeak or clatter with pedal up can be caused by insufficient bearing pre-load, out-of-plane pressure plate fingers, transmission or a worn or damaged release bearing. The following procedure will isolate the cause.

TEST STEP		RESULT	ACTION TO TAKE
<b>A0</b>	<b>DEPRESS CLUTCH PEDAL</b>		
	• With engine idling and transaxle in <b>NEUTRAL</b> , depress clutch pedal to the floor.	Noise still present	REPLACE damaged or worn release bearing.
		Noise gone	GO to A1. RELEASE bearing OK.
<b>A1</b>	<b>DISENGAGE BEARING</b>		
	• Disconnect clutch cable from release lever and move lever away from cable to disengage bearing from pressure plate fingers.	Noise still present	Noise is from transaxle. REFER to Section 16-36 or 16-37 for Transaxle Diagnosis.
		Noise gone	GO to A2. Transaxle is OK.
<b>A2</b>	<b>PRE-LOAD BEARING</b>		
	• Apply 5 lb. load to lever end of clutch release shaft assembly in direction of cable — pull to preload bearing.	Noise still present	LUBRICATE pivot and bushings to free up binding release lever.
		Noise gone	Clutch control system damaged or quadrant tension spring out of position. SERVICE or REPLACE as required any sticky or binding clutch control components.

CC4035-E



## SPECIFICATIONS

Engine	Pressure Plate			Clutch Disc			
	Diameter		Color Identification (Paint Daub)	Diameter		No. of Springs	Color Identification (Paint Daub)
	mm	In.		mm	In.		
2.5L HSC. CFI	215	8.5	None	215	8.5	2 Bright Red (Large) 2 Silver (Small) 2 Pigeon Blue (Large) 2 Bright Red (Small)	Brown

CC5443-B

## TORQUE SPECIFICATIONS

Description	N-m	Lb-Ft
Bolt — Transaxle Clutch Housing-To-Engine N605805-S2	38-52	28-38
Bolt — Pressure Plate-To-Flywheel N602549-S2	17-32	12-24
Pin-To-Release Fork — 7565	40-55	30-40

CC5442-B

## SPECIAL SERVICE TOOLS

Tool Number	Description
T81P-7550-A	Clutch Plate Aligner

CC4038-B



# SECTION 16-03 Clutch Linkage, Mechanical

SUBJECT	PAGE	SUBJECT	PAGE
<b>DESCRIPTION AND OPERATION</b>		<b>REMOVAL AND INSTALLATION (Cont'd.)</b>	
Clutch Control System, Self-Adjusting .....	16-03-1	Starter/Clutch Interlock Switch .....	16-03-6
Starter/Clutch Interlock Switch .....	16-03-2	<b>SPECIFICATIONS</b> .....	16-03-9
<b>DIAGNOSIS</b> .....	16-03-8	<b>TESTING</b>	
<b>REMOVAL AND INSTALLATION</b>		Starter/Clutch Interlock Switch	
Clutch Cable Assembly .....	16-03-5	Continuity .....	16-03-7
Clutch Pedal Assembly .....	16-03-3	<b>VEHICLE APPLICATION</b> .....	16-03-1

## VEHICLE APPLICATION

Taurus/Sable.

## DESCRIPTION AND OPERATION

### Clutch Control System, Self-Adjusting

The illustration shows the relationship between the clutch controls and the balance of the system. The clutch control system is self-adjusting and pedal motion is transmitted by cable to the clutch release lever.

**NOTE:** After proper installation of the cable, adjustment is completed by pulling the clutch pedal to its upmost position.

With the pedal in the upmost position, the pawl is free of the quadrant and the quadrant orientation is governed by the position of the clutch release fingers, the quadrant being free to rotate independent of the pedal. The adjuster load spring force ensures contact between the release bearing and the fingers. As the disc facing wears, the fingers are gradually moved away from the flywheel and this movement is translated to the quadrant, adjusting the quadrant orientation relative to the pedal, when the pawl is free of the quadrant.

During normal running position, the pawl is engaged with the quadrant, locking it to the pedal. For the rest of the pedal travel, the system works as a conventional system; the pedal motion being transmitted to the release fingers. The quadrant remains locked to the pedal during pedal movement. Since the release bearing in this system is constant-running, transmission neutral rollover noise can be detected as such only by disengaging the release bearing from the clutch release fingers.

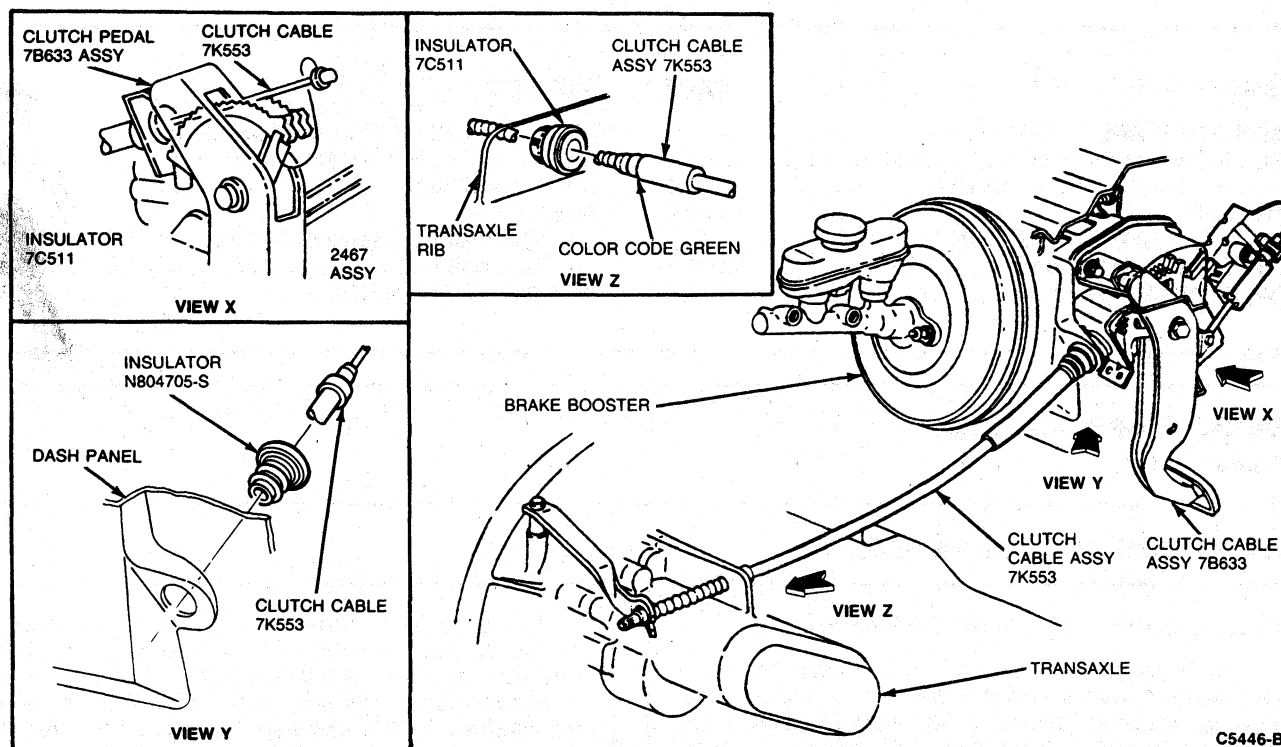
This is best accomplished by disconnecting the cable from the release lever and moving the lever away from the cable. If neutral noise is evident under this condition, it is emanating from the transmission.

**NOTE:** Lift clutch pedal to the upmost position when connecting or disconnecting the clutch cable.

Noise associated with the release bearing/clutch system will be evident during all or some portion of pedal travel.

The clutch is a Belleville spring-type pressure plate and a multi-stage damped disc utilizing a self-centering, constant running release bearing.

## DESCRIPTION AND OPERATION (Continued)

**Starter/Clutch Interlock Switch**

The starter/clutch interlock switch is designed to prevent starting the engine unless the clutch pedal is fully depressed. The switch is connected between the ignition switch and the starter motor relay coil and maintains an open circuit with the clutch pedal up (clutch engaged).

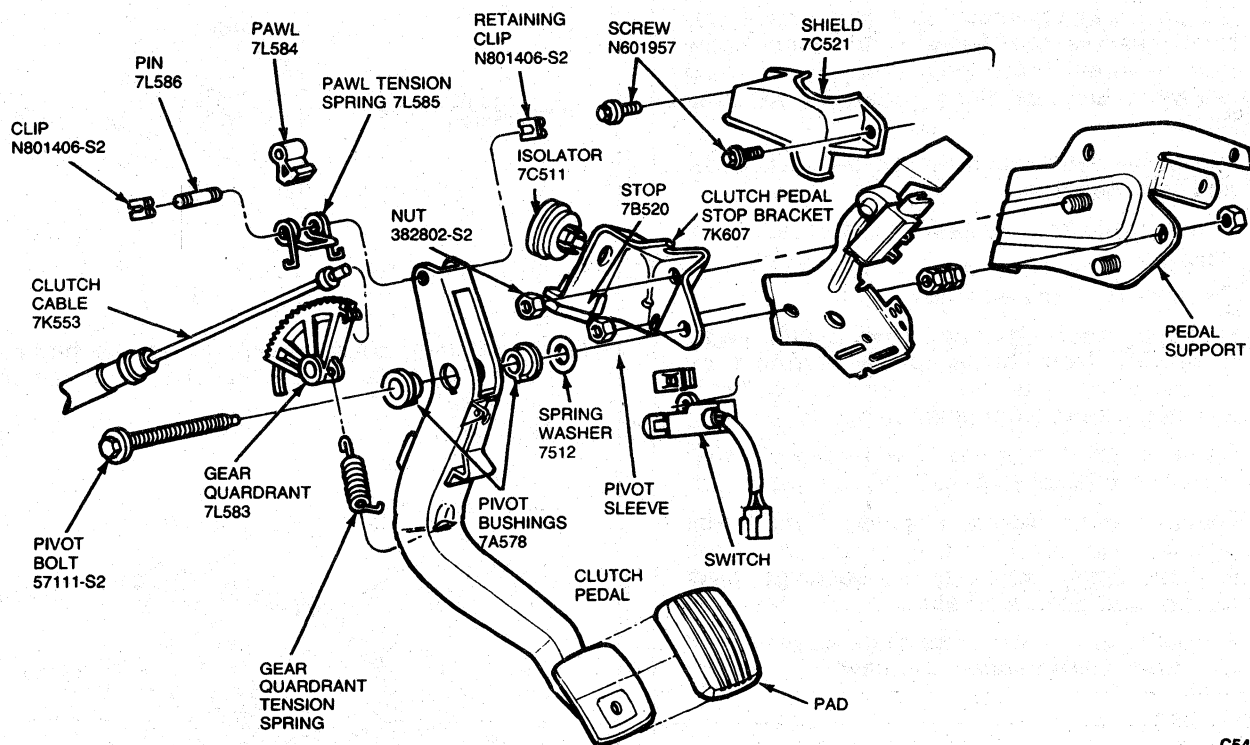
The switch is designed to automatically self-adjust the first time the clutch pedal is pressed to the

floor. The self-adjuster consists of a two-piece clip snapped together over a serrated rod. When the plunger or rod is extended, the clip bottoms out on the switch body and allows the rod to ratchet over the serrations to a position determined by the clutch pedal travel. In this way, the switch is set to close the starter circuit when the clutch pedal is pressed all the way to the floor (clutch disengaged).

## REMOVAL AND INSTALLATION

### Clutch Pedal Assembly

Refer to the following illustration while performing the Removal and Installation procedures for the Clutch Pedal Assembly.

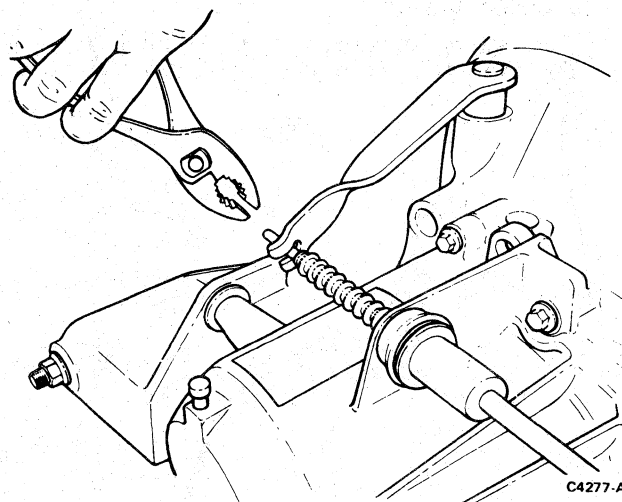


C5445-B

### Removal

1. Prop up clutch pedal to lift pawl free of quadrant which is part of self-adjuster mechanism.
2. Remove air cleaner assembly to gain access to clutch cable.
3. Grasp extended tip of clutch cable with a pair of pliers, and unhook clutch cable from release lever.

**NOTE:** Do not grasp the wire strand portion of inner cable since this may cut the wires and result in cable failure.



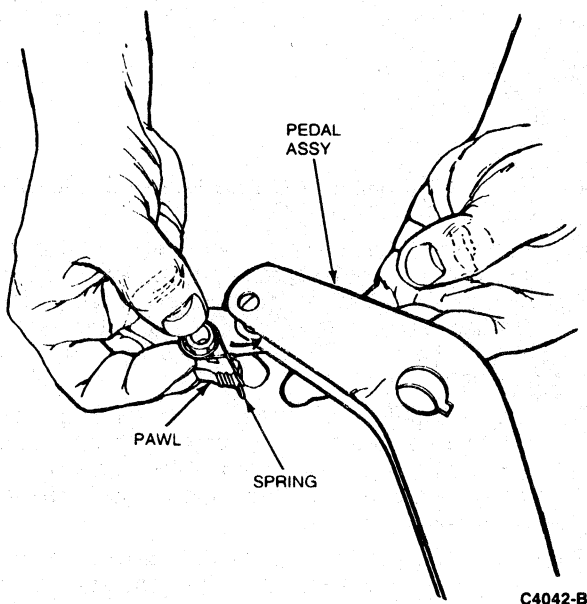
C4277-A

## REMOVAL AND INSTALLATION (Continued)

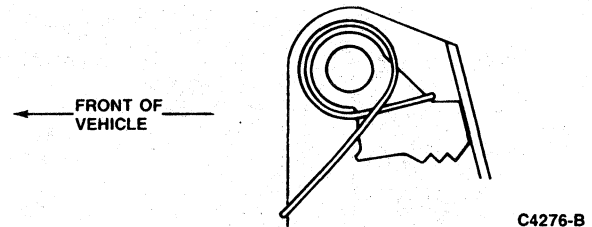
4. Position clutch shield away from mounting plate bracket by removing rear retaining screw. Loosen front retaining screw located near toe board, and rotate shield out of way. Secure by snugging up front screw. (Rear retaining screw is nearest instrument panel.)
5. Lift up on clutch pedal to release pawl and rotate gear quadrant forward and unhook cable from quadrant. Allow gear quadrant to swing rearward. **Do not allow quadrant to snap back.**
6. Pull cable out through recess between pedal and gear quadrant.
7. Unseat cable from insulator at clutch pedal stop bracket.
8. Disconnect clutch switches.
9. Remove mounting plate, and clutch pedal assembly from brake pedal support by removing two nuts from brake booster studs and two screws from pedal support.
10. Remove pivot bolt nut that attaches stop mounting bracket to pedal and remove pedal.
11. Remove gear quadrant spring from pedal recess, and pivot bolt from clutch pedal. Remove spring washers, two bushings, pivot sleeve, and gear quadrant.
12. Remove pawl pivot pin retaining clip, pawl pivot pin, pawl tension spring and pawl.

## Installation

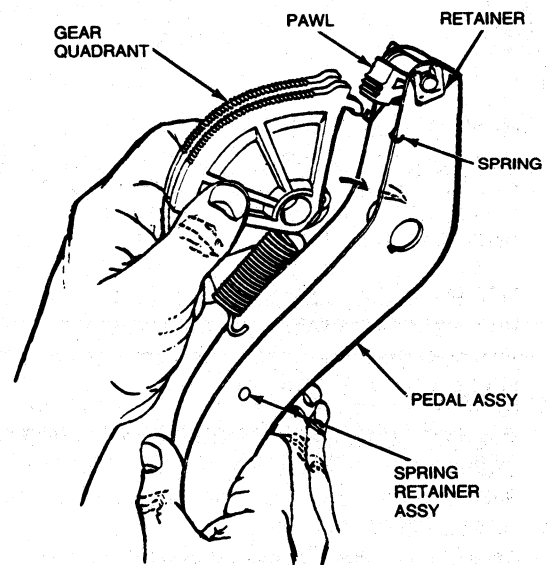
1. Lubricate quadrant pivot bore, pawl pivot bore, quadrant pivot pin and quadrant pivot sleeve.
2. Insert pawl, spring and pivot pin into clutch pedal, and secure with retainer clip.



NOTE: Proper orientation of the pawl spring and pawl.

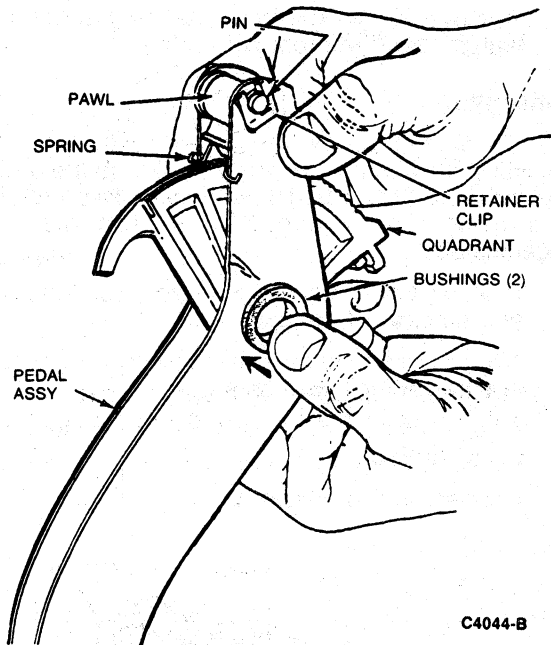


3. Install gear quadrant with spring attached into clutch pedal. Note direction of hook on free end of spring.



## REMOVAL AND INSTALLATION (Continued)

4. Rotate gear quadrant and place pawl on gear quadrant face.
5. Install two bushings and pivot sleeve into clutch pedal.



C4044-B

6. Hook tension spring to hole in clutch pedal.
7. Position stop mounting bracket and spring washer to clutch pedal assembly. Place bolt through pivot sleeve and install switch plate and pivot bolt nut. Tighten to 34-40 N·m (25-30 lb-ft).

NOTE: Ensure spring washer is functional and is not trapped under the pivot sleeve.

8. Position clutch pedal assembly on brake pedal support bracket and install three nuts. Tighten to 20-34 N·m (15-25 lb-ft).
9. Secure clutch pedal assembly and support bracket to brake booster studs and pedal support.
10. Pull clutch cable through insulator, clutch pedal stop bracket and the recess between pedal and gear quadrant. Rotate gear quadrant forward by lifting up on clutch pedal to release pawl, and hook cable into gear quadrant.
11. Install clutch shield-to-brake pedal support bracket.
12. Install clutch switches and adjust as outlined in Section 37-05.
13. Using a piece of wire, cord, tape or similar device, secure clutch pedal in its upmost position to ensure pawl is disengaged from quadrant.
14. Hook clutch cable into release lever in engine compartment.
15. Remove device used to secure clutch pedal up against stop in Step 13.
16. Adjust clutch by depressing clutch pedal several times.
17. Install air cleaner assembly.

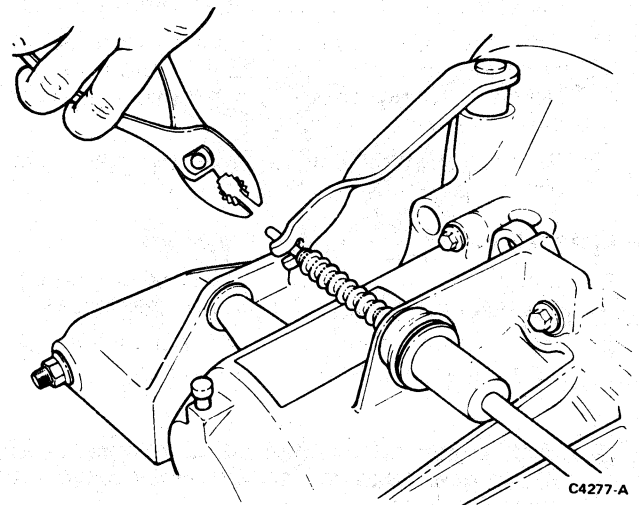
## Clutch Cable Assembly

## Removal

**CAUTION:** Whenever the clutch cable is disconnected for any reason, such as transmission removal or clutch, clutch pedal components, or clutch cable replacement, it is imperative that the proper method for installing the clutch cable be followed.

1. Prop up clutch pedal to lift pawl free of quadrant which is part of self-adjuster mechanism.
2. Remove air cleaner assembly to gain access to clutch cable.
3. Grasp the extended tip of the clutch cable with a pair of pliers, and unhook clutch cable from clutch bearing release lever.

NOTE: Do not grasp wire strand portion of inner cable since this may cut wires and result in cable failure.



4. Disconnect cable from insulator that is located on the rib of transaxle.
5. Position clutch shield away from brake pedal support bracket by removing the rear retaining screw (located nearest the instrument panel). Loosen front retaining screw and rotate shield out of the way. Secure by snugging up front screw.
6. With clutch pedal lifted up to release pawl, rotate gear quadrant forward. Unhook clutch cable from gear quadrant. Allow quadrant to swing rearward. **Do not allow quadrant to snap back.**
7. Pull cable out through recess between clutch pedal and gear quadrant, and from insulator on pedal assembly.
8. Withdraw cable through engine compartment.

## REMOVAL AND INSTALLATION (Continued)

## Installation

**CAUTION:** The clutch pedal must be lifted to disengage the adjusting mechanism during cable installation. Failure to do so will result in damage to the self-adjuster mechanism.

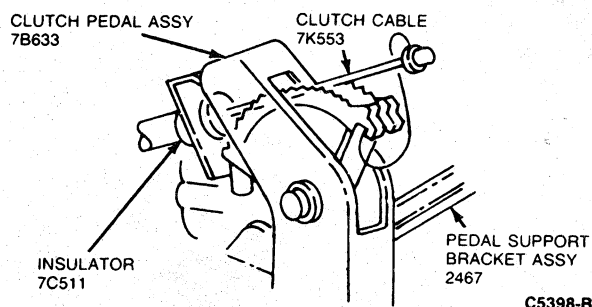
**CAUTION:** Under no circumstances should a prying instrument such as a screwdriver or a pry bar be used to install the cable into the quadrant.

1. Insert clutch cable assembly from engine or passenger compartment through dash panel and dash panel grommet.

**NOTE:** If the clutch pedal assembly was removed, the cable may be installed through the passenger compartment.

**NOTE:** Ensure cable is routed inboard of the brake lines and not trapped at the spring tower by the brake lines.

2. Push clutch cable through insulator on stop bracket, and through recess between pedal and gear quadrant.



3. With clutch pedal lifted up to release pawl, rotate gear quadrant forward. Hook cable into gear quadrant.
4. Secure clutch shield on brake pedal support bracket.
5. Secure pedal in upmost position using a piece of wire, cord, tape or similar device.
6. Install clutch cable in insulator on rib of transaxle.
7. Hook cable into clutch release lever in engine compartment.
8. Remove device used to temporarily secure pedal against its stop.
9. Adjust clutch by depressing clutch pedal several times.
10. Install air cleaner.

## Starter/Clutch Interlock Switch

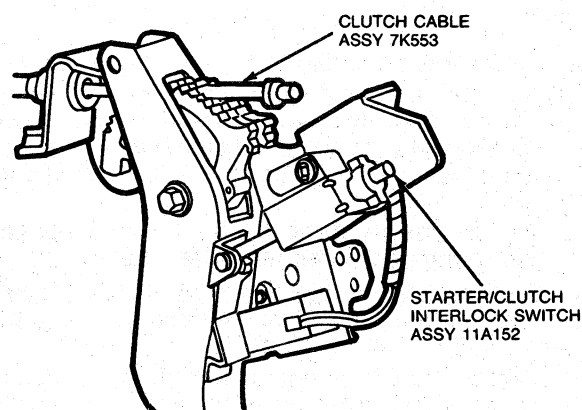
## Removal

1. Disconnect wiring connector.
2. Remove clutch interlock attaching screw and hairpin clip, then remove switch.

## Installation

**NOTE:** Always install the switch with the self-adjusting clip about 25.4mm (1-inch) from the end of the rod. The clutch pedal must be fully up (clutch engaged). Otherwise, the switch may be misadjusted.

1. Insert eyelet end of rod over pin on clutch pedal and secure with hairpin clip.
2. Align mounting boss with corresponding hole in bracket. Attach with screw.
3. Reset clutch interlock switch by pressing clutch pedal to floor.
4. Connect wiring connector.

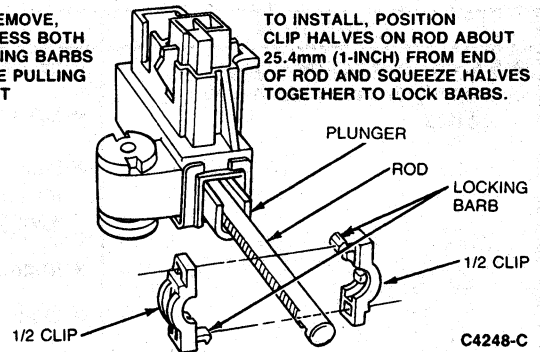


**TESTING****Starter/Clutch Interlock Switch Continuity**

1. Remove panel above clutch pedal.
2. Disengage wiring connector by flexing retaining tab on switch and withdrawing connector.
3. Using a test lamp or continuity tester, check to see that switch is open with clutch pedal up (clutch engaged), and closed at approximately 25.4mm (1-inch) from clutch pedal full down position (clutch disengaged).
4. If switch does not operate as in Step 2, check if self-adjusting clip is out of position on rod. It should be near end of rod.
5. If self-adjusting clip is out of position, remove and reposition clip to about 25.4mm (1-inch) from end of rod.
6. Reset switch by pressing clutch pedal to floor.
7. Repeat Step 3. If switch is damaged or clips do not remain in place, replace switch.

TO REMOVE,  
DEPRESS BOTH  
LOCKING BARBS  
WHILE PULLING  
APART

TO INSTALL, POSITION  
CLIP HALVES ON ROD ABOUT  
25.4mm (1-INCH) FROM END  
OF ROD AND SQUEEZE HALVES  
TOGETHER TO LOCK BARBS.



## DIAGNOSIS

Refer to the following diagnosis charts to service the clutch linkage.

## CLUTCH DIAGNOSIS

CONDITION	POSSIBLE SOURCE	ACTION
<ul style="list-style-type: none"> <li>Clutch does not disengage properly or gears clash while shifting.</li> </ul>	<ul style="list-style-type: none"> <li>Improper clutch pedal travel.</li> <li>Spring Washer improperly installed.</li> <li>Pawl does not fully engage due to missing, damaged, or weak pawl spring.</li> <li>Improper clutch cable installed.</li> <li>Damaged rubber insulators.</li> <li>Loose pedal support attachments.</li> <li>Carpet, sound deadener out of position.</li> <li>Floor mats interfering with pedal travel.</li> <li>Pawl binding due to entrapped sound absorber.</li> <li>Broken components inside of clutch housing.</li> <li>External linkage worn or damaged.</li> </ul>	<ul style="list-style-type: none"> <li>Correct assembly.</li> <li>Install new spring.</li> <li>Install correct cable.</li> <li>Correct insulators.</li> <li>Loosen and retighten to specification.</li> <li>Position correctly.</li> <li>Remove contamination and free up pawl.</li> <li>Replace or service. Refer to Section 16-02.</li> <li>Service or replace linkage parts as required.</li> </ul>
<ul style="list-style-type: none"> <li>Pedal makes ratcheting noise while traveling to or from floor.</li> </ul>	<ul style="list-style-type: none"> <li>Teeth stripped on pawl or quadrant.</li> </ul>	<ul style="list-style-type: none"> <li>Replace quadrant, pawl and pawl spring.</li> </ul>
<ul style="list-style-type: none"> <li>Pedal travels to floor with no effort or noise.</li> </ul>	<ul style="list-style-type: none"> <li>Pawl does not engage quadrant due to missing spring.</li> <li>Broken clutch cable.</li> <li>Broken components inside of clutch housing.</li> </ul>	<ul style="list-style-type: none"> <li>Install spring.</li> <li>Replace clutch cable.</li> <li>Replace or service. Refer to Section 16-02.</li> </ul>
<ul style="list-style-type: none"> <li>Clutch squeaks or scrubs when the pedal is in motion.</li> </ul>	<ul style="list-style-type: none"> <li>Clutch release linkage and/or cable — lack of lubrication, binding, interference, worn or kinked.</li> <li>Lack of lubrication on the clutch release lever pivot and lever to release bearing contact.</li> <li>Lack of lubrication in the clutch release bearing bore and the release bearing guide.</li> <li>Flywheel housing out of alignment.</li> </ul>	<ul style="list-style-type: none"> <li>Lubricate with Multi-Purpose Long-Life Lubricant C1AZ-19590-B or equivalent. Service as required.</li> <li>Remove transmission and release bearing. Lubricate with Multi-Purpose Long-Life Lubricant C1AZ-19590-B or equivalent, accordingly.</li> <li>Lubricate with Multi-Purpose Long-Life Lubricant C1AZ-19590-B or equivalent, accordingly.</li> </ul>

CC5401-C



## DIAGNOSIS (Continued)

## CLUTCH DIAGNOSIS — Continued

CONDITION	POSSIBLE SOURCE	ACTION
<ul style="list-style-type: none"> <li>• *Excessive pedal effort over 20 kg (45 lbs.).</li> </ul>	<ul style="list-style-type: none"> <li>• Damaged or worn cable.</li> <li>• Clutch pedal binding.</li> <li>• Clutch release lever binding.</li> <li>• Clutch disc worn or pressure plate damaged.</li> </ul>	<ul style="list-style-type: none"> <li>• Inspect cable. Replace if kinked or crushed.</li> <li>• Disconnect cable from release lever. Check for smooth operation or binding. Replace if operation is erratic.</li> <li>• Disconnect cable from release lever. Check for free pedal movement and free up as required.</li> <li>• Inspect and service. Refer to Section 16-02.</li> <li>• Replace or service. Refer to Section 16-02.</li> </ul>
<ul style="list-style-type: none"> <li>• Noise when clutch pedal is depressed.</li> </ul>	<ul style="list-style-type: none"> <li>• Check clutch interlock switch.</li> <li>• Noisy clutch speed control switches.</li> <li>• Insufficient lubrication on clutch pivot sleeve.</li> <li>• Damaged release bearing.</li> </ul>	<ul style="list-style-type: none"> <li>• Inspect interlock switch activating rod for binding or excessive noise. Replace switch if necessary.</li> <li>• Check speed control switch if required.</li> <li>• Lubricate clutch pivot sleeve with Multi-Purpose Long-Life Lubricant C1AZ-19590-B.</li> <li>• Replace or service, refer to Section 16-02.</li> </ul>
<ul style="list-style-type: none"> <li>• Vehicle will not start with clutch pedal fully depressed.</li> </ul>	<ul style="list-style-type: none"> <li>• Clutch interlock switch improperly adjusted.</li> <li>• Clutch interlock switch damaged.</li> <li>• Starter, wiring or battery damaged.</li> </ul>	<ul style="list-style-type: none"> <li>• Reposition self-adjusting clip or rod on press and release clutch pedal.</li> <li>• Perform continuity test. Replace switch if necessary.</li> <li>• Refer to Section 28-02 and/or Section 31-02, Body, Chassis and Electrical manual.</li> </ul>

\*In the event of a sheared teeth condition on the pawl or quadrant, the pedal efforts are to be evaluated after installation of new components. If the pedal efforts are in excess of 20 kg (45 lbs), the clutch disc, pressure plate, or clutch cable may require replacement.

CC5402-B

## SPECIFICATIONS

## TORQUE SPECIFICATIONS

Description	N·m	Lb·Ft
Pedal assembly to brake support bracket nuts	20-34	15.25
Stop mounting bracket to clutch pedal assembly	34-40	25-30

CC5447-A

# SECTION 16-37 Transaxle—MTX III 5-Speed

SUBJECT	PAGE	SUBJECT	PAGE
<b>CLEANING AND INSPECTION</b>		<b>MAJOR SERVICE OPERATIONS (Cont'd.)</b>	
Flywheel .....	16-37-55	In-Vehicle Service (Cont'd.)	
Transaxle Case .....	16-37-54	Transaxle Fluid Level Check .....	16-37-54
Aluminum Transaxle Case Service .....	16-37-54	Input Cluster Shaft Bearings .....	16-37-47
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<b>DESCRIPTION</b> .....	16-37-1	Shift Cables, Brackets and Clamp	
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Reverse Shift Relay Lever and Bracket .....	16-37-44	Power Flow .....	16-37-6
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Driven Gear .....	16-37-54		

## VEHICLE APPLICATION

Taurus/Sable.

## DESCRIPTION

The MTX III 5-Speed Manual Transaxle is similar in design and function to the MTX II 4-Speed Manual Transaxle. The major differences are to accommodate the addition of a 5th gear driveshaft assembly and a 5th gear shift fork assembly, which provides a 5th gear drive range feature.

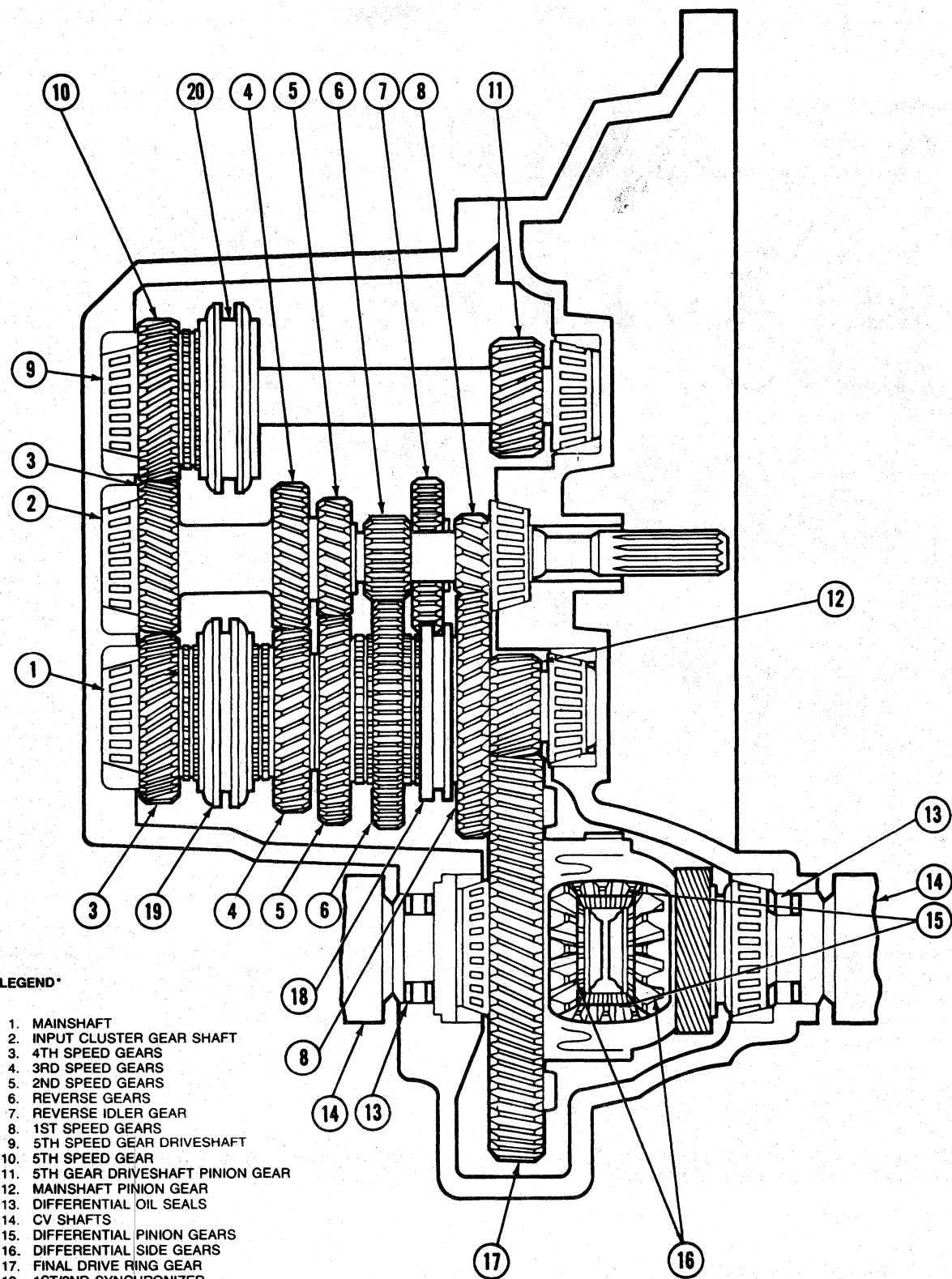
The transaxle is a front wheel drive powertrain unit. The transmission and differential assemblies are housed in a single two-piece aluminum alloy case. The transaxle is bolted to the back of the engine and is mounted transversely in the vehicle with the engine on the right and the transaxle on the

left. Three separate gear shaft assemblies are used; the input cluster gear shaft, the main shaft and the 5th gear driveshaft. Helical cut gears are used in all forward ranges for quiet operation. All five forward gears are synchronized for ease of shifting.

The 5th gear range provides an effective overdrive ratio, which allows the engine to operate at reduced rpm providing reduced engine wear and improved fuel economy.

An automatic transmission type fluid is used as a lubricant to ensure shifting ease under all driving conditions.

## DESCRIPTION (Continued)



## LEGEND\*

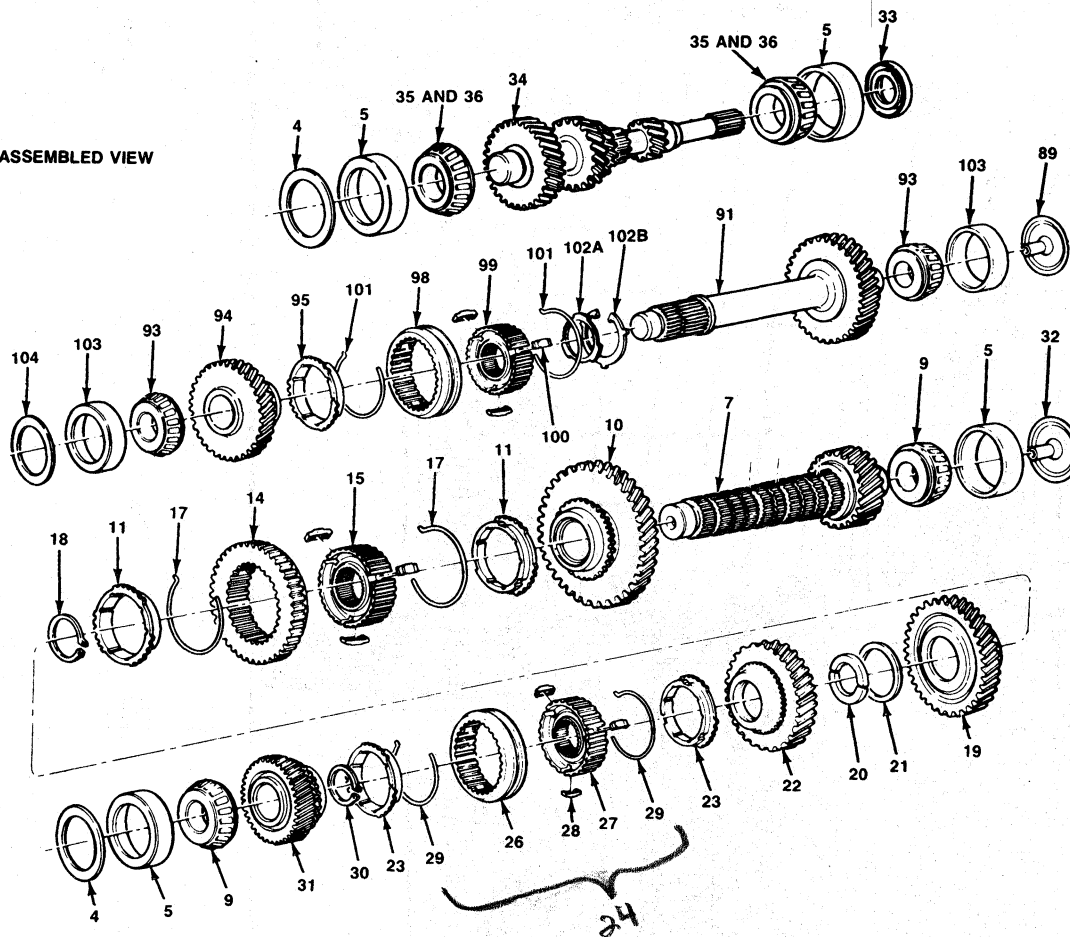
1. MAINSHAFT
2. INPUT CLUSTER GEAR SHAFT
3. 4TH SPEED GEARS
4. 3RD SPEED GEARS
5. 2ND SPEED GEARS
6. REVERSE GEARS
7. REVERSE IDLER GEAR
8. 1ST SPEED GEARS
9. 5TH SPEED GEAR DRIVESHAFT
10. 5TH SPEED GEAR
11. 5TH GEAR DRIVESHAFT PINION GEAR
12. MAINSHAFT PINION GEAR
13. DIFFERENTIAL OIL SEALS
14. CV SHAFTS
15. DIFFERENTIAL PINION GEARS
16. DIFFERENTIAL SIDE GEARS
17. FINAL DRIVE RING GEAR
18. 1ST/2ND SYNCHRONIZER
19. 3RD/4TH SYNCHRONIZER
20. 5TH SYNCHRONIZER

\*REFER TO EXPLODED VIEW TO REFERENCE PART NUMBERS

C4164-E

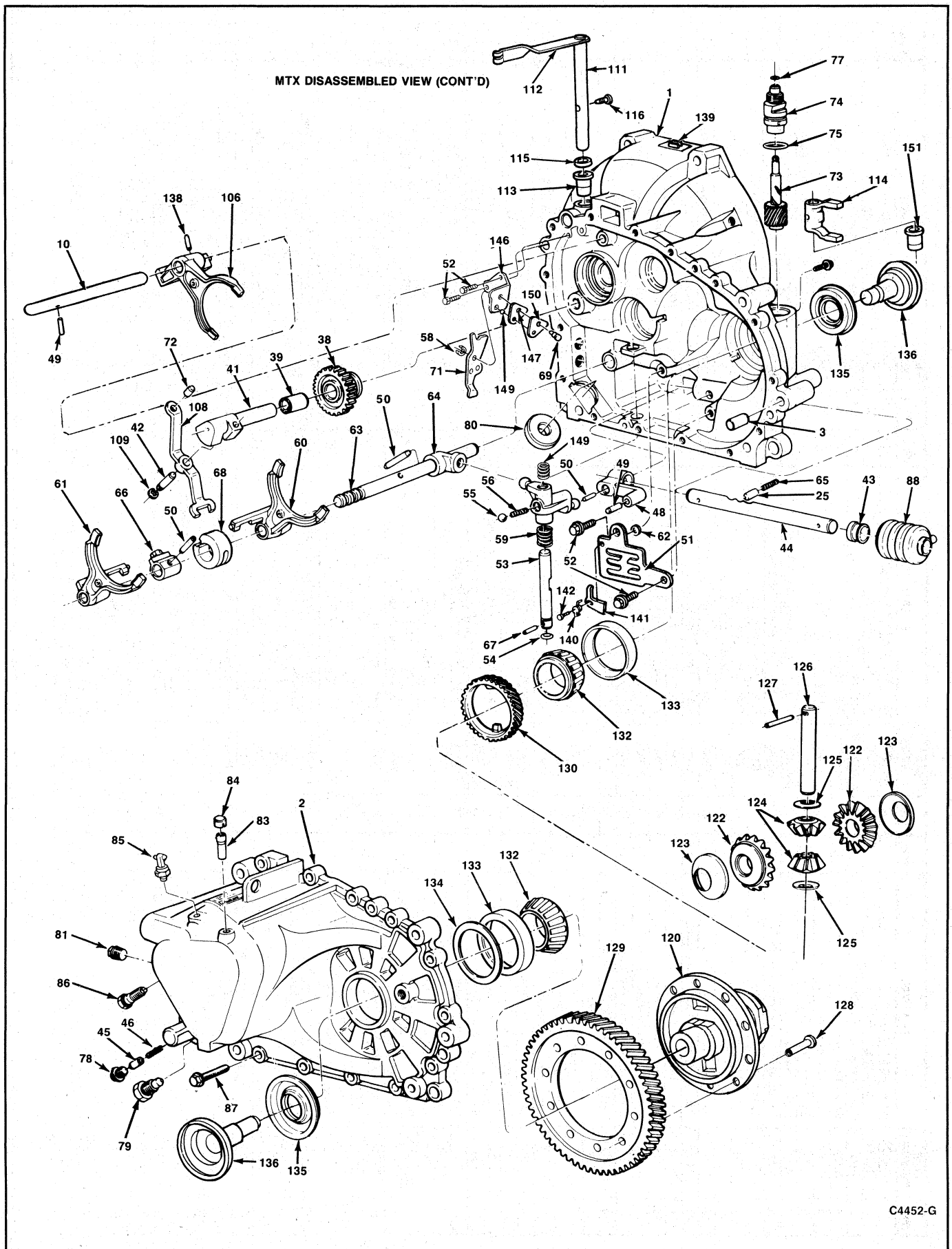
## DESCRIPTION (Continued)

MTX DISASSEMBLED VIEW



C4451-G

## DESCRIPTION (Continued)



## DESCRIPTION (Continued)

ITEM	PART NUMBER	PART NAME	REQ.	ITEM	PART NUMBER	PART NAME	REQ.	ITEM	PART NUMBER	PART NAME	REQ.
1	7F096-DA	Case - Transaxle Clutch	1	52	N801087-S	Bolt - M6-1.0 X 22 Hex. Flange Head	4	102B	7G042	Retainer - Trans. 5th Synchro. Insert	1
2	7F097-BA	Case - Transaxle Trans.	1	53	7C355	Shaft - Trans. Shift Lever	1	103	7F433	Cup - Trans. Bearing	2
3	6397	Dowel - Trans. Case to Clutch Housing	2	54	N802277-S	Seal - 9mm X 2.6 'O' Ring Oil	1	104	7L172	Shim - Trans. Bearing Preload	1
4	7L172	Shim - Trans. Bearing Preload	2	55	N-802568-S	Ball - 10.319mm	1	105	7358	Shaft - Trans. 5th Shift Fork Control	1
5	7F433	Cup - Trans. Bearing	4	56	7L058	Spring - Trans. 5th Rev. Inhibitor	1	106	7B297	Fork - Trans. 5th Shift	1
6	7C094	Saft Assy. - Trans. Main	1	57	7F116	Lever - Trans. Shift	1	107	7G043	Lever Assy. - Trans. 5th Shift Relay	1
7	7061	Shaft - Trans. Main	1	58	N663109-S	Ring - 10mm Retaining Type RB Ext.	1	108	7G044	Lever - Trans. 5th Shift Relay	1
8	7F431	Bearing Assy. - Trans. Tapered Roller	2	59	7G046	Spring - Trans. 3rd/4th Shift Bias	1	109	N802832-S	Ring - 8mm Retaining Type RB Ext.	1
9	7F432	Cone & Roller Assy. - Trans. Bearing	2	60	7C114	Fork - Trans. 1st/2nd Shift	1	110	7503	Shaft Assy. - Clutch Release	1
10	7100	Gear - Trans. 1st Speed	1	61	7230	Fork - Trans. 3rd/4th Shift	1	111	7510	Shaft - Clutch Release	1
11	7107	Ring - Trans. Synchro. Blocking	2	62	7F177	Plate & Spring Assy. - Trans.	1	112	7591	Lever - Clutch Release	1
12	7124	Synchronizer Assy. - Trans. 1st/2nd	1	63	7358	Shaft - Trans. Main Shift Fork Control	1	113	7N620	Bushing - Clutch Release Shaft - Upper	1
13	7K012	Gear & Hub Assy. - Trans. 1st/2nd Sync.	1	64	7K105	Block - Trans. Fork Control Shaft	1	114	7541	Lever - Clutch Release	1
14	7K013	Gear - Trans. Rev. Sliding	1	65	7234	Spring - Trans. Input Shift Shaft	1	115	N803859-S	Washer - Flat 17.7 Dia. (Felt)	1
15	7C115	Hub - Trans. 1st/2nd Synchro.	1	66	7346	Arm - Trans. Shift Fork Selector	1	116	7565	Pin - Clutch Release Lever	1
16	7C396	Insert - Trans. 1st/2nd Synchro. Hub	3	67	N646629-S	Pin - 5mm X 30.0 Spring	1	117	7F485	Differential and Gear Assy. - Transaxle	1
17	7109	Spring - Trans. Synchro. Retaining	2	68	7K201	Sleeve - Trans. Shift Fork Interlock	1	118	4026	Differential Assy.	1
18	N661228-S	Ring - 35mm Retaining Type SB Ext.	1	69	7F111	Pin - Trans. Rev. Relay Lever Pivot	1	119			
19	7102	Gear - Trans. 2nd Speed	1	70				120	4205	Case - Diff. Gear	1
20	7A385	Washer - Trans. 2nd/3rd Thrust	2	71	7K002	Lever - Trans. Rev. Shift Relay	1	121			
21	7A046	Ring - Trans. 2nd/3rd Thrust Washer Ret.	1	72	7K218	Pin - Trans. Rev. Shift Relay Lever	2	122	4236	Gear - Diff. Side	2
22	7B340	Gear - Trans. 3rd Speed	1	73	7271	Gear - Trans. Speedo Driven	1	123	4228	Washer - Diff. Side Gear Thrust	2
23	7107	Ring - Trans. Synchro. Blocking	2	74	17K288	Retainer - Trans. Speedo. Driven Gear	1	124	4215	Gear - Diff. Pinion	2
24	7B280	Synchronizer Assy. - Trans. 3rd/4th	1	75	N801061-S	Seal - 25mm X 2.6 'O' Ring Oil	1	125	4230	Washer - Diff. Pinion Gear Thrust	2
25	7K204	Plunger - Trans. Shift Shaft Detent	1	76	N801034-S2	Screw - M4 - 0.7 X 25 Hex. Washer Head	1	126	4211	Shaft - Diff. Pinion Gear	1
26	7108	Sleeve - Trans. 3rd/4th Synchro.	1	77	N801370-S	Seal - 5.16mm X 1.6 'O' Ring Oil	1	127	N800979-S	Pin - 4.75mm X 38.1 Spring	1
27	7105	Hub - Trans. 3rd/4th Synchro.	1	78	7F489	Screw - Trans. Detent Plunger Ret.	1	128	N803929-S	Rivet - 10mm X 32 Solid Flat Hd.	10
28	7K198	Insert - Trans. 3rd/4th Synchro. Hub	3	79	7F488	Pin - Trans. Fork Interlock Sleeve Ret.	1	129	7F343	Gear - Trans. Final Drive Ring	1
29	7109	Spring - Trans. Synchro. Retaining	2	80	7L027	Ceramic Magnet - Trans. Case	1	130	7285	Gear - Trans. Speedo. Drive	1
30	N661226-S	Ring - 32mm Retaining Type SB Ext.	1	81	7N439	Plug - JIS PT 1/2 Sq. Hd.	1	131	4220	Bearing Assy. - Diff. Tapered Roller	2
31	7110	Gear - Trans. 4th Speed	1	82	7034	Vent Assy. - Trans. Case	1	132	4221	Cone & Roller Assy. - Diff. Bearing	2
32	7L276	Funnel - Trans. Main Shaft	1	83	7035	Body - Trans. Vent	1	133	4222	Cup - Diff. Bearing	2
33	7048	Seal Assy. - Trans. Input Shaft Oil	1	84	7036	Cap - Trans. Vent	1	134	4A451	Shim - Diff. Bearing Preload	1
34	7017	Shaft - Trans. Input Cluster Gear	1	85	15520	Switch Assy. - Trans. Back-up Lamp	1	135	1177	Seal Assy. - Diff. Oil	2
35	7F431	Bearing Assy. - Trans. Tapered Roller	2	86	N801862-S2	Bolt - M8-1.25 X 33 Hex. Head	1	136	Reference	Shipping Plug	2
36	7F432	Cone & Roller Assy. - Trans. Bearing	2	87	N605790-S2	Bolt - M8-1.25 X 40 Hex. Flange Head	15	137	7B148	Tag - Transaxle Service I.D.	1
37	7141	Gear & Bushing Assy. - Trans. Rev. Idler	1	88	7F110	Boot - Trans. Input Shift Shaft	1	138	N646624-S	Pin - 5mm X 20.0 Spring Slot Hvy.	1
38	7142	Gear - Trans. Rev. Idler	1	89	7L276	Funnel - Trans. 5th Gear Shaft	1	139	7986	Plug - Trans. Timing Window	1
39	7143	Bushing - Trans. Rev. Idler Gear	1	90	7C094	Shaft Assembly - Trans. 5th Gear	1	140	7E200	Spring - Trans. Shift Gate Plate Pawl	1
40	7N322	Shaft Assy. - Trans. Rev. Idler Gear	1	91	7061	Shaft - Trans. 5th Gear Drive	1	141	7E159	Pawl - Trans. Shift Gate Plate	1
41	7140	Shaft - Trans. Rev. Idler Gear	1	92	7F431	Bearing Assy. - Trans. Tapered Roller	2	142	7E484	Pin - Trans. Rev. Lockout Pawl Pivot	1
42	7F111	Pin - Trans. 5th Relay Lever Pivot	1	93	7F432	Cone & Roller Assy. - Trans. Bearing	2	143	N663103-S2	Ring - 4mm Ret. Type RB Ext.	1
43	7288	Seal Assy. - Trans. Shift Shaft Oil	1	94	7K316	Gear - Trans. 5th Speed	1	144	7B146	Spring - Trans. 5th/Rev. Kick Down	1
44	7L267	Shaft - Trans. Input Shift	1	95	7107	Ring - Trans. Synchro. Blocking	1	145	70378	Bracket Assy. - Rev. Shift Relay Lever Support	1
45	7K204	Plunger - Trans. Shift Shaft Detent	1	96	7124	Synchronizer Assy. - Trans. 5th	1	146	70379	Bracket - Rev. Shift Relay Lever Support	1
46	7C288	Spring - Trans. Shift Shaft Detent	1	97				147	7L128	Spring - Trans. Rev. Shift Relay Lever	1
47	7F477	Arm Assy. - Trans. Shift Gate Selector	1	98	7106	Sleeve - Trans. 5th Synchro.	1	148	7K423	Shaft Assy. - Trans. 5th Shift Fork Control	1
48	7F478	Arm - Trans. Shift Gate Selector	1	99	7105	Hub - Trans. 5th Synchro.	1	149	7217	Ball - 8.731mm	1
49	7F013	Pin - Trans. Shift Gate Selector	2	100	7K198	Insert - Trans. 5th Synchro. Hub	3	150	7L128	Spring - Trans. Rev. Shift Relay Lever Ret., Sec.	1
50	N646635-S	Pin - 5mm X 25.0 Spring Slot Hvy.	3	101	7109	Spring - Trans. 5th Synchro. Ret.	2	151	7N620	Bushing - Clutch Release Shaft - Lower	1
51	7F476	Plate - Trans. Shift Gate	1	102A	7L049	Spacer - Trans. 5th Synchro. Insert Retaining	1				

CC6394-A

## OPERATION

### Power Flow

Engine torque is transferred from the clutch to the input cluster gear shaft. The four forward gears on the input cluster gear shaft are in constant mesh with a matching gear on the main shaft. The 4th gear on the input cluster gear shaft is simultaneously meshed with the 5th speed gear on the 5th gear shaft. These meshed gear sets provide the five available forward gear ratios.

Both the main shaft and the fifth gear shaft have a pinion gear, which is constantly engaged with the final drive ring gear of the differential assembly. If one of the gears (1 through 4) on the main shaft is selected, and that gear is locked to the shaft by its shifted synchronizer, then the input cluster shaft gear will drive the main shaft pinion gear; driving the differential final drive ring gear. If the 5th gear is selected the input cluster shaft 4th gear will drive the 5th gear shaft pinion gear; driving the differential final drive ring gear. At this time, the main shaft gears will rotate freely. Refer to Specifications for Gear Ratios.

The 5th gear range provides a ratio, in which, the input speed (rpm) from the engine is less than the transmission output speed to the differential.

REVERSE is accomplished by sliding a spur gear into mesh with the input cluster shaft gear and the reverse idler gear. The reverse idler gear acts as an idler and reverses the direction of main shaft rotation.

In NEUTRAL, none of the gears on the main shaft or the 5th gear driveshaft are locked to their shafts. No torque from the engine to the input cluster gear shaft is transferred to the differential assembly and to the wheels through the halfshafts.

### Shift Cables

#### External

The manual shift mechanism is made up of the following components:

- Control Assembly.
- Crossover Cable.
- Selector Cable.

- Switch and Bracket Assembly.
- Clamp Assembly.
- Cable Bracket.
- Shift Boot/Knob Assembly.
- Shift Knob Medallion.
- Cable Retainer.

The control assembly mounts on the inside of the vehicle to a console bracket and tunnel crossmember and is concealed by the console and the shift boot/knob assembly.

Two cables are used to actuate the transmission input shift shaft. The crossover cable rotates the input shaft on the transmission when the shift knob is moved side-to-side and the selector cable causes fore-aft motion of the input shaft when the shift knob is moved into each gear position.

The crossover cable is routed from the shifter, along the top of the tunnel under the carpet, and through the dash panel into the engine compartment. It is then anchored to the switch and bracket assembly which is bolted to the transaxle case.

To prevent damage or dislocation of the dash panel sealing grommet on the cable and to hold the cable tightly to the top of the tunnel, a guide bracket is attached to the tunnel with two screws.

The selector cable is routed from the shifter, through a hole in the tunnel immediately in front of the shifter, and under the vehicle where it is also anchored to the switch and bracket assembly.

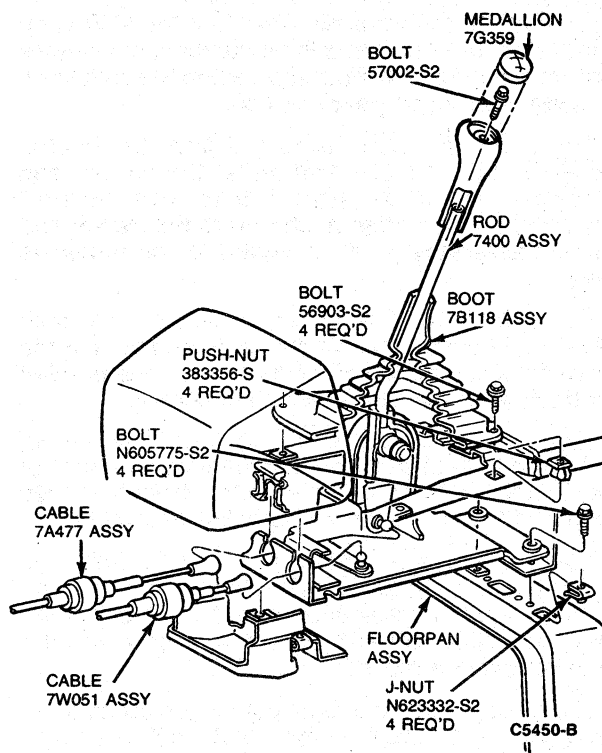
Both cables are attached to the switch and bracket assembly each with two bolts and a retainer, and both cables are anchored to the shifter control assembly using 'U' shaped spring clips which are installed using a mallot.

The movable cores of both cables are attached to the shifter with snap-on ball and socket fittings, while at the transmission, a clamp assembly is installed on the input shaft and the cable cores are similarly attached to the clamp with snap-on ball and socket fittings.

## OPERATION (Continued)

The balls and sockets used for the crossover cable are a different size than those used for the selector cable to eliminate incorrect cable attachment. Also, to aid in cable installation at the control assembly, green paint identifies the crossover cable with its proper attaching point on the shifter. The cables are further identified on the transmission end showing part numbers and the letters "MTX" to separate them from automatic transmission cables which will be in the plants.

The manual shift mechanism and cables incorporate no adjustable features and no adjustments are required before or after installation.



## Internal

Internally, the gear shift mechanism begins with the input shift shaft, which is connected to the external linkage.

Attached to the input shift shaft is the shift shaft selector arm. The selector arm and its associated selector plate act together to transmit the inward, outward and rotational movements of the input shift shaft to the internal shift lever. The shift lever in turn, transmits these motions to the main shift control shaft, to which the 1st/2nd and 3rd/4th shift forks are attached.

The 5th shift relay lever is connected to a main shift control shaft member and transmits motion to the 5th gear control shaft, to which the 5th shift fork is attached. Movement in one direction actuates 5th gear. In the other direction the reverse shift relay lever is actuated, engaging the reverse idler gear with the input cluster and main shaft gear.

An interlock is provided on the main shift control shaft. The interlock allows the shifting of only one synchronizer at a time. This prevents the engagement of the transmission in two gears at the same time.

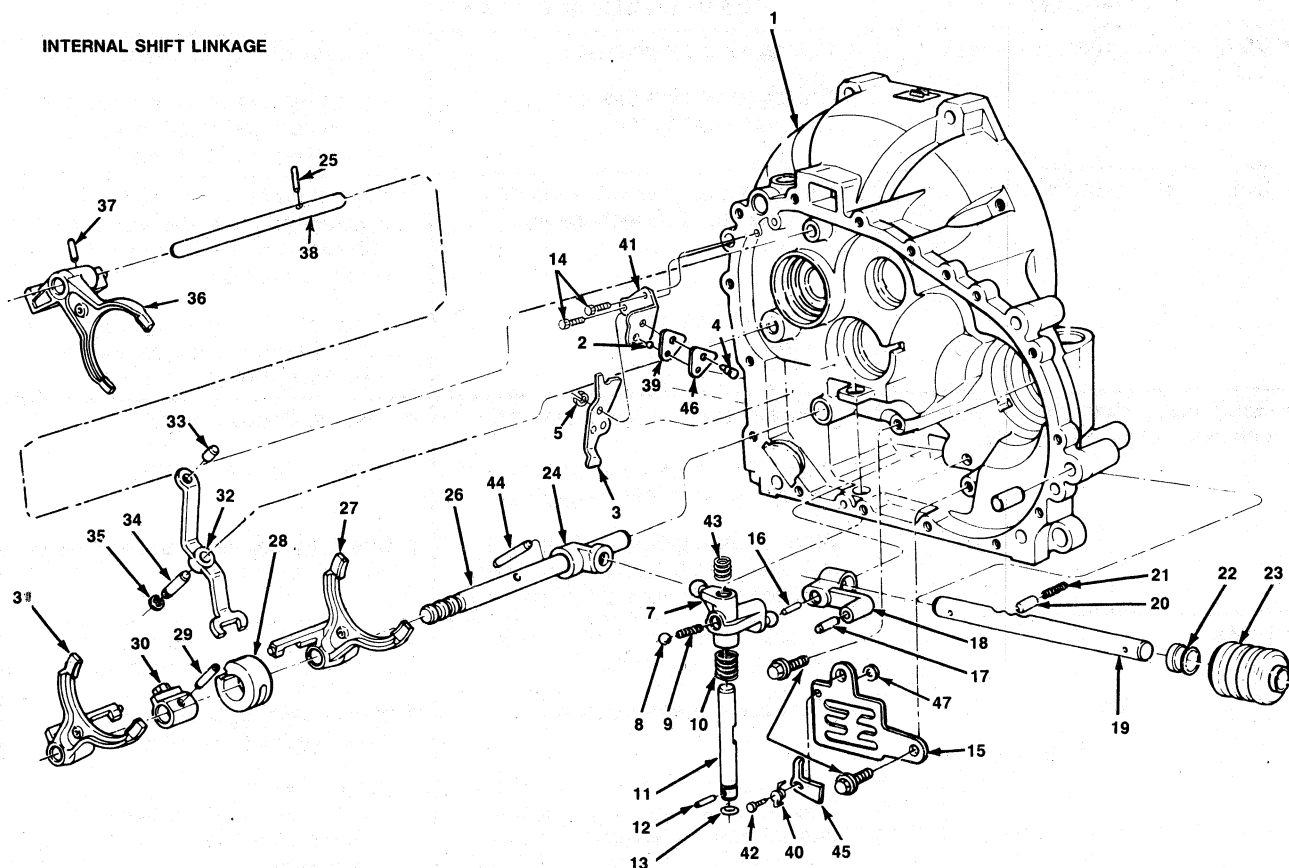
The reverse sliding gear is shifted into position when a pin on the 5th gear control shaft engages the reverse relay lever. The pin moves the reverse relay lever which moves the gear on the reverse idler shaft into engagement with the input cluster and main shaft gears.

The backup lamp switch is actuated by movement of the 5th gear control shaft.



## OPERATION (Continued)

## INTERNAL SHIFT LINKAGE



## LEGEND\*

- |  |   |
|--|---|
| 1. CASE—CLUTCH HOUSING                   | 25. PIN—SHIFT GATE SELECTOR                           |
| 2. BALL                                  | 26. SHAFT—MAIN SHIFT FORK CONTROL                     |
| 3. LEVER—REVERSE RELAY                   | 27. FORK—1ST/2ND                                      |
| 4. PIN—REVERSE RELAY LEVER PIVOT         | 28. SLEEVE—FORK INTERLOCK                             |
| 5. RING—EXTERNAL RETAINING               | 29. PIN—SPRING  |
| 7. LEVER—SHIFT                           | 30. ARM—FORK SELECTOR                                 |
| 8. BALL—10.319mm                         | 31. FORK—3RD/4TH                                      |
| 9. SPRING—5TH/REVERSE INHIBITOR          | 32. LEVER—5TH SHIFT RELAY                             |
| 10. SPRING—3RD/4TH SHIFT BIAS            | 33. PIN—REVERSE SHIFT RELAY LEVER                     |
| 11. SHAFT—SHIFT LEVER                    | 34. PIN—5TH RELAY LEVER PIVOT                         |
| 12. PIN—SHIFT LEVER                      | 35. RING—EXTERNAL RETAINING                           |
| 13. SEAL—SHIFT LEVER SHAFT               | 36. FORK—5TH  |
| 14. BOLTS—SHIFT GATE ATTACHING           | 37. SPRING PIN—5TH RETAINING                          |
| 15. PLATE—SHIFT GATE                     | 38. SHAFT—5TH FORK CONTROL                            |
| 16. ROLL PIN—SELECTOR ARM                | 39. SPRING—TRANS REVERSE SHIFT RELAY LEVER            |
| 17. PIN—SHIFT GATE SELECTOR              | 40. SPRING—SHIFT GATE PAWL                            |
| 18. ARM—SHIFT GATE SELECTOR              | 41. BRACKET—REVERSE SHIFT RELAY LEVER SUPPORT         |
| 19. SHAFT—INPUT SHIFT                    | 42. PIN—REVERSE LOCKOUT PAWL PIVOT                    |
| 20. PLUNGER—SHIFT SHAFT DETENT           | 43. SPRING—5TH/REVERSE KICKDOWN                       |
| 21. SPRING—SHIFT SHAFT DETENT            | 44. PIN—REVERSE RELAY LEVER ACTUATING                 |
| 22. SEAL ASSEMBLY—SHIFT SHAFT OIL        | 45. PAWL—SHIFT GATE PLATE                             |
| 23. BOOT—SHIFT SHAFT                     | 46. SPRING—TRANS REVERSE SHIFT RELAY LEVER RET., SEC. |
| 24. BLOCK—TRANS INPUT FORK CONTROL SHAFT | 47. C-CLIP  |

\*REFER TO EXPLODED VIEW TO REFERENCE PART NUMBERS

## DIAGNOSIS

## TRANSAXLE

CONDITION	POSSIBLE SOURCE	ACTION
<ul style="list-style-type: none"> <li>Clicking noise in reverse gear</li> </ul>	<ul style="list-style-type: none"> <li>Damaged or rough gears.</li> <li>Damaged linkage preventing complete gear travel.</li> </ul>	<ul style="list-style-type: none"> <li>Replace damaged gears.</li> <li>Check for damaged or misaligned shift linkage or other causes of shift linkage travel restrictions.</li> </ul>
<ul style="list-style-type: none"> <li>Gear clash into reverse</li> </ul>	<ul style="list-style-type: none"> <li>Owner not familiar with manual transmission shift techniques.</li> <li>Damaged linkage preventing complete gear travel.</li> </ul>	<ul style="list-style-type: none"> <li>Instruct customer on non-synchronous reverse and clutch spin-time-lapse required before a shift into reverse.</li> <li>Check for damaged or misaligned shift linkage or other causes of shift linkage bind.</li> </ul>
<ul style="list-style-type: none"> <li>Gears clash when shifting from one forward gear to another</li> </ul>	<ul style="list-style-type: none"> <li>Improper clutch disengagement.</li> <li>Clutch disc installed improperly with damper springs toward flywheel.</li> <li>Worn or damaged shift forks, synchro-teeth (usually high mileage phenomenon). Forward gears only.</li> </ul>	<ul style="list-style-type: none"> <li>Refer to Section 16-02.</li> <li>Refer to Section 16-02.</li> <li>Check for damage, and service or replace as required.</li> </ul>
<ul style="list-style-type: none"> <li>Leaks</li> </ul>	<ul style="list-style-type: none"> <li>Excessive amount of lubricant in transaxle — wrong type.</li> <li>Other components leaking.</li> <li>False report. (Do not assume that lube on lower case surfaces is from gasket material leakage or seals).</li> <li>Worn or damaged internal components.</li> <li>Slight mist from vent.</li> </ul>	<ul style="list-style-type: none"> <li>Check lube level and type. Fill to bottom of filler plug opening.</li> <li>Identify leaking fluid at engine, power steering, or transaxle.</li> <li>Remove all traces of lube on exposed transaxle surfaces. Operate transaxle and inspect for new leakage.</li> <li>Remove transaxle clutch housing lower dust cover and inspect for lube inside housing. Inspect for leaks at the shift lever shaft seal, differential seals and input shift shaft seal. Service as required.</li> <li>Normal condition that does not require service. If dripping, check lubricant level.</li> </ul>
<ul style="list-style-type: none"> <li>Locked in one gear — it cannot be shifted out of that gear</li> </ul>	<ul style="list-style-type: none"> <li>Damaged external shift mechanism.</li> <li>Internal shift components worn or damaged.</li> <li>Synchronizer damaged by burrs which prevent sliding action.</li> </ul>	<ul style="list-style-type: none"> <li>Check external shift mechanism for damage. Service or replace as required.</li> <li>Disconnect external shift mechanism and verify problem by trying to shift input shift rail. Remove transaxle. Inspect the problem gear, shift rails, and fork and synchronizer assemblies for wear or damage. Service or replace as required.</li> <li>Replace synchronizer assembly.</li> </ul>
<ul style="list-style-type: none"> <li>Noise in Neutral</li> </ul>	<ul style="list-style-type: none"> <li>Neutral rollover rattle.</li> </ul>	<ul style="list-style-type: none"> <li>Refer to ②.</li> </ul>

## DIAGNOSIS (Continued)

## TRANSAXLE — Continued

CONDITION	POSSIBLE SOURCE	ACTION
<ul style="list-style-type: none"> <li>Noisy in forward gears</li> </ul>	<ul style="list-style-type: none"> <li>Low lubricant level.</li> <li>Contact between engine/transaxle and chassis.</li> <li>Transaxle to engine block bolts loose.</li> <li>Worn or damaged input/output bearings. Worn or damaged gear teeth (usually high mileage phenomenon).</li> <li>Gear rattle.</li> </ul>	<ul style="list-style-type: none"> <li>Fill to bottom of filler plug opening with proper lubricant (ATF). Type F.</li> <li>Check for contact or for broken engine motor mounts.</li> <li>Tighten to specification.</li> <li>Remove transaxle. Inspect bearings and gear teeth for wear or damage. Replace parts as required.</li> <li>Refer to ①.</li> </ul>
<ul style="list-style-type: none"> <li>Shifts hard</li> </ul>	<ul style="list-style-type: none"> <li>Improper clutch disengagement.</li> <li>External shift mechanism binding.</li> <li>Clutch disc installed improperly with damper springs toward flywheel.</li> <li>Internal damage to synchronizers or shift mechanism.</li> <li>Incorrect lubricant.</li> <li>Sticking blocker ring.</li> </ul>	<ul style="list-style-type: none"> <li>Refer to Section 16-02.</li> <li>Refer to Section 16-02.</li> <li>Refer to Section 16-02.</li> <li>Check for damage to internal components.</li> <li>Verify that ATF type lube is present. Do not use gear lube or hypoid type lubricants.</li> </ul>
<ul style="list-style-type: none"> <li>Walks out of gear</li> </ul>	<ul style="list-style-type: none"> <li>Damaged linkage preventing complete travel into gear.</li> <li>Floor shift boot stiff or improperly installed boot.</li> <li>Floor shift interference between shift handle and console.</li> <li>Broken/loose engine mounts.</li> <li>Worn or damaged internal components.</li> </ul>	<ul style="list-style-type: none"> <li>Check for damaged shift mechanism.</li> <li>Verify jumpout with boot removed, replace boot if necessary.</li> <li>Adjust console to eliminate interference.</li> <li>Check for broken or loose engine mounts and service as required.</li> <li>Check shift forks, shift rails and shift rail detent system for wear or damage, synchronizer sliding sleeve and gear clutching teeth for wear or damage. Repair or replace as required.</li> </ul>

CC5455-B

## DIAGNOSIS (Continued)

## TRANSAXLE — Continued

CONDITION	POSSIBLE SOURCE	ACTION
<ul style="list-style-type: none"> <li>Will not shift into one gear — all other gears OK</li> </ul>	<ul style="list-style-type: none"> <li>Damaged external shift mechanism or cables.</li> <li>Floor shift. Interference between shift handle and console or floor cut out.</li> <li>Restricted travel of internal shift components.</li> <li>Broken crossover cable or cable disconnected from shifter or clamp assembly.</li> <li>Will not shift into gears of one plane only, (1st and 2nd or 3rd or 4th).</li> </ul>	<ul style="list-style-type: none"> <li>Check for damaged shift mechanism. Service or replace as necessary.</li> <li>Adjust console or cut out floor pan to eliminate interference.</li> <li>Disconnect external shift mechanism and shift the input shift rail through the gears to verify problem. Remove transaxle. Inspect fork system, synchronizer system and gear clutch teeth for restricted travel. Service or replace as required.</li> <li>Check for broken or disconnected cable. Attach or replace.</li> </ul>
<ul style="list-style-type: none"> <li>Will not shift into REVERSE</li> </ul> <p><b>NOTE:</b> The shift gate plate pawl prevents 5th-reverse shifts.</p>	<ul style="list-style-type: none"> <li>Damaged external shift mechanism.</li> <li>Worn or damaged internal components.</li> <li>Normal blockout due to position of non-synchronized reverse gear components. (Approximately 10% occurrence of normal reverse shifting).</li> </ul>	<ul style="list-style-type: none"> <li>Check for damaged external shift mechanism. Remove shift mechanism at input shift rail and try shifting into REVERSE at the rail.</li> <li>Remove transaxle. Check for damaged reverse gear train or shaft components, misaligned reverse relay lever, shift rail and fork system. Check the gear clutching teeth and synchronizer system for restricted travel or damage. Service or replace as required.</li> <li>This condition is normal to all transaxles and requires only a double clutch procedure to successfully engage reverse.</li> </ul>

① Gear Rattle is a repetitive metallic impact or rapping noise which occurs on a manual transaxle powertrain when the vehicle is lugging in gear. The rattle noise intensity increases with transaxle operating temperature and engine torque, and decreases with increasing vehicle speed. Since the gear ratios have been designed to achieve maximum fuel economy, there may be instances when gear rattle is distinctly noticeable under lugging conditions. This, however, is not detrimental to the engine or transaxle provided that the appropriate gear ratio is selected for the vehicle speed.

② Neutral Rollover Rattle has the same characteristics as gear rattle except rollover now occurs with the engine idling, transaxle in neutral and the clutch engaged. The rollover noise intensity increases with transaxle operating temperature and engine torque load resulting from engine driven accessories (air conditioning and alternator). Gear rollover noise is inherent in manual transaxles and is not detrimental to the engine or transaxle. However, in vehicles where the engine idle speed is below specification or rough, the rollover noise can deteriorate to a level where a harsh clattering noise similar to loose marbles in the transaxle will become audible.

**NOTE:** Replacement of transaxle components will not correct this condition.

**NOTE:** Gear rollover noise, caused by engine torsional vibrations, and clutch throwout bearing noise are sometimes mistaken for bearing noise. Gear rollover noise will disappear when the transaxle is engaged in gear. Due to a constant running throwout bearing (used for the self-adjusting clutch mechanism) noise caused by a worn or damaged throwout bearing will be noticeable with the clutch engaged or disengaged. Throwout bearing noise can be checked by removing the clutch release cable and sliding the throwout bearing away from contact with the pressure plate (by movement of the clutch release arm) if the noise is eliminated, then the throwout bearing is worn or damaged. When complaints of this nature are encountered, it will be necessary to check the vehicle to determine if bearing noise exists. Transaxle repairs will not eliminate gear rollover noise or clutch throwout bearing noise.

CC5458-B

## DIAGNOSIS (Continued)

SHIFT LINKAGE		
CONDITION	POSSIBLE SOURCE	ACTION
<ul style="list-style-type: none"> <li>● Binding, sticking shift feel — difficult to find or engage gears, high shift efforts</li> </ul>	<ul style="list-style-type: none"> <li>● Worn, broken shift cables.</li> <li>● Kinked shift cable.</li> <li>● Bolts holding control assembly to body missing or loose.</li> <li>● Bolts holding switch and bracket assembly to transaxle case missing or loose.</li> <li>● Body J-nuts missing or broken.</li> <li>● Bolt, nut, and clamp washers loose at shift rod to transaxle connection.</li> <li>● Plastic pivot housing on control assembly broken, cracked.</li> <li>● Shift lever pivot balls worn or loose.</li> <li>● Shift lever loose on control assembly.</li> <li>● Cable sealing boot torn.</li> </ul>	<ul style="list-style-type: none"> <li>● Replace shift cables.</li> <li>● Replace shift cable.</li> <li>● Tighten or replace bolts.</li> <li>● Tighten or replace bolts.</li> <li>● Replace J-nuts on floor pan or console bracket.</li> <li>● Tighten or replace bolt, nut and clamp washers.</li> <li>● Replace control assembly.</li> <li>● Replace control assembly.</li> <li>● Replace control assembly.</li> <li>● Replace shift cables.</li> </ul>
<ul style="list-style-type: none"> <li>● Excessive noise, rattles, buzz or tizz</li> </ul>	<ul style="list-style-type: none"> <li>● Worn pivot balls on shift lever.</li> <li>● Loose bolt, nut and clamp washers at shift rod to transaxle connection.</li> <li>● Loose control assembly.</li> <li>● Loose shift knob causes tizz.</li> </ul>	<ul style="list-style-type: none"> <li>● Replace control assembly.</li> <li>● Tighten or replace bolt, nut, and clamp washers.</li> <li>● Tighten or replace bolts holding control assembly to body J-nuts.</li> <li>● Tighten screw under shift graphics medallion or replace boot/knob assembly.</li> </ul>

CC5459-A

## DIAGNOSIS (Continued)

## SHIFT LINKAGE — Continued

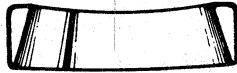
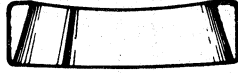
CONDITION	POSSIBLE SOURCE	ACTION
<ul style="list-style-type: none"> <li>● Excessive noise, rattles, buzz or tizz (Continued)</li> </ul>	<ul style="list-style-type: none"> <li>● Pivot balls on shift lever chipped, cracked.</li> </ul>	<ul style="list-style-type: none"> <li>● Replace shift lever assembly.</li> </ul>
<ul style="list-style-type: none"> <li>● Shifter is inoperative — cannot shift gears</li> </ul>	<ul style="list-style-type: none"> <li>● Bolt, nut and clamp washers loose at clamp to transaxle connection.</li> <li>● Shifter attachment to body J-nuts loose.</li> <li>● Shift lever loose on control assembly cable.</li> <li>● Shift cable broken or bent.</li> <li>● Cable clips loose at control.</li> <li>● Cable retainers loose/missing.</li> </ul>	<ul style="list-style-type: none"> <li>● Tighten or replace bolt, nut and clamp washers.</li> <li>● Replace or tighten bolts on body J-nuts.</li> <li>● Replace or tighten "C"-clip on control assembly.</li> <li>● Replace shift cable.</li> <li>● Replace clips at control.</li> <li>● Tighten or replace retainers at switch and bracket assembly.</li> </ul>
<ul style="list-style-type: none"> <li>● Shift lever feels sloppy or loose</li> </ul>	<ul style="list-style-type: none"> <li>● Bolts holding control assembly to body weld bolts missing or loose.</li> <li>● Body J-nuts missing or broken.</li> <li>● Bolts holding bracket bar to transaxle case missing or loose.</li> <li>● Bolt, nut and clamp washers loose at clamp to transaxle connection.</li> <li>● Plastic control bellcrank cracked or broken.</li> <li>● Control assembly attaching screw loose or missing.</li> <li>● Shift lever pivot balls worn or loose.</li> <li>● Shift knob is loose on shift lever.</li> </ul>	<ul style="list-style-type: none"> <li>● Tighten or replace bolts.</li> <li>● Replace J-nuts on console bracket, or floor-pan.</li> <li>● Tighten or replace bolts.</li> <li>● Tighten or replace bolt, nut and clamp washers.</li> <li>● Replace control assembly.</li> <li>● Tighten or replace control assembly attaching screws.</li> <li>● Replace shift lever assembly.</li> <li>● Align shaft knob and tighten screw under medallion.</li> </ul>

CC5456-A

**DIAGNOSIS (Continued)****BEARING DIAGNOSIS**

CONSIDER THE FOLLOWING FACTORS WHEN DIAGNOSING BEARING CONDITION:

1. GENERAL CONDITION OF ALL PARTS DURING DISASSEMBLY AND INSPECTION.
2. CLASSIFY THE PROBLEM WITH THE AID OF THE ILLUSTRATION.
3. DETERMINE THE CAUSE.
4. MAKE ALL SERVICES FOLLOWING RECOMMENDED PROCEDURES.

**GOOD BEARING****BENT CAGE**

CAGE DAMAGE DUE TO IMPROPER HANDLING OR TOOL USAGE.

REPLACE BEARING

**BENT CAGE**

CAGE DAMAGE DUE TO IMPROPER HANDLING OR TOOL USAGE.

REPLACE BEARING.

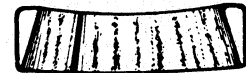
**GALLING**

METAL SMEARS ON ROLLER ENDS DUE TO OVERHEAT, LUBRICANT PROBLEM OR OVERLOAD.

REPLACE BEARING — CHECK SEALS AND CHECK FOR PROPER LUBRICATION.

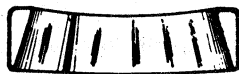
**CRACKED INNER RACE**

RACE CRACKED DUE TO IMPROPER FIT, COCKING, OR POOR BEARING SEATS.

**ETCHING**

BEARING SURFACES APPEAR GRAY OR GRAYISH BLACK IN COLOR WITH RELATED ETCHING AWAY OF MATERIAL USUALLY AT ROLLER SPACING.

REPLACE BEARINGS — CHECK SEALS AND CHECK FOR PROPER LUBRICATION.

**BRINELLING**

SURFACE INDENTATIONS IN RACEWAY CAUSED BY ROLLERS EITHER UNDER IMPACT LOADING OR VIBRATION WHILE THE BEARING IS NOT ROTATING.

REPLACE BEARING IF ROUGH OR NOISY.

**HEAT DISCOLORATION**

HEAT DISCOLORATION IS DARK BLUE RESULTING FROM OVERLOAD OR NO LUBRICANT (YELLOW OR BROWN COLOR IS NORMAL).

EXCESSIVE HEAT CAN CAUSE SOFTENING OF RACES OR ROLLERS.

TO CHECK FOR LOSS OF TEMPER ON RACES OR ROLLERS A SIMPLE FILE TEST MAY BE MADE. A FILE DRAWN OVER A TEMPERED PART WILL GRAB AND CUT METAL, WHEREAS, A FILE DRAWN OVER A HARD PART WILL GLIDE READILY WITH NO METAL CUTTING.

REPLACE BEARINGS IF OVER HEATING DAMAGE IS INDICATED. CHECK SEALS AND OTHER PARTS.

**FATIGUE SPALLING**

FLAKING OF SURFACE METAL RESULTING FROM FATIGUE.

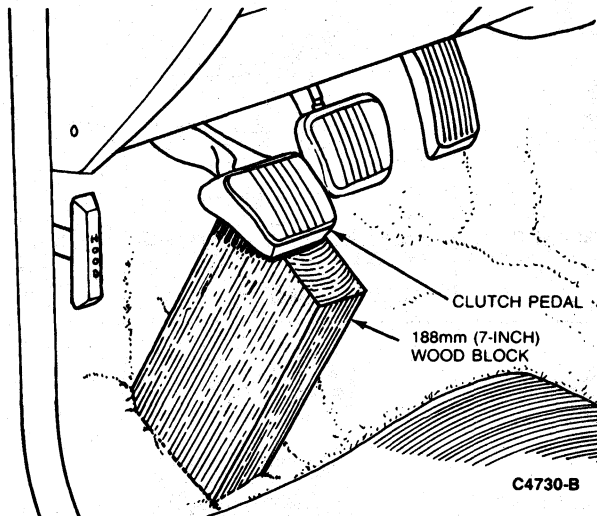
REPLACE BEARING — CLEAN ALL RELATED PARTS.

## REMOVAL AND INSTALLATION

## Transaxle

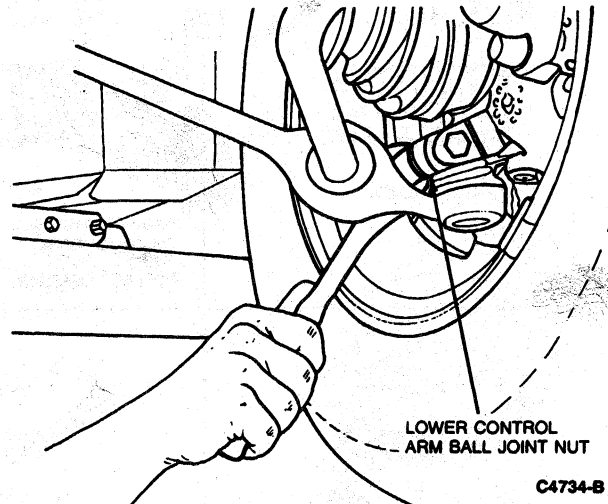
## Removal

1. Disconnect battery ground cable.
2. Wedge a wood block approximately 188mm (7-inches) in length under the clutch pedal to hold the clutch pedal up slightly beyond its normal position.

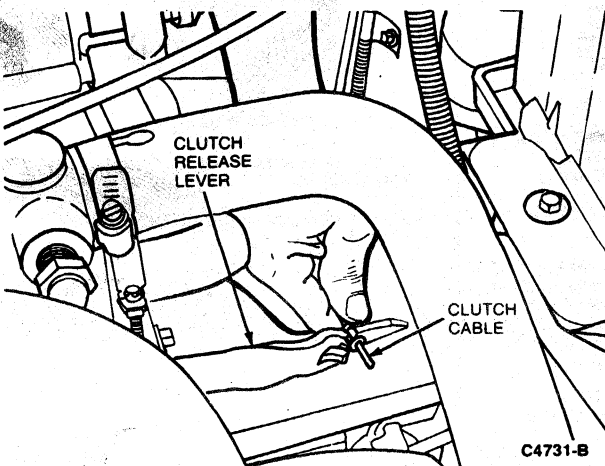


- 2 - either side of the picture point  
clutch of 8MM cable clamp screw
4. Using a 13mm socket, remove the top transaxle-to-engine mounting bolts.
  5. Raise the vehicle on a hoist. Refer to the Pre-Delivery manual, Section 50-04. Using a 18mm socket, remove the nut and bolt that secures the lower control arm ball joint to the steering knuckle assembly.

Discard the removed nut and bolt. Repeat procedure on the opposite side.



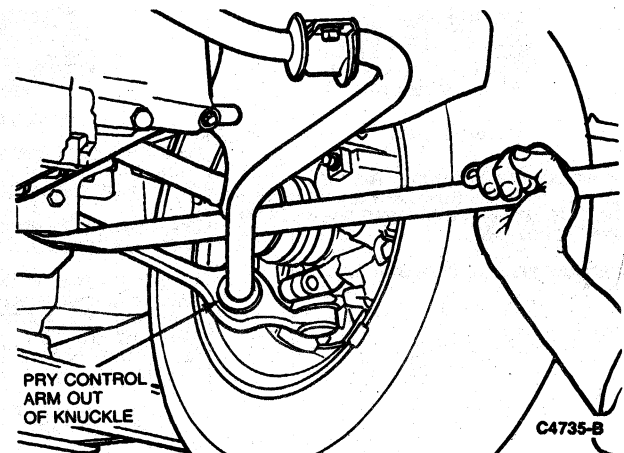
3. Grasp the clutch cable and pull forward, disconnecting it from the clutch release shaft assembly.  
Remove the clutch cable casing from the rib on the top surface of the transaxle case.



6. Using Tool D83P-4026-A or equivalent, pry the lower control arm away from the knuckle.

NOTE: Exercise care not to damage or cut the ball joint boot. Pry bar must not contact the lower arm.

Repeat the procedure on the opposite side.





## REMOVAL AND INSTALLATION (Continued)

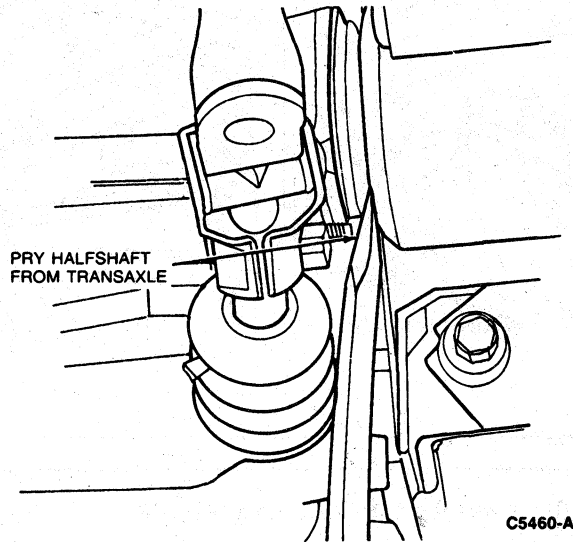
7. Using a large pry bar, pry the left inboard CV joint assembly from the transaxle.

NOTE: Lubricant will drain from the seal at this time. Install Shipping Plugs T81P-1177-B or equivalent (two required).

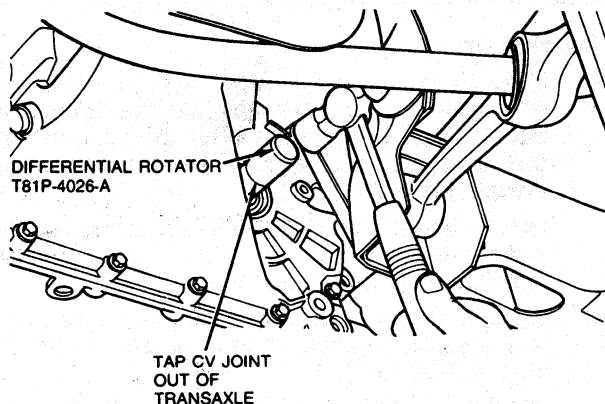
Remove the inboard CV joint from the transaxle by grasping the LH steering knuckle and swinging the knuckle and halfshaft outward from the transaxle.

NOTE: Use caution during the use of the pry bar and removal of the CV joint assembly, to prevent damage to the differential oil seal. Repeat procedure on the RH side.

REMOVING SUPPORT BEARING 10MM

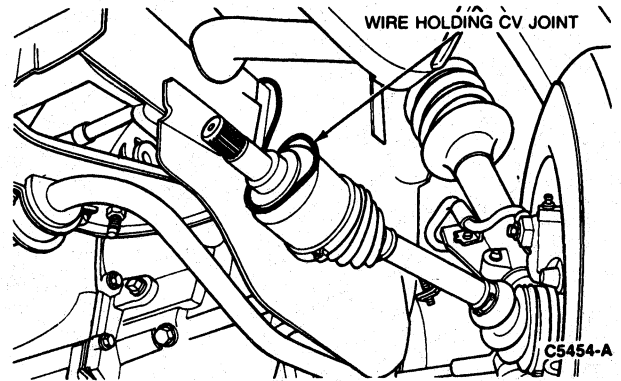


8. If the CV joint assembly cannot be pried from the transaxle, insert Differential Rotator T81P-4026-A or equivalent through LH side and tap the joint out. Tool can be used from either side of transaxle.

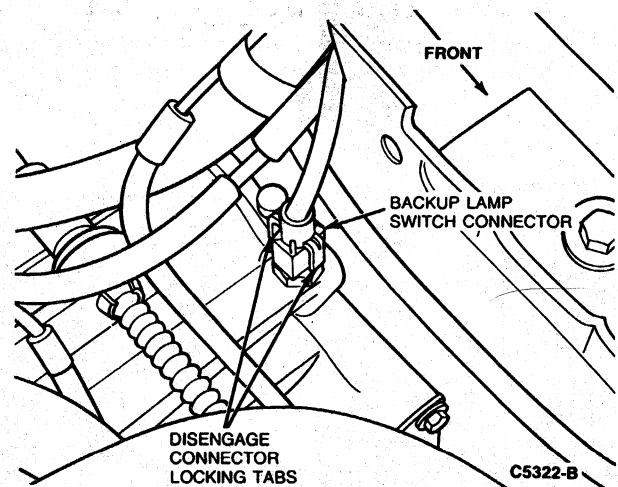


9. Wire the halfshaft assembly in a near level position to prevent damage to the assembly during remaining operations.

Repeat procedure on the opposite side.



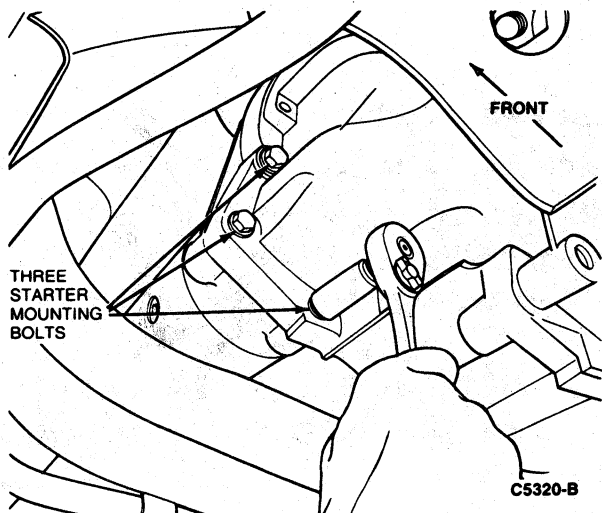
10. Using a small screwdriver, remove the backup lamp switch connector from the transaxle backup lamp switch, located on top of the transaxle.



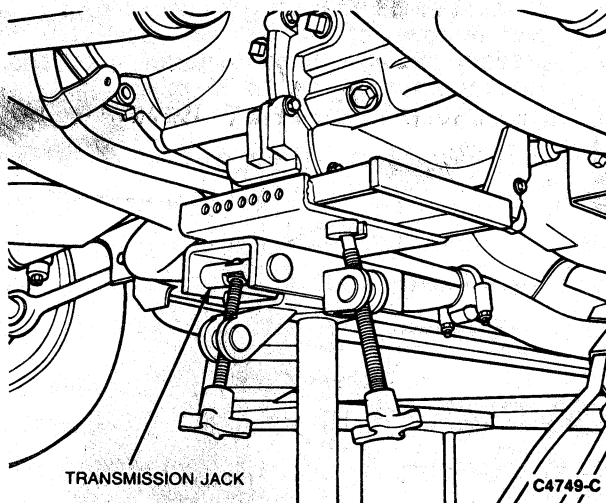
## REMOVAL AND INSTALLATION (Continued)

11. Using a 13mm deep-well socket, remove the three starter stud bolts.

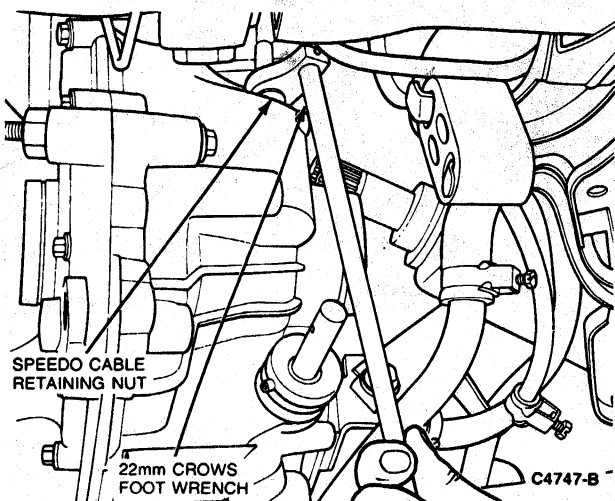
*top cable - 15mm  
middle clamp*



15. Using a 13mm socket remove the two stiffener brace attaching bolts from the lower position of the clutch housing. *2 products?*
16. Remove subframe. Refer to Section 14-07 for procedures.
17. Position a transmission jack under the transaxle.



12. Remove the 6M shift mechanism-to-shift shaft attaching nut and bolt and control selector indicator switch arm. Remove from the shift shaft.
13. Remove the 10M and 12M bolts attaching the shift cable and bracket assembly to the transaxle. *REMOVE NUTS NOT BOLTS.*
14. Using a 22mm crowfoot wrench, remove the speedometer cable from the transaxle.



18. Lower the transaxle support jack.
19. Using a 13mm socket, remove the lower engine-to-transaxle attaching bolts. *2 on side*
20. Remove the transaxle from the rear face of the engine and lower it from the vehicle.

**WARNING: THE TRANSAXLE CASE CASTING MAY HAVE SHARP EDGES. WEAR PROTECTIVE GLOVES WHEN HANDLING THE TRANSAXLE ASSEMBLY.**

## Installation

1. Using a transmission jack such as Rotunda 014-00210 or equivalent, raise the transaxle into position. Engage the input shaft spline into the clutch disc and work the transaxle onto the dowel sleeves.

NOTE: Make sure that the transaxle assembly is flush with the rear face of the engine prior to installation of the attaching bolts.

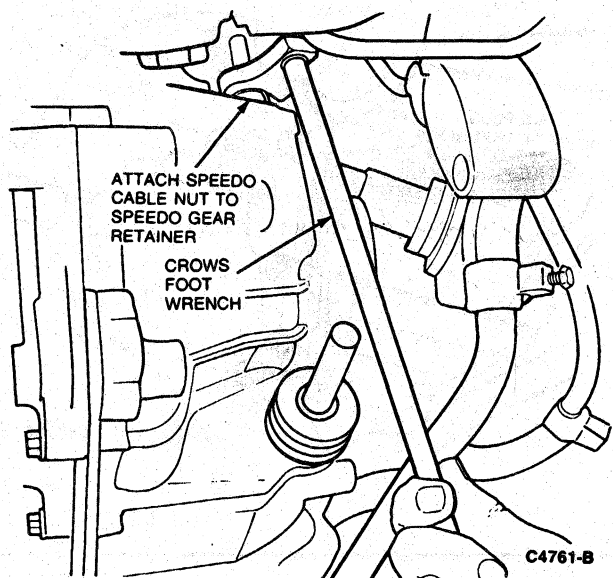
2. Using a 13mm socket, install the lower engine-to-transaxle attaching bolts. Tighten to 38-42 N·m (28-31 lb-ft).

**WARNING: DO NOT ATTEMPT TO START THE ENGINE PRIOR TO INSTALLING THE CV JOINTS. DIFFERENTIAL SIDE GEAR DISLOCATION DAMAGE COULD RESULT.**

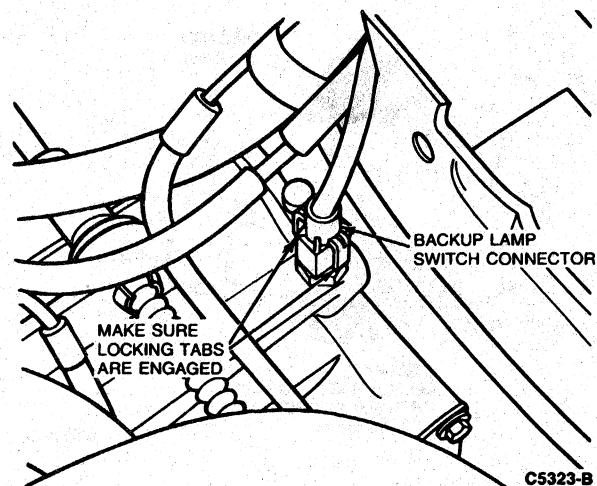
## REMOVAL AND INSTALLATION (Continued)

3. Using a 22mm crowfoot wrench, install the speedo cable.

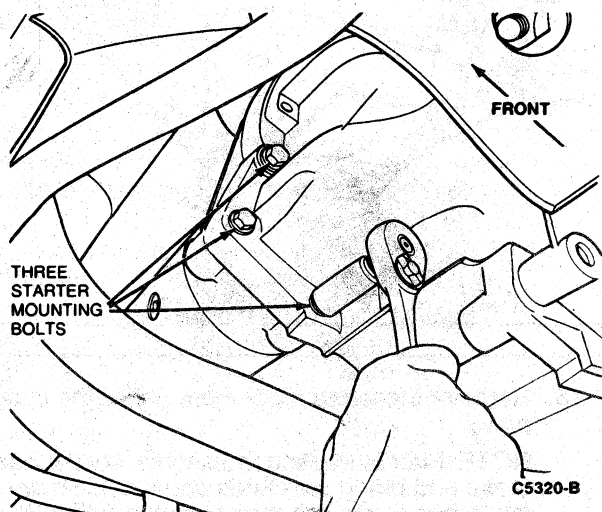
**CAUTION:** Use care when threading the cable nut onto the retainer to prevent cross-threading.



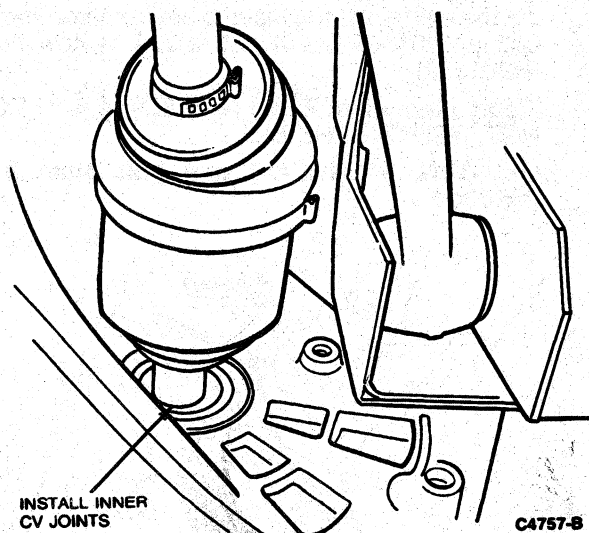
8. Install the backup lamp switch connector to the transaxle switch.



4. Install 10M and 12M bolts attaching the shift cable and bracket to transaxle. Tighten 10M bolt to 22-30 N·m (16-22 lb-ft). Tighten the 12M bolt to 31-47.5 N·m (22-35 lb-ft).
5. Install 6M bolt attaching shift mechanism-to-shift shaft. Tighten bolt to 9-13 N·m (7-10 lb-ft).
6. Using a 13mm socket, install the two bolts that attach the stiffener brace to the lower portion of the clutch housing. Tighten bolts to 21-28 N·m (15-21 lb-ft).
7. Using a 13mm deep-well socket, install the three starter stud bolts. Tighten to 41-54 N·m (30-40 lb-ft).



9. Remove seal plugs and install the inner CV joints into the transaxle.

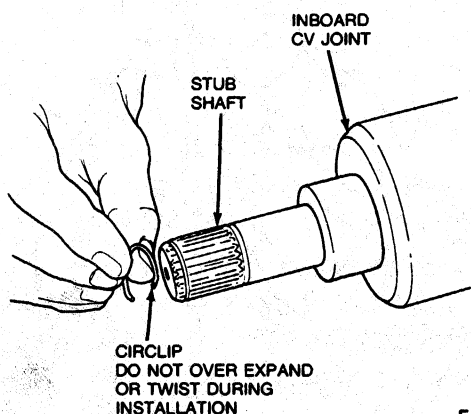


10. Install two 10mm bolts center bearing to bracket on RH side halfshaft.

## REMOVAL AND INSTALLATION (Continued)

**CAUTION:** To ensure proper installation, the following points must be observed:

- New circlips are required on both inner joints prior to installation.



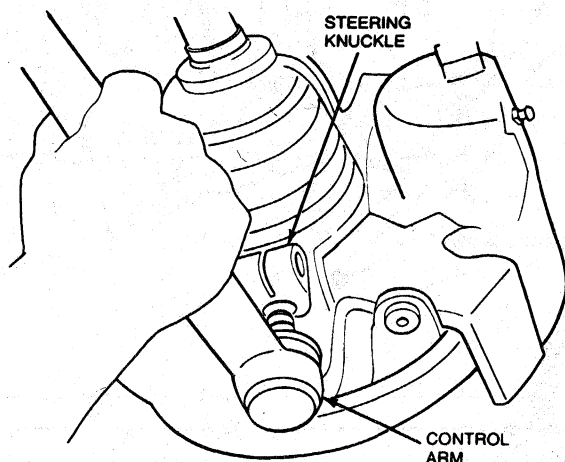
E4313-C

- Use caution while inserting shaft into the transaxle to avoid damage to the oil seals.
- Ensure that both joints are fully seated in the transaxle. Lightly pry outward to confirm that the retaining rings are seated. If rings are not seated, the joint will move out of the transaxle.

11. Attach sub-frame and the lower ball joint to the steering knuckle, taking care not to damage or cut the ball joint boot. Insert a new service pinch bolt (N7801305-S100) and attach a new nut (N801308).

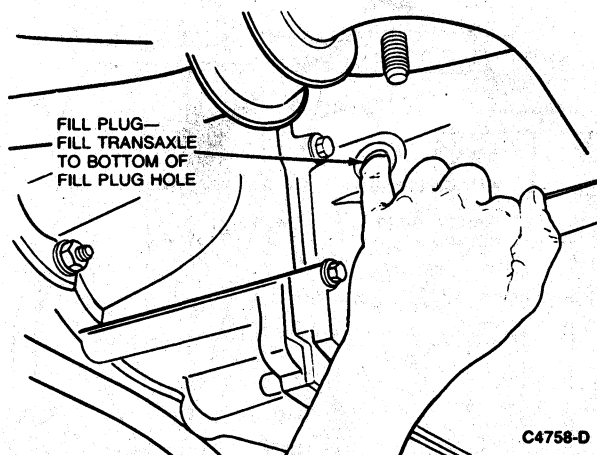
Tighten the nut to 50-60 N·m (37-44 lb-ft) DO NOT TIGHTEN THE BOLT.

**CAUTION:** A new nut and bolt must be installed.



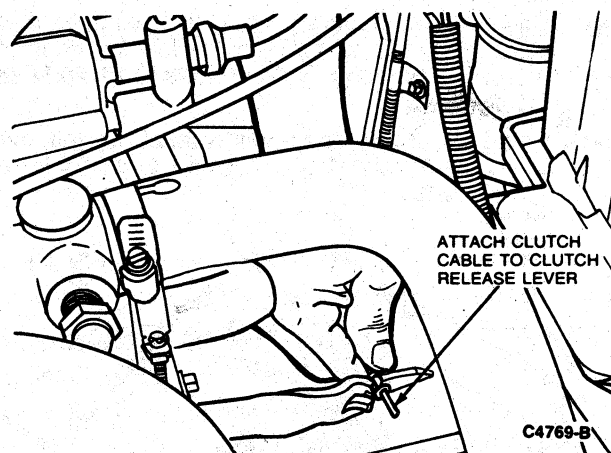
C4141-B

12. Fill the transaxle with either Motorcraft Type F (ESW-M2C33-F) or Motorcraft DEXRON® II or equivalent automatic transmission fluid.



C4758-D

13. Using a 13mm socket, install the top transaxle-to-engine mounting bolts. Tighten to 38-42 N·m (28-31 lb-ft).
14. Connect the clutch cable to the clutch release shaft assembly.



C4769-B

15. Remove the wood block from under the clutch pedal.

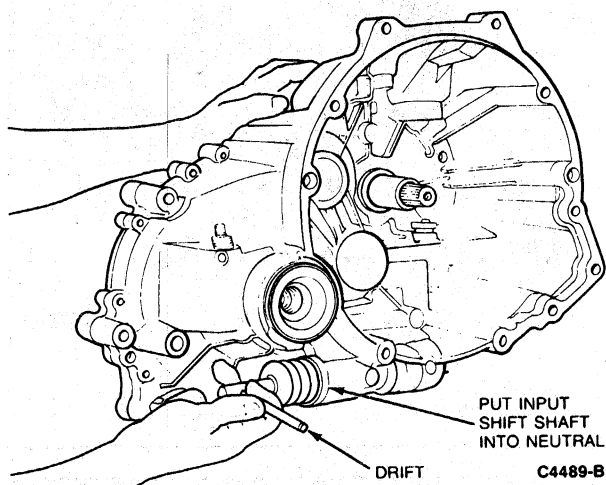
**NOTE:** Prior to starting the engine, set the hand brake and pump the clutch pedal a minimum of two times to ensure proper clutch adjustment.

## REMOVAL AND INSTALLATION (Continued)

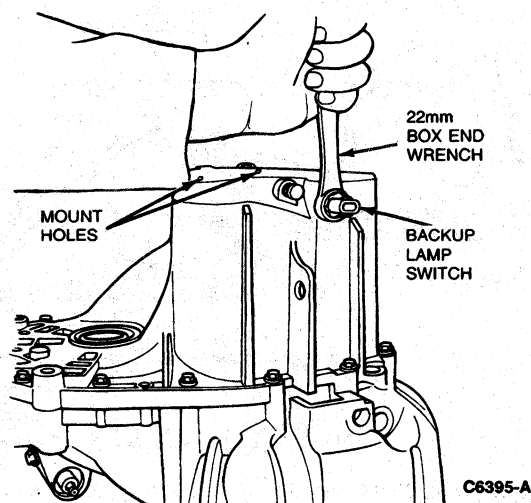
**Gear Set****Removal**

1. Using a drift in the input shift shaft hole, shift the transaxle into NEUTRAL. Pull or push the shaft into the center detent position (NEUTRAL).

The shift shaft will rotate slightly from side-to-side when positioned in NEUTRAL.

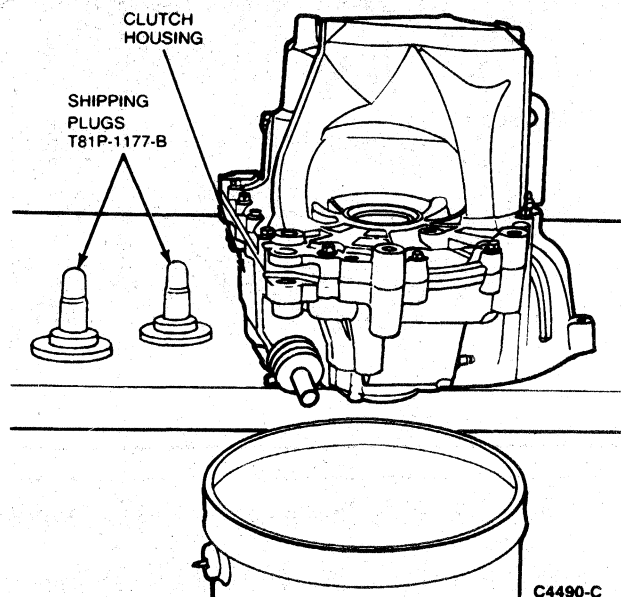


NOTE: If case half is being replaced, use a 22mm box end wrench to remove the backup lamp switch assembly.

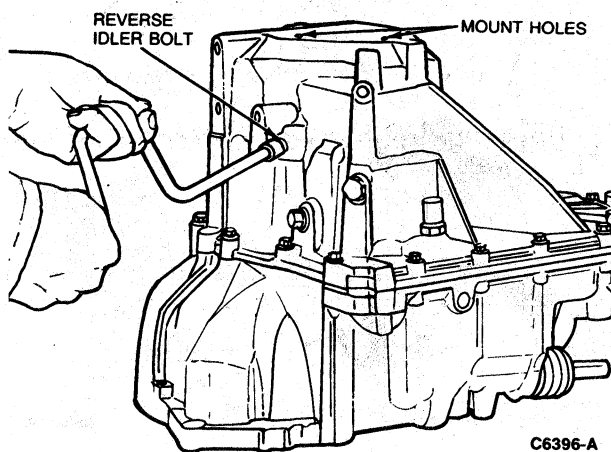


2. Remove the two Shipping Plugs T81P-1177-B or equivalent from the transaxle and drain the transmission fluid.

NOTE: Place the transaxle on a bench with the clutch housing face down to aid draining and service.



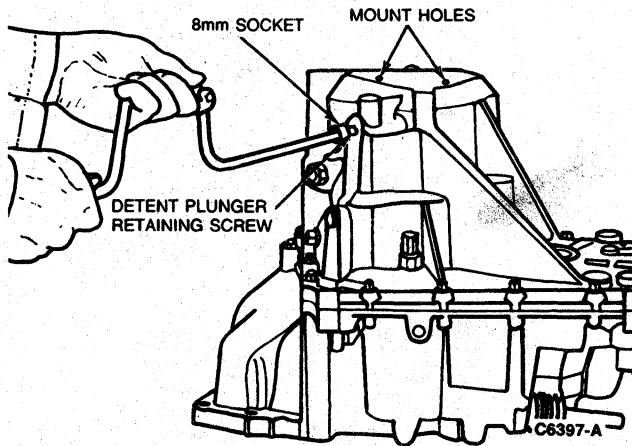
3. Using a 13mm socket wrench, remove the reverse idler shaft retaining bolt.



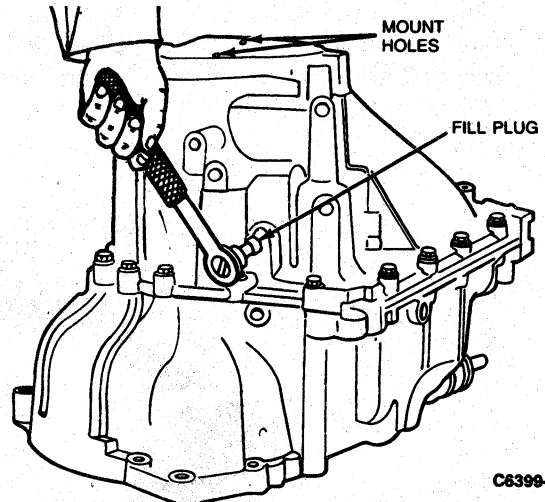
## REMOVAL AND INSTALLATION (Continued)

4. Using an 8mm socket wrench, loosen the detent plunger retaining screw in the transmission case.

*short stubby*

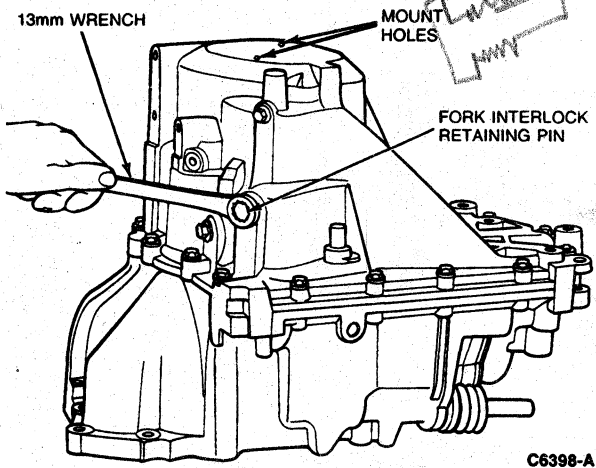


6. Using a 3/8 inch extension bar and ratchet, remove the fill plug.

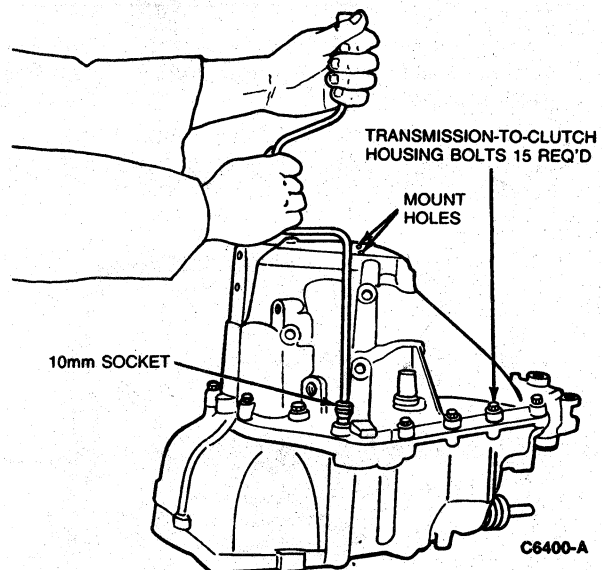


5. Using a 13mm wrench, remove the shift fork interlock sleeve retaining pin.

*stubby*

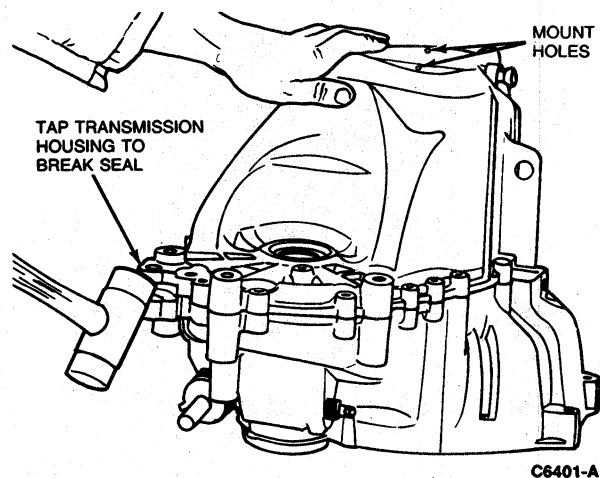


7. Using a 10mm socket wrench, remove the 15 clutch housing-to-transmission case attaching bolts.

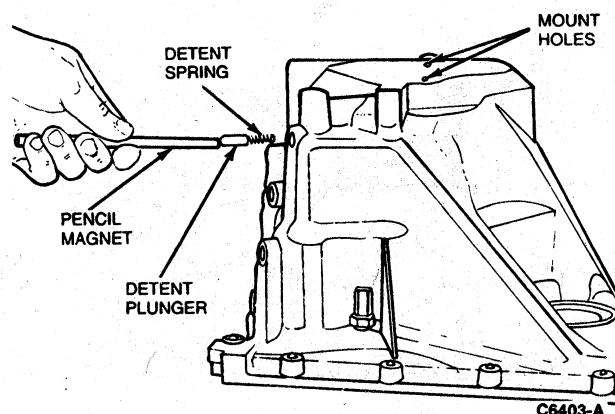


## REMOVAL AND INSTALLATION (Continued)

8. Using a plastic tipped hammer, tap the transmission case to break the seal between the case halves.



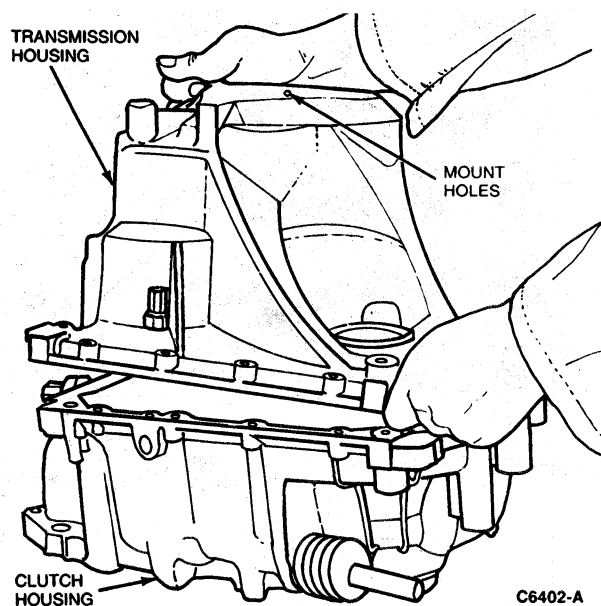
10. Remove the detent plunger retaining screw. Then, using a pencil magnet, remove the detent spring and the detent plunger.



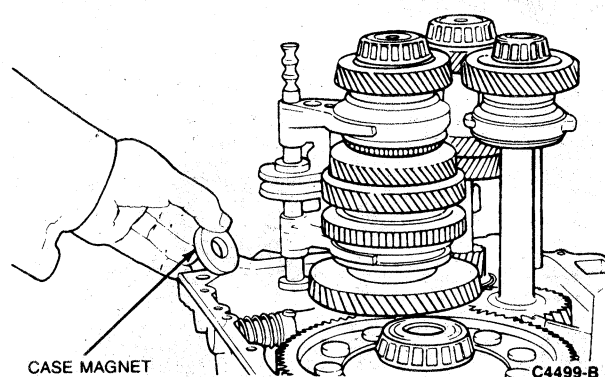
9. Separate the case halves.

NOTE: Do not insert pry bars or screwdrivers between the case halves.

Be careful not to drop the bearing cups or shims from the transmission case housing.



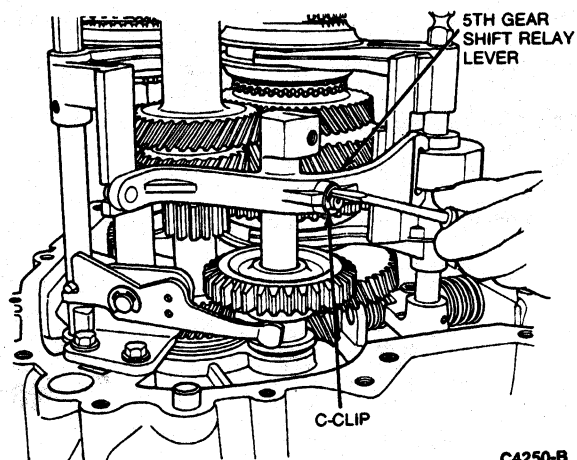
11. Remove the case magnet.



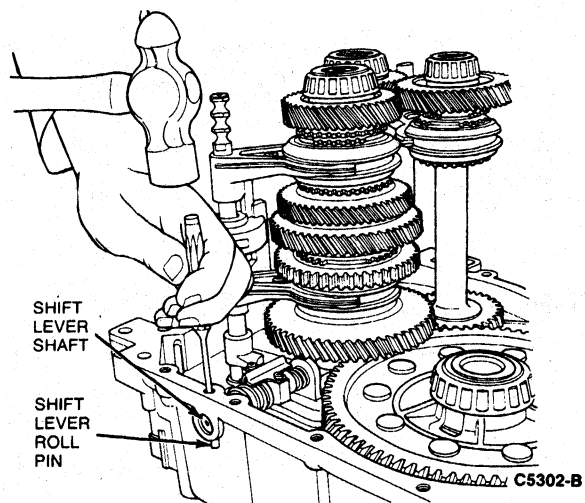


## REMOVAL AND INSTALLATION (Continued)

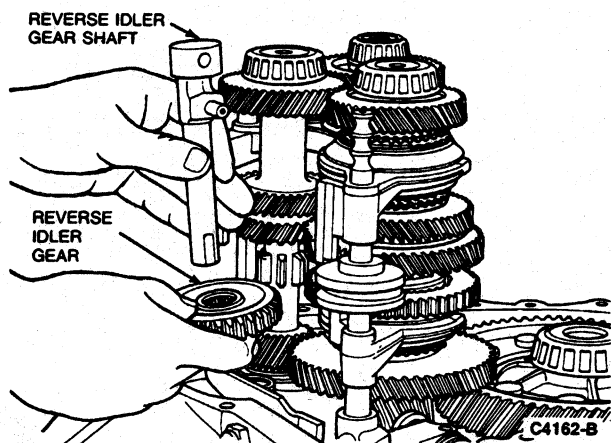
12. Using a small screwdriver, remove the C-clip retaining ring from the 5th gear relay lever pivot pin. Remove the 5th gear shift relay lever.



14. Using a 5/32-inch punch, drive the roll pin from the shift lever shaft.

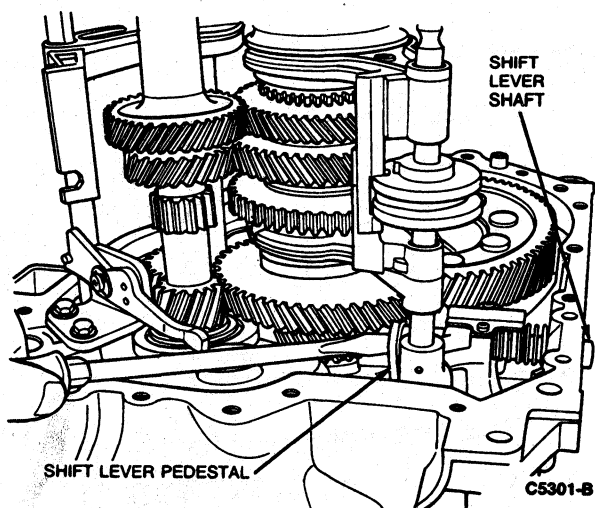


13. Lift the reverse idler shaft and reverse idler gear from the case.



15. Using a screwdriver, gently pry on the shift lever shaft so that the hole in the shaft is exposed.

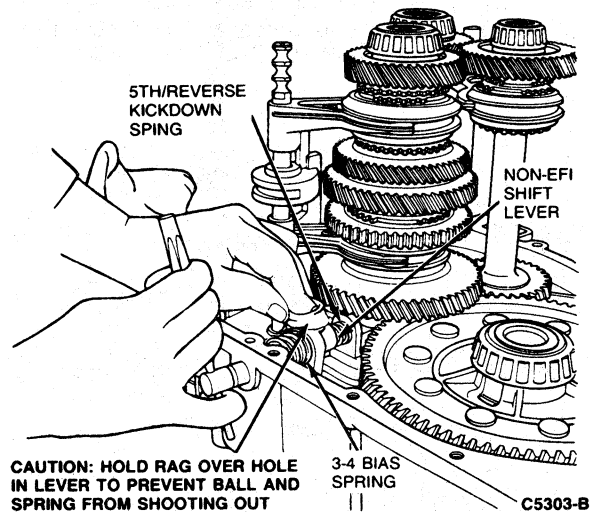
**CAUTION:** Be careful not to damage main shaft gear teeth or pedestal when prying with the screwdriver.





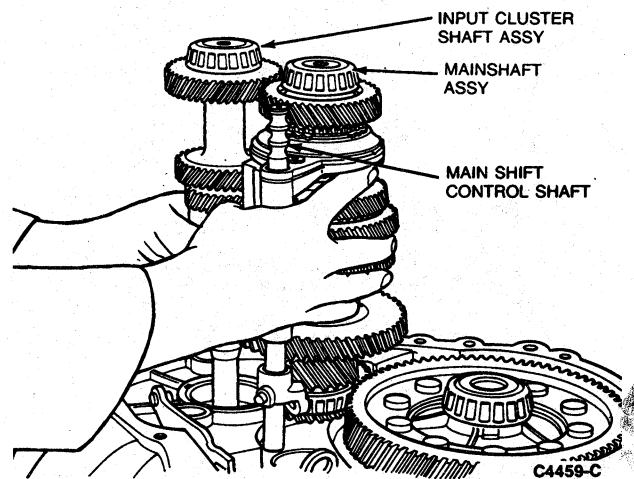
## REMOVAL AND INSTALLATION (Continued)

16. Hold a rag over the hole in the lever to prevent the ball and the 5th inhibitor spring from shooting out and remove the shift lever shaft.

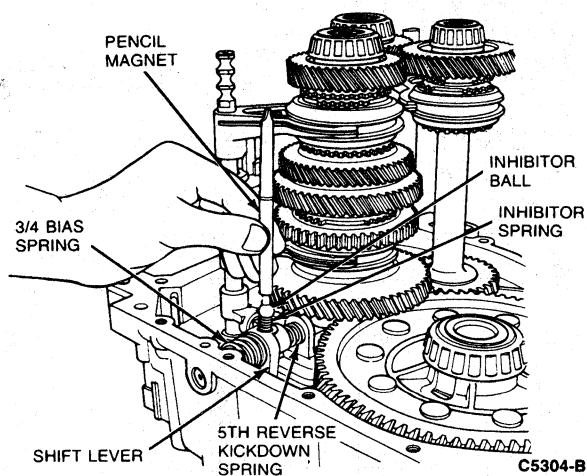


18. Remove the main shaft assembly, input cluster shaft assembly and the main shift control shaft assembly as one unit.

NOTE: Be careful not to drop bearings or gears (slip fit).

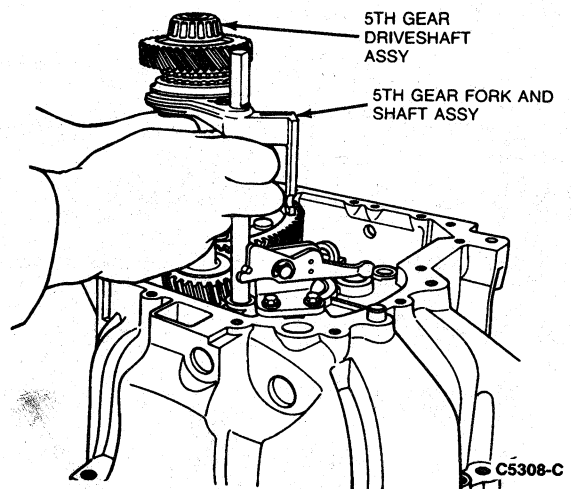


17. Remove the inhibitor ball and spring from the hole in the shift lever using a pencil magnet. Then, remove the shift lever, 5th/reverse kickdown spring, and 3-4 bias spring.



19. Remove the 5th gear shaft assembly and 5th gear fork assembly from their bores in the case.

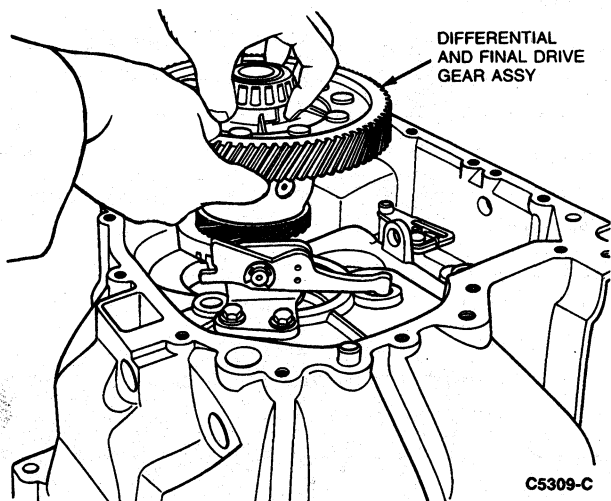
NOTE: Be careful not to drop bearings or gears (slip fit).



**REMOVAL AND INSTALLATION (Continued)**

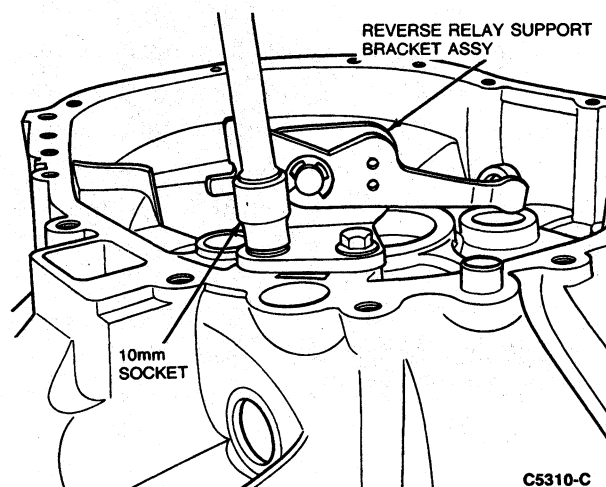
20. Lift the differential and final drive gear assembly from the clutch housing case.

NOTE: Refer to Section 51-21 for service procedures related to the differential.

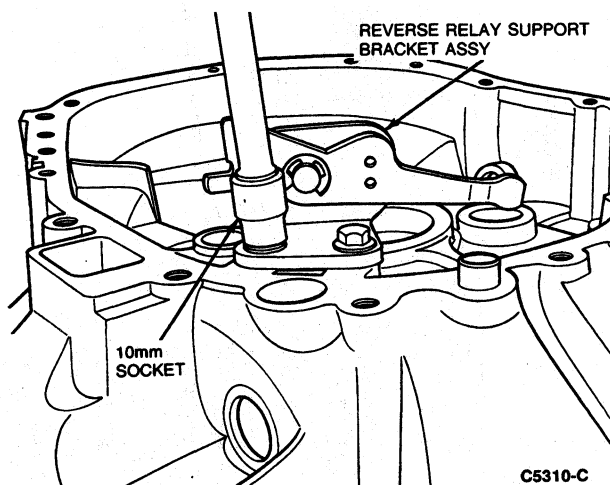
**Installation**

NOTE: Prior to installation, thoroughly clean all parts and inspect their condition. Lightly oil the bores with Motorcraft Type F (ESW-M2C233-F) or Motorcraft DEXRON® II transmission fluid or equivalent.

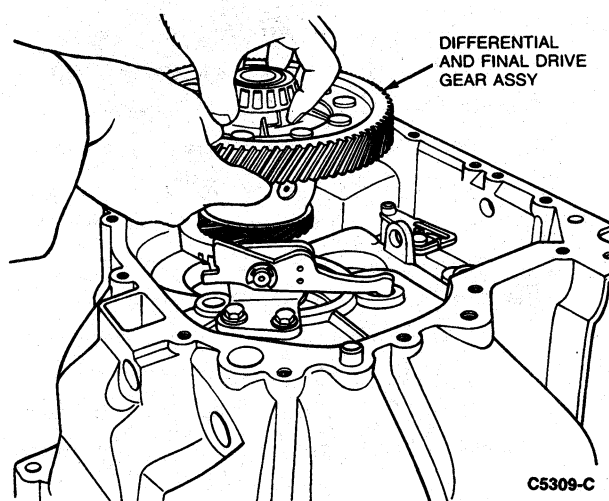
1. Using a 10mm socket, install reverse relay lever support bracket assembly to the case with two bolts. Tighten bolts to 8-11 N·m (6-8 lb-ft).



21. Using a 10mm socket, remove two bolts retaining reverse shift relay lever support bracket assembly.



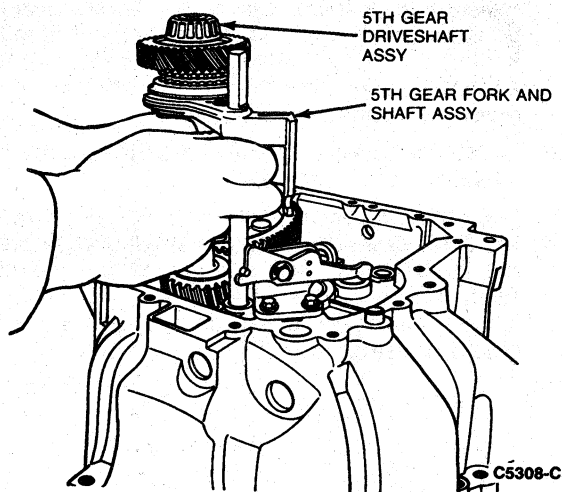
2. Place the differential and the final drive gear assembly into the clutch housing case. Align the differential gears for later installation of the halfshafts.



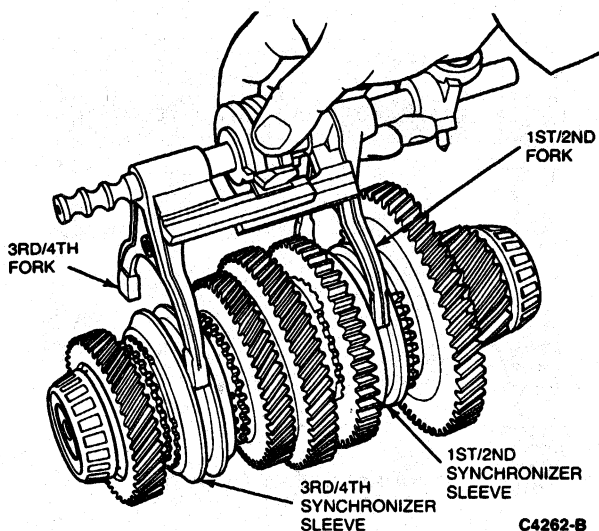
## REMOVAL AND INSTALLATION (Continued)

3. Install the 5th gear shaft assembly and the fork shaft assembly in the case.

**CAUTION:** Be careful not to damage the 5th gear shaft oil funnel.



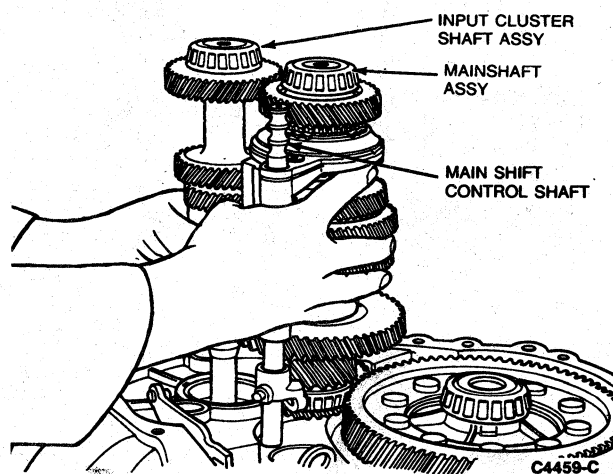
4. Position the main shift control shaft assembly so that the shift forks engage their respective slots in the synchronizer sleeves on the main shaft assembly.



5. Bring the main shaft assembly into mesh with the input cluster shaft assembly. Holding the three shafts (input cluster shaft, main shaft and the main shift control shaft) in their respective working positions, lower them into their bores in the clutch housing case as one unit.

**NOTE:** When performing this operation care must be taken to avoid movement of the 3rd/4th synchronizer sleeve. This could result in overtravel of the synchronizing sleeve to hub, allowing inserts to pop out of position.

**CAUTION:** Be careful not to damage the input shaft oil seal or main shaft oil funnel.

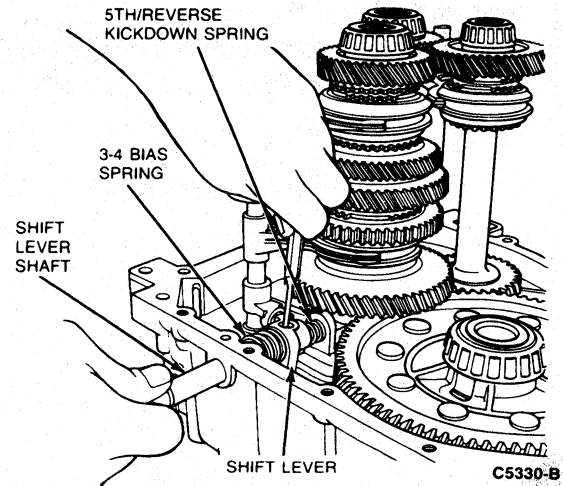


**REMOVAL AND INSTALLATION (Continued)**

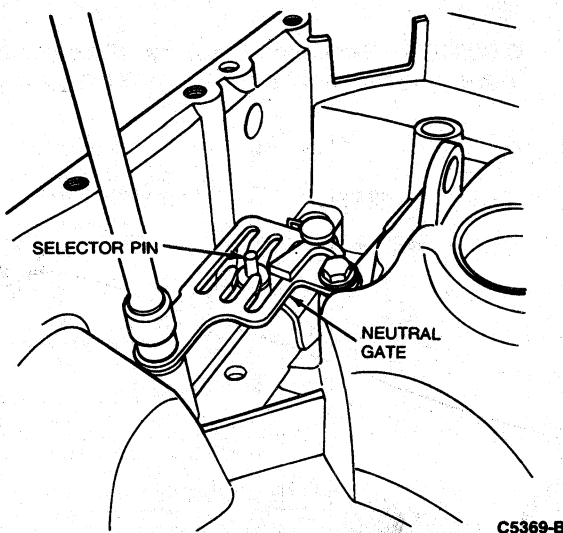
6. Position the shift lever, 3-4 bias spring and 5th/reverse kickdown spring in their working positions (with one shift leverball located in the socket of the input shift gate selector plate arm assembly and the other in the socket of the main shift control shaft block).

Install the spring and ball in the 5th and reverse inhibitor shift lever hole.

Slide the shift lever shaft (notch down) through the shift lever. Then using a small drift, depress the inhibitor ball and spring and tap the shift shaft through the shift lever and the 5th gear kickout spring and then tap into its bore in the clutch housing.

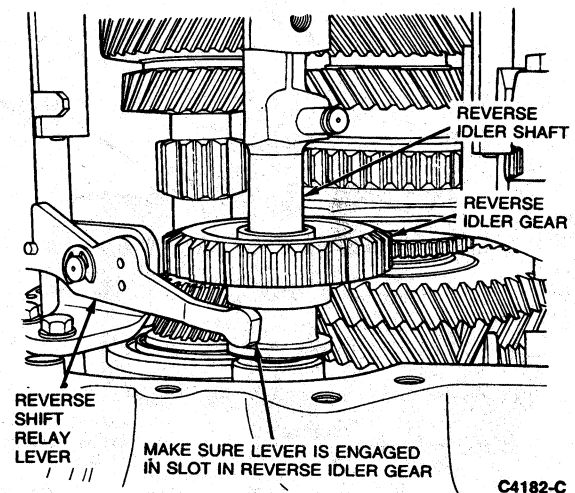


7. Align the shift shaft roll pin hole with the case bore and tap the roll pin in, slightly below the case mating surface.
8. Verify that the selector pin is in the neutral gate of the control selector plate and the finger of the fork selector arm is partially engaged with the 1st/2nd fork and partially engaged with the 3rd/4th fork.



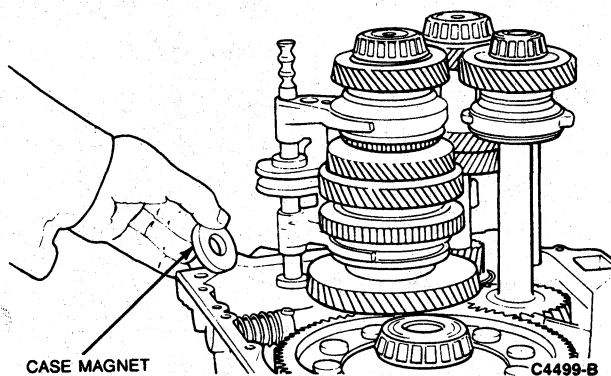
9. Position reverse idler gear over bore in clutch housing while engaging reverse shift relay lever in the slot of the gear. Slide the reverse idler shaft through the gear and into its bore.

Make sure lever is engaged in slot in gear.

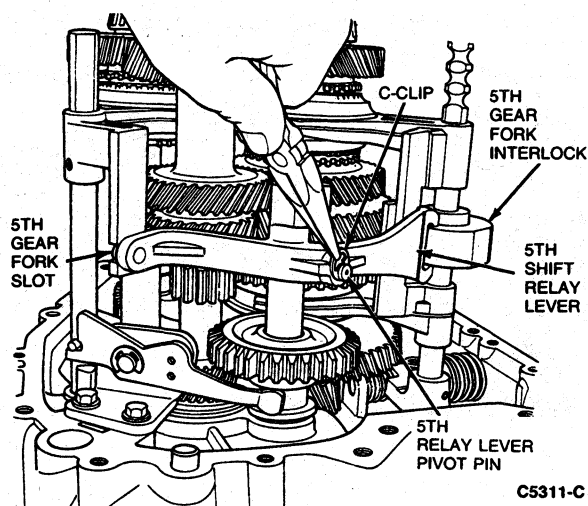


## REMOVAL AND INSTALLATION (Continued)

10. Install the magnet in its pocket in the clutch housing case.

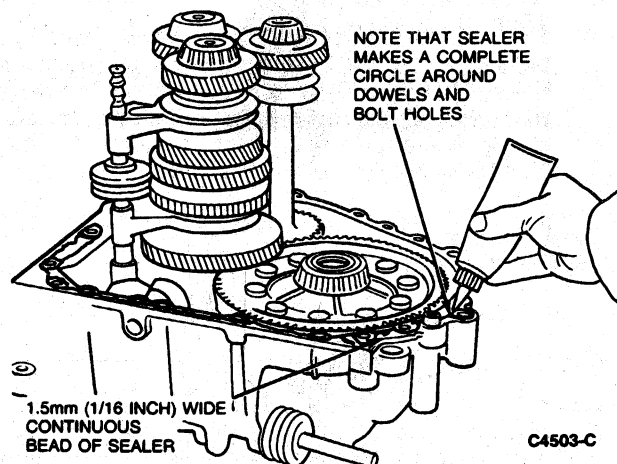


11. Install the 5th shift relay lever onto the reverse idler shaft, aligning it with the fork interlock sleeve and 5th gear fork slot and install the retaining ring (C-clip).



12. Verify that the gasket surfaces of the transmission case and clutch housing are perfectly clean and free of burrs or nicks.

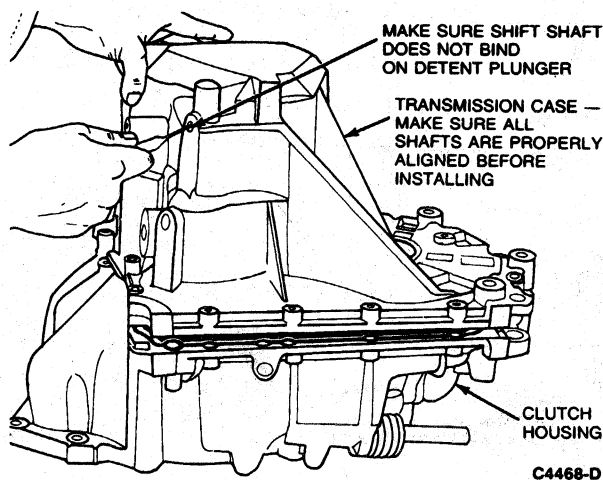
Apply a 1.5mm (1/16-inch) wide bead of Gasket Eliminator E1FZ-19562-A (ESP-M4G228) or equivalent to the clutch housing.



13. Install the detent spring and plunger in their bore in the case. Carefully lower the transmission case over the clutch housing, then using a punch, depress the spring and plunger.

Gently move the transmission case until the shift control shaft, main shaft, input cluster shaft and 5th gear shaft align with their respective bores in the transmission case.

14. Gently slide the transmission case over the dowels and flush onto the clutch housing case. Make sure that the case does not bind on the magnet.



**REMOVAL AND INSTALLATION (Continued)**

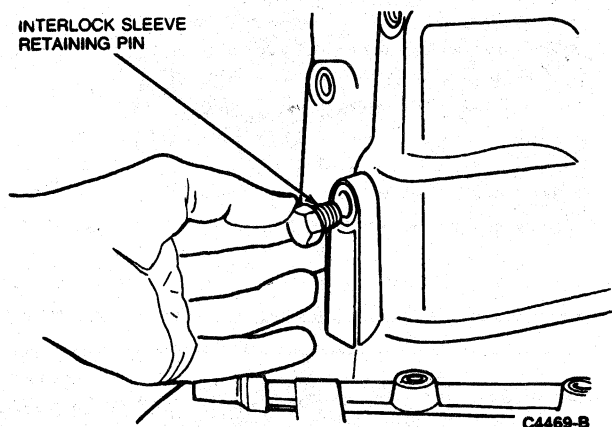
15. Apply Pipe Sealant with Teflon® D8AZ-19554-A or equivalent to the threads of the interlock sleeve retaining pin, in a clockwise direction.

Use a drift to align the slot in the interlock sleeve with the hole in the transaxle case and install the retaining pin.

Using a 13mm socket tighten to 16-20 N·m (12-15 lb-ft).

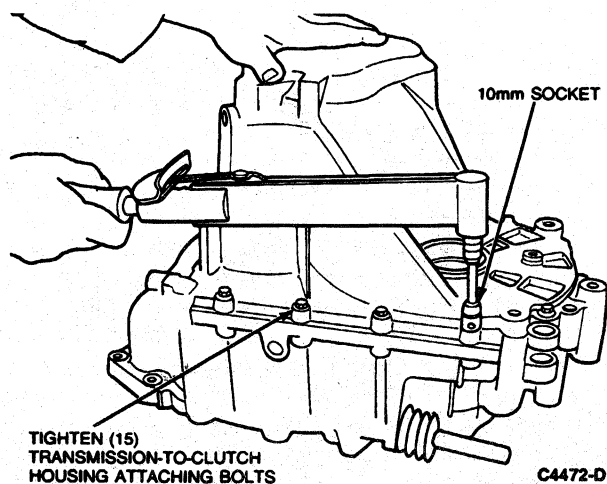
**NOTE:** If the hole in the case does not align with the slot in the interlock sleeve, remove the case half and check for proper installation of the interlock sleeve.

INTERLOCK SLEEVE  
RETAINING PIN



C4469-B

16. Using a 10mm socket and torque wrench, install the 15 transmission case-to-clutch housing bolts. Tighten to 18-23 N·m (13-17 lb-ft).



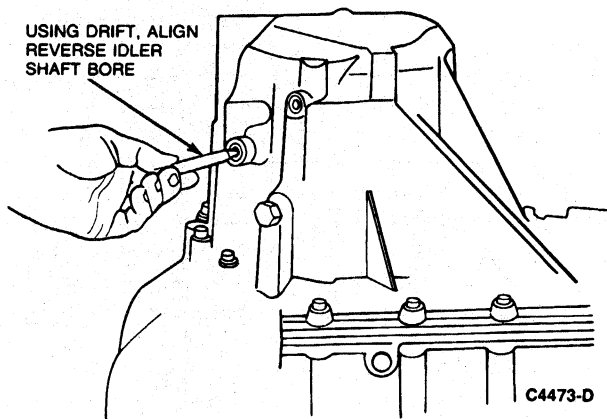
10mm SOCKET

TIGHTEN (15)  
TRANSMISSION-TO-CLUTCH  
HOUSING ATTACHING BOLTS

C4472-D

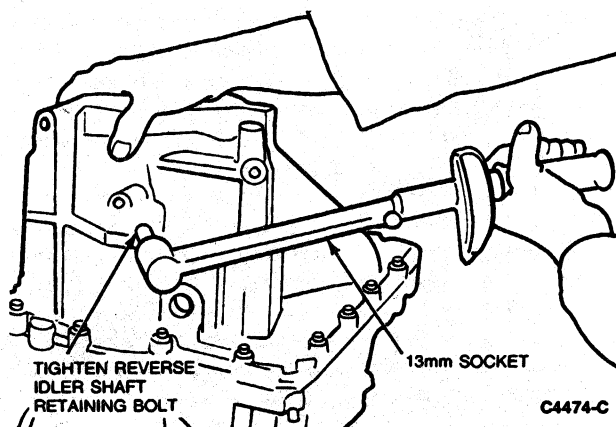
17. Use a drift to align the bore in the reverse idler shaft with the retaining screw hole in the transmission case.

USING DRIFT, ALIGN  
REVERSE IDLER  
SHAFT BORE



C4473-D

18. Install the reverse idler shaft retaining bolt. Tighten to 22-27 N·m (16-20 lb-ft).



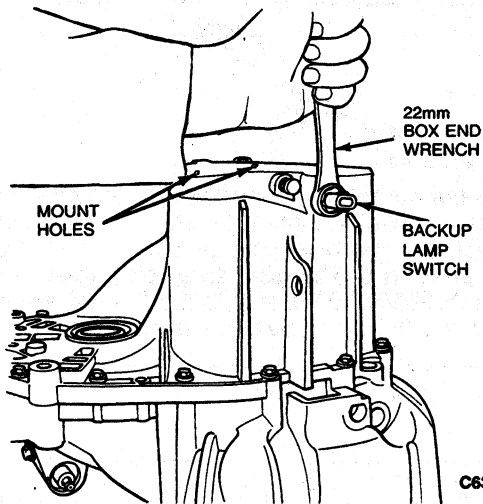
TIGHTEN REVERSE  
IDLER SHAFT  
RETAINING BOLT

13mm SOCKET

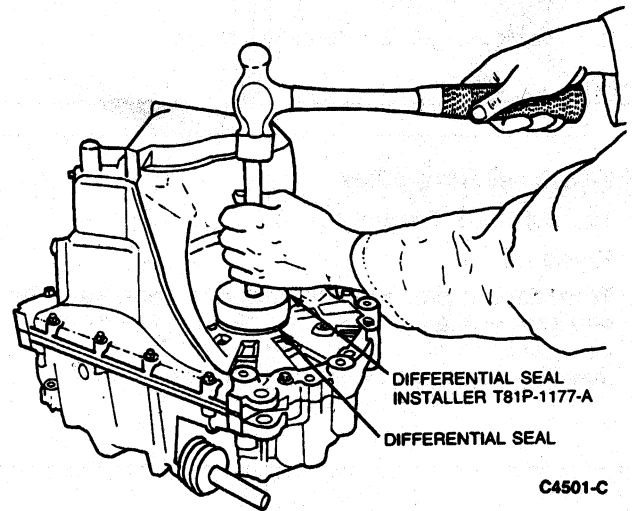
C4474-C

## REMOVAL AND INSTALLATION (Continued)

19. Apply Pipe Sealant with Teflon® (D8AZ-19554-A or equivalent) to the threads of the backup lamp switch in a clockwise direction and install. Using a 22mm box end wrench tighten to 16-20 N·m (12-15 lb-ft).

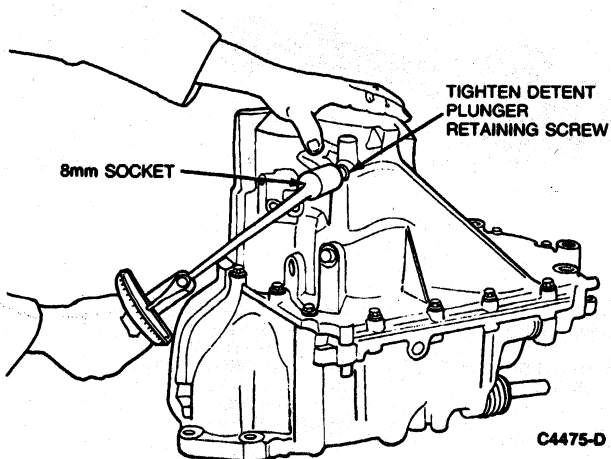


21. Tap the differential seal into the transmission case with Differential Seal Installer T81P-1177-A or equivalent.



20. Apply Pipe Sealant with Teflon® (D8AZ-19554-A or equivalent) to the threads of the detent plunger retaining screw.

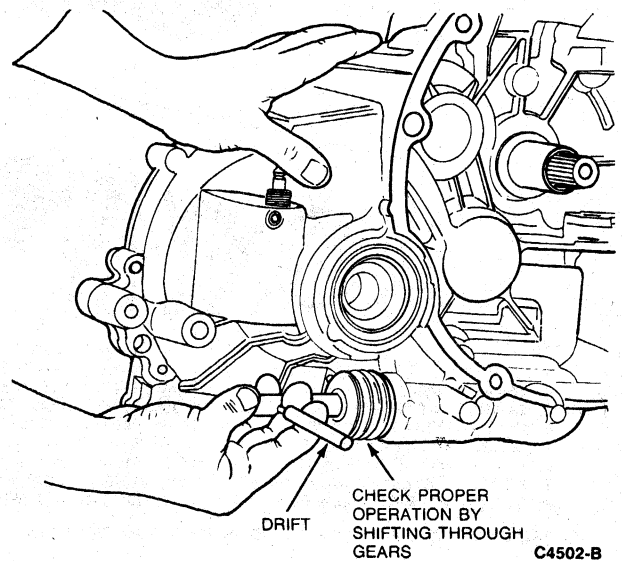
Install the retaining screw using an 8mm socket and torque wrench. Tighten to 7.5-11 N·m (6-8 lb-ft).



22. Place the transaxle upright and position a drift through the hole in the input shift shaft. Shift the transaxle into and out of all gears to verify proper installation.

NOTE: Transaxle will not shift directly into REVERSE from 5th gear.

NOTE: The fill plug should be attached to the transaxle and installed after the transaxle has been installed in the vehicle and fluid has been added.



## REMOVAL AND INSTALLATION (Continued)

## Flywheel

## Removal and Installation

1. Remove pressure plate and disc. Refer to Section 16-02.
2. Remove flywheel retaining bolts.
3. Carefully remove flywheel from vehicle. Inspect flywheel for damage or wear as outlined in this Section.
4. To install, reverse Steps 1 through 3.

## Flywheel Ring Gear

## Manual-Shift Transmission

## Removal

To replace a damaged or worn ring gear, heat the ring gear with a blow torch on the engine side of the gear, and knock it off the flywheel. Do not hit the flywheel when removing the ring gear.

## Installation

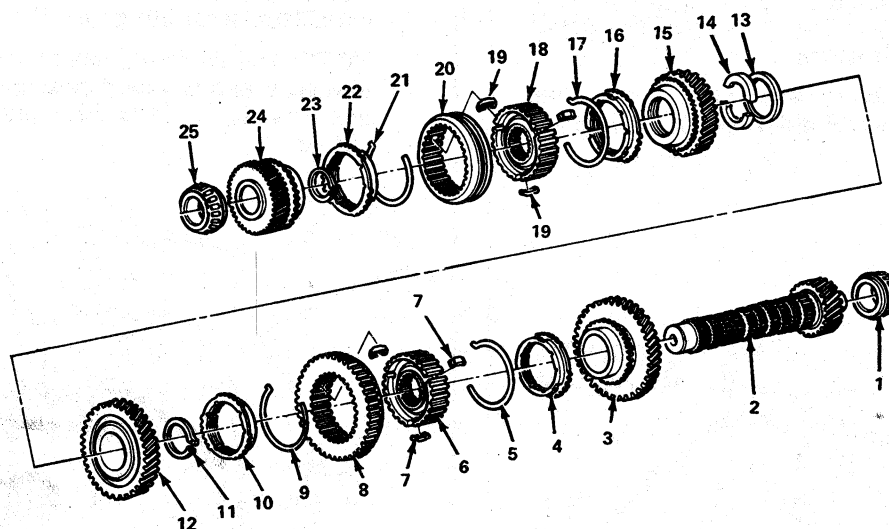
Heat the new ring gear evenly until the gear expands enough to slip onto the flywheel. Make sure the gear is seated properly against the shoulder. **Do not heat any portion of the gear to a temperature higher than 260°C (500°F). If this limit is exceeded, the temper will be removed from the ring gear teeth.**

## DISASSEMBLY AND ASSEMBLY

## Differential Final Drive Gear Assembly

Refer to Section 15-21 for disassembly and assembly.

## Main Shaft Assembly



## LEGEND\*

- |                                 |  |                                  |
|---------------------------------|--|----------------------------------|
| 1. BEARING — MAINSHAFT FRONT    | 9. SPRING — SYNCHRONIZER                   | 18. HUB — 3RD/4TH SYNCHRO        |
| 2. SHAFT — MAIN                 | 10. RING — SYNCHRO BLOCKER                 | 19. INSERT — SYNCHRO HUB 3RD/4TH |
| 3. GEAR — 1ST SPEED             | 11. RING — 1ST/2ND SYNCHRO RETAINING       | 20. SLEEVE — 3RD/4TH SYNCHRO     |
| 4. RING — SYNCHRO BLOCKER       | 12. GEAR — 2ND SPEED                       | 21. SPRING — SYNCHRONIZER        |
| 5. SPRING — SYNCHRONIZER        | 13. RING — 2ND/3RD THRUST WASHER RETAINING | 22. RING — SYNCHRO RETAINING     |
| 6. HUB — 1ST/2ND SYNCHRO        | 14. WASHER — 2ND/3RD GEAR THRUST           | 23. RING — RETAINING             |
| 7. INSERT — SYNCHRO HUB 1ST/2ND | 15. GEAR — 3RD SPEED                       | 24. GEAR — 4TH SPEED             |
| 8. GEAR — REVERSE SLIDING       | 16. RING — SYNCHRO BLOCKER                 | 25. BEARING — MAINSHAFT REAR     |
|                                 | 17. SPRING — SYNCHRONIZER                  |                                  |

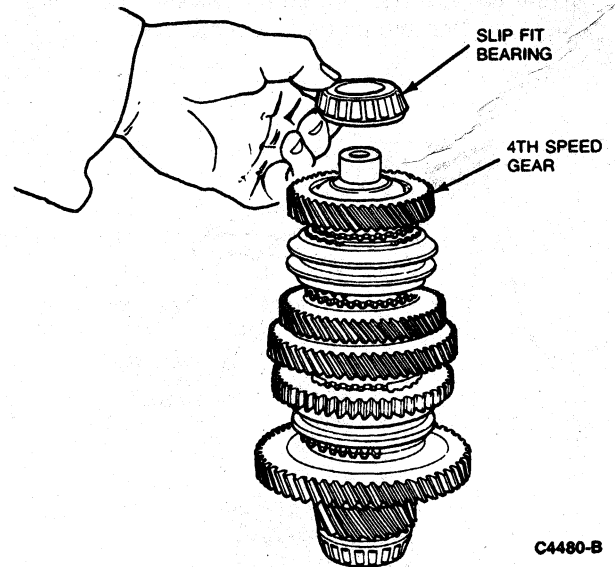
\*REFER TO EXPLODED VIEW TO REFERENCE PART NUMBERS

C3979-F

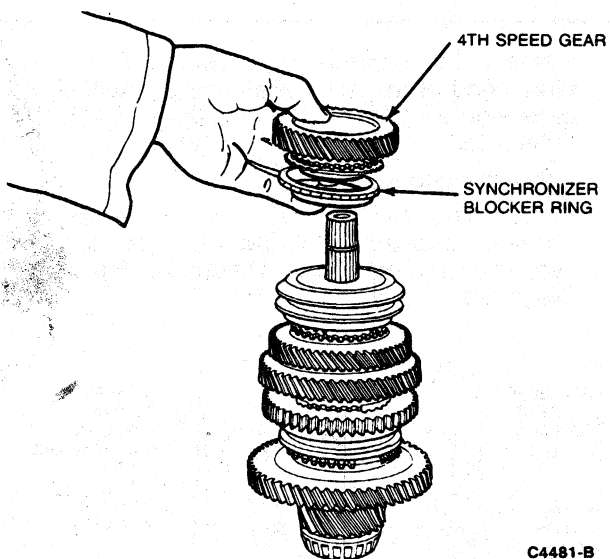


**DISASSEMBLY AND ASSEMBLY (Continued)****Disassembly**

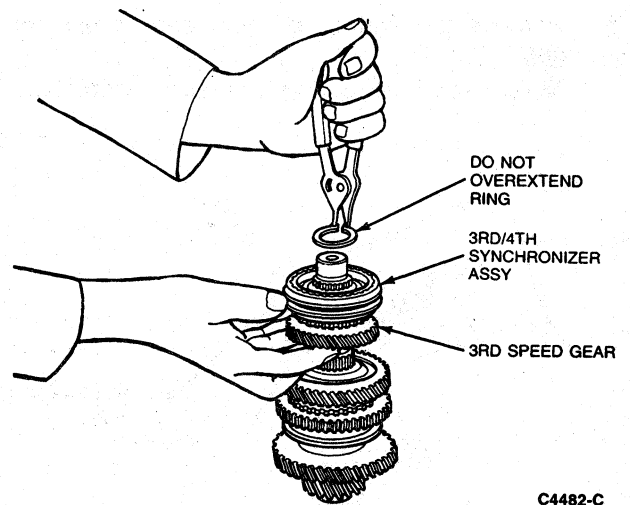
1. Remove the slip fit bearing on the 4th speed gear end of the shaft.  
Label the bearing for proper installation.



2. Remove the 4th speed gear and synchronizer blocker ring.  
NOTE: Tag blocker ring for proper installation.

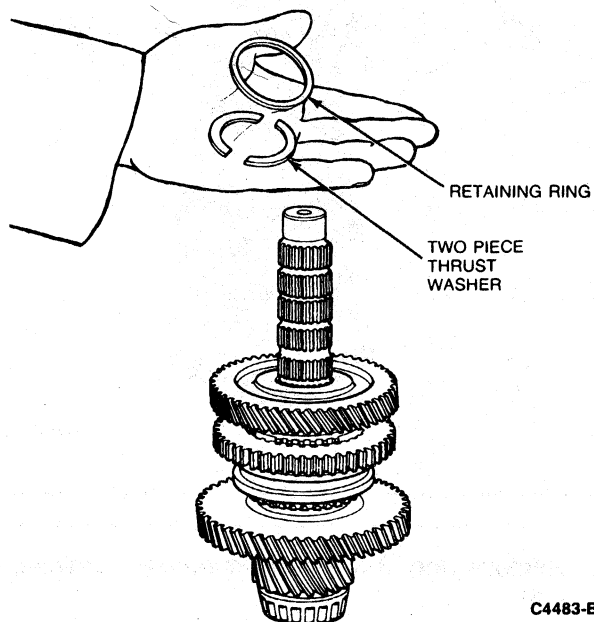


3. Remove the 3rd/4th synchronizer retaining ring.  
Slide the 3rd/4th synchronizer assembly, blocker ring and 3rd speed gear from the shaft.  
NOTE: Tag blocker ring for proper installation.

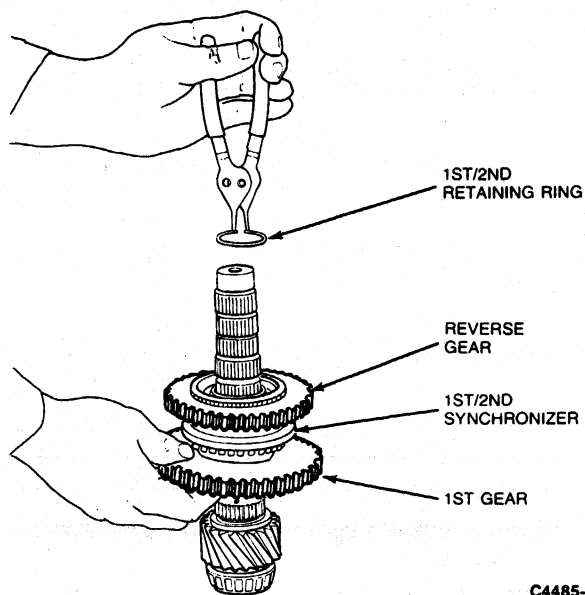


## DISASSEMBLY AND ASSEMBLY (Continued)

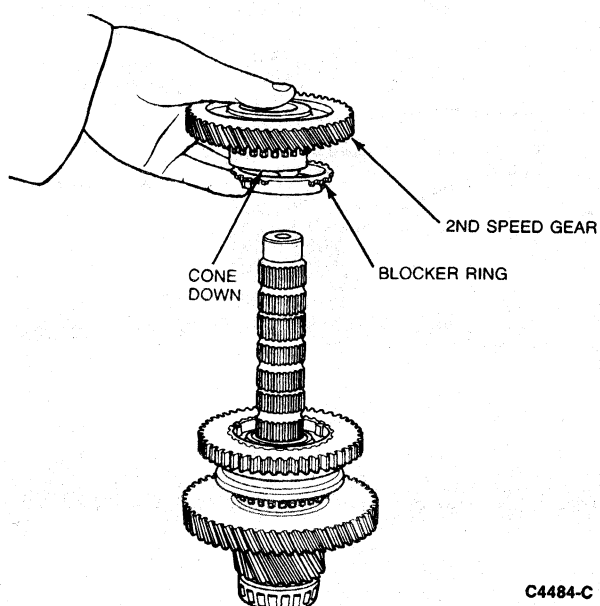
4. Remove the 2nd/3rd thrust washer retaining ring and the two piece thrust washer.



6. Remove the 1st/2nd synchronizer retaining ring. Slide the 1st/2nd synchronizer assembly, blocker ring and 1st speed gear off the shaft.  
NOTE: Tag blocker ring for proper installation.

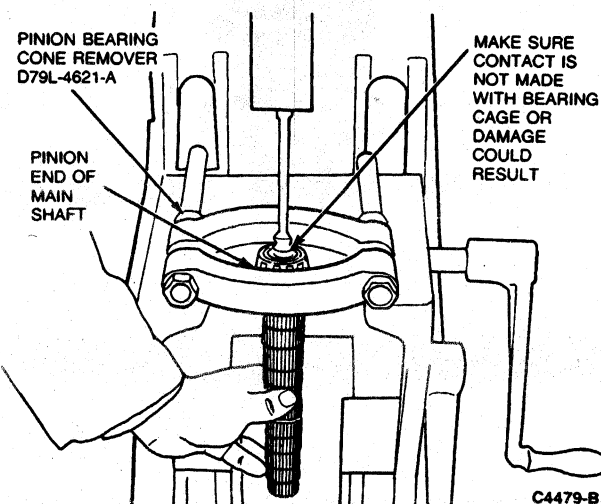


5. Remove the 2nd speed gear and its blocker ring.  
NOTE: Tag blocker ring for proper installation.



7. Remove the tapered roller bearing from the pinion end of the main shaft using a socket or extension and Pinion Bearing Cone Remover D79L-4621-A or equivalent and an arbor press.  
Label the bearing.

NOTE: This bearing does not have to be removed to disassemble the main shaft only to replace if damaged. Refer to Bearing Diagnosis.



## DISASSEMBLY AND ASSEMBLY (Continued)

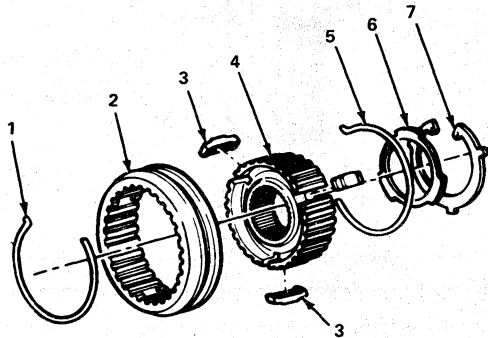
## Synchronizer

## Disassembly and Assembly

NOTE: Prior to disassembly note position of index marks.

To disassemble the synchronizer assembly, remove the synchronizer springs with a small screwdriver. Do not compress the springs more than is necessary. Remove the three hub inserts. Slide the hub and sleeve apart.

5TH SYNCHRONIZER ASSEMBLY

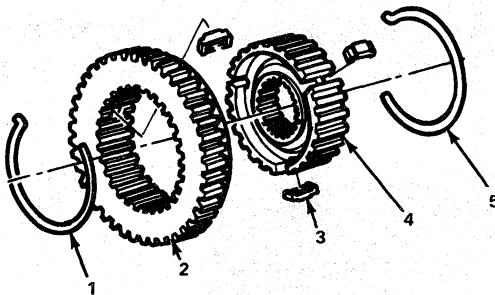


## LEGEND:

1. SPRING—SYNCHRONIZER RETAINER
2. GEAR AND SYNCHRONIZER SLEEVE
3. INSERTS—SYNCHRONIZER HUB
4. HUB—SYNCHRONIZER
5. SPRING—SYNCHRONIZER RETAINER
6. SPACER—SYNCHRONIZER INSERT RETAINING
7. RETAINER—5TH SYNCHRONIZER INSERT

NOTE: THE 5TH SYNCHRONIZER IS POSITIONED ON SHAFT SO THAT PLASTIC SPACER AND RETAINER IS NEXT TO 5TH DRIVE GEAR

C4174-C

SYNCHRONIZER ASSEMBLY  
1ST/2ND AND 3RD/4TH (TYPICAL)

## LEGEND:

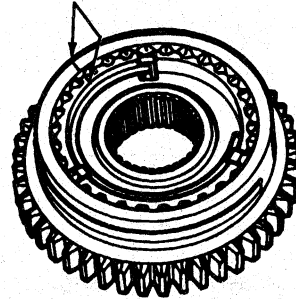
1. SPRING — SYNCHRONIZER RETAINER
2. GEAR AND SYNCHRONIZER SLEEVE
3. INSERTS — SYNCHRONIZER HUB
4. HUB — SYNCHRONIZER
5. SPRING — SYNCHRONIZER RETAINER

C4072-D

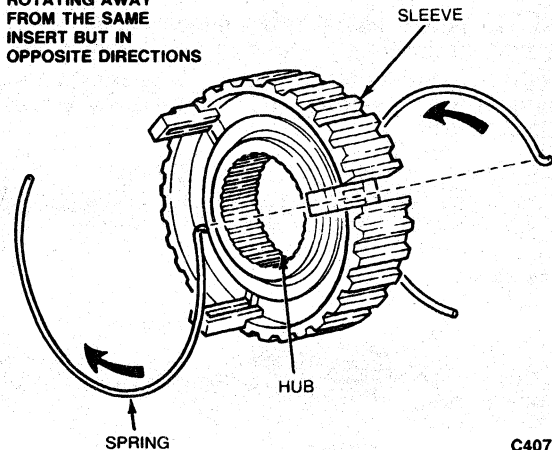
In assembling the synchronizers, some points must be noted:

1. Slide the sleeve over the hub. The index marks must be aligned.
2. Place the three inserts into their slots. Place the tab on the synchronizer spring into the groove of one of the inserts and snap the spring into place.

Place the tab of the other spring into the same insert (on the other side of the synchronizer assembly) and rotate the spring in the opposite direction and snap into place.

ALIGNMENT MARKS  
(SINGLE SET OF MARKS)

NOTE THE SPRINGS  
ROTATING AWAY  
FROM THE SAME  
INSERT BUT IN  
OPPOSITE DIRECTIONS



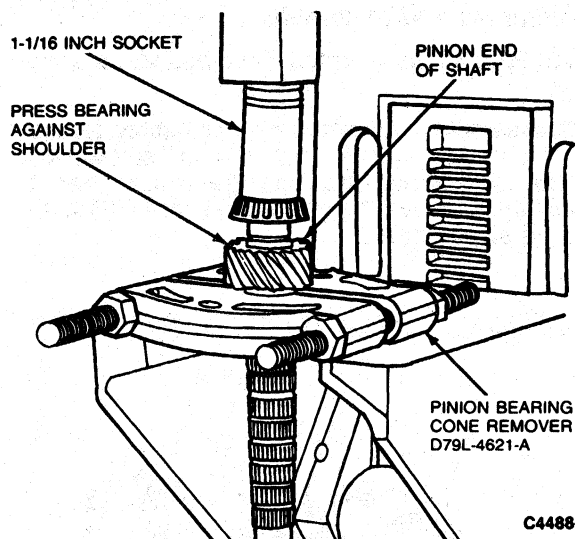
C4073-C

NOTE: When assembling synchronizers, notice that the sleeve and the hub have an extremely close fit and must be held square to prevent jamming. (Do not force the sleeve onto the hub).

**DISASSEMBLY AND ASSEMBLY (Continued)****Main Shaft Assembly****Assembly**

NOTE: Prior to assembly of the main shaft, thoroughly clean all parts and inspect their condition. Lightly oil the gear bores and other parts with Motorcraft Type F (ESW-M2C233) or Motorcraft DEXRON® II or equivalent transmission fluid.

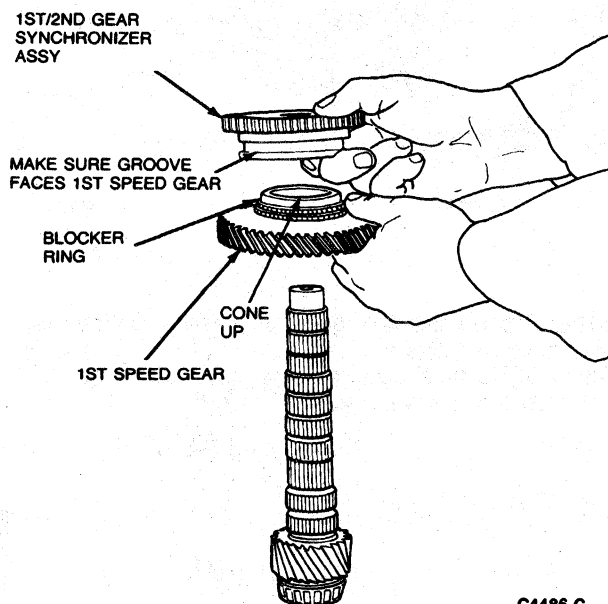
1. Install the bearing on the pinion end of the shaft using a 1-1/16 inch socket and an arbor press.



2. Slide the 1st speed gear and tagged blocker ring onto the main shaft. Slide the 1st/2nd synchronizer assembly into place, making sure the shift fork groove on the reverse sliding gear faces the 1st speed gear.

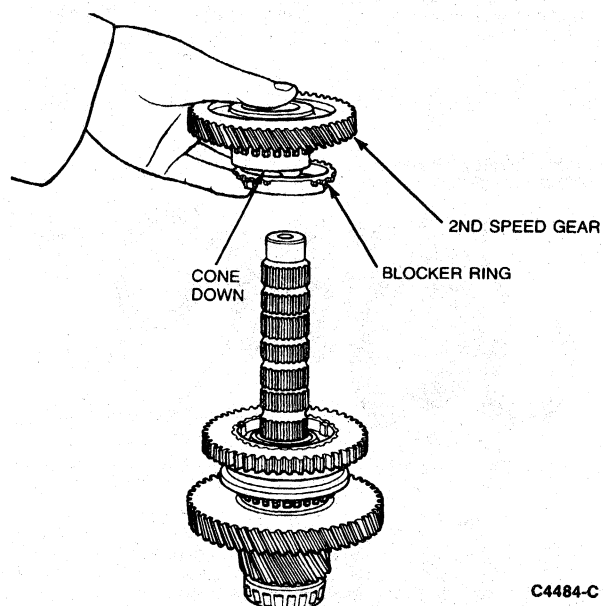
NOTE: When installing the synchronizer, align the three grooves in the 1st gear blocker ring with the synchronizer inserts. This allows the synchronizer assembly to seat properly in the blocker ring.

Install the synchronizer retaining ring.



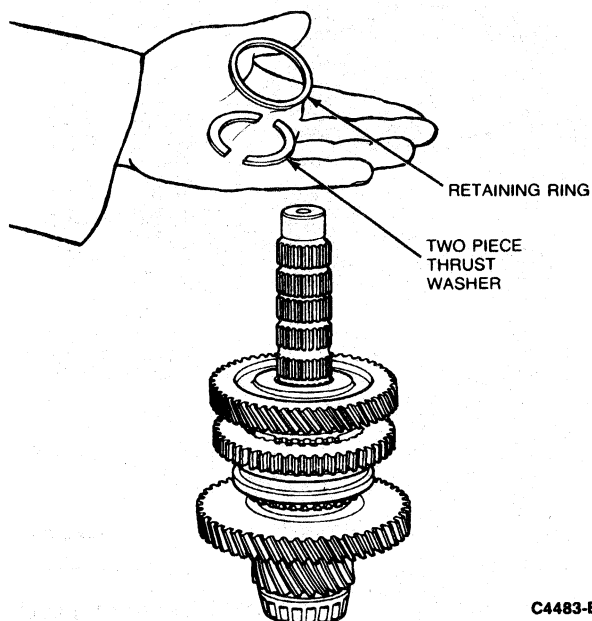
3. Install the tagged 2nd speed blocker ring and the 2nd speed gear.

NOTE: When installing the synchronizer, align the three grooves in the 2nd gear blocker ring with the synchronizer inserts. This allows the synchronizer assembly to seat properly in the blocker ring.



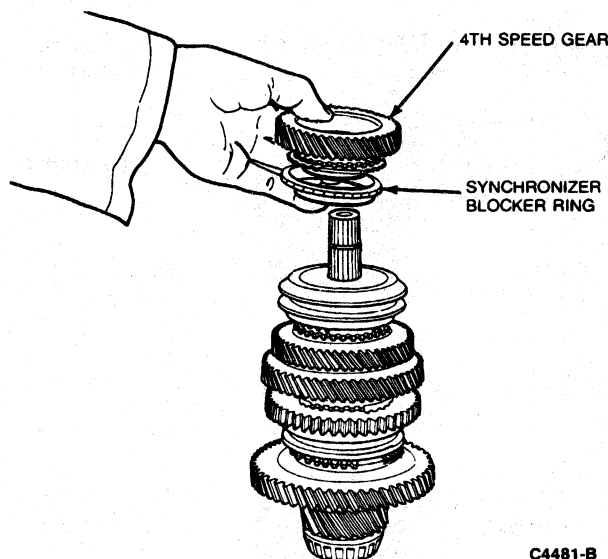
## DISASSEMBLY AND ASSEMBLY (Continued)

4. Install the thrust washer halves into the groove on the main shaft and then the retaining ring around the thrust washer halves.



6. Install the tagged 4th gear blocker ring and the 4th speed gear.

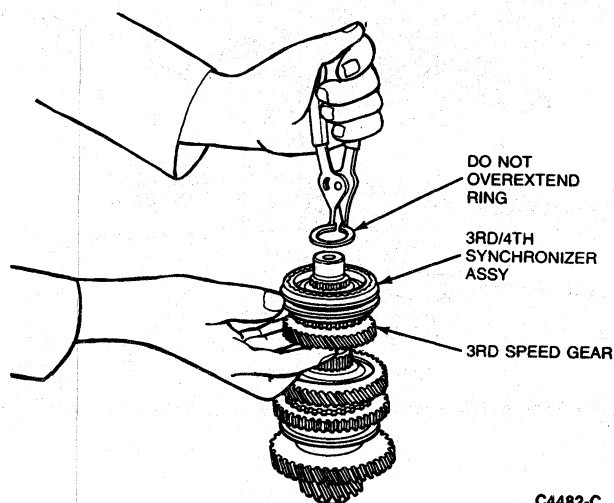
NOTE: When installing the synchronizer, align the three grooves in the 4th gear blocker ring with the synchronizer inserts. This allows the synchronizer assembly to seat properly in the blocker ring.



5. Slide the 3rd speed gear onto the shaft followed by the tagged 3rd gear synchronizer blocker ring and the 3rd/4th gear synchronizer assembly.

NOTE: When installing the synchronizer, align the three grooves in the 3rd gear blocker ring with the synchronizer inserts. This allows the synchronizer assembly to seat properly in the blocker ring.

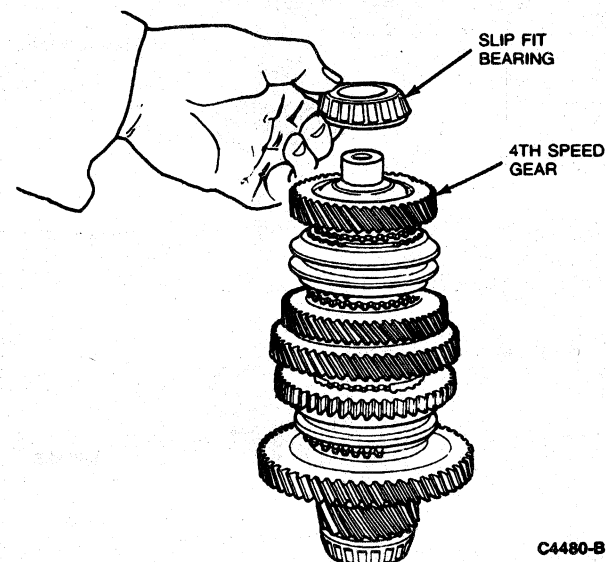
Install the synchronizer retaining ring.



7. Install the slip fit bearing on the 4th gear end of the shaft.

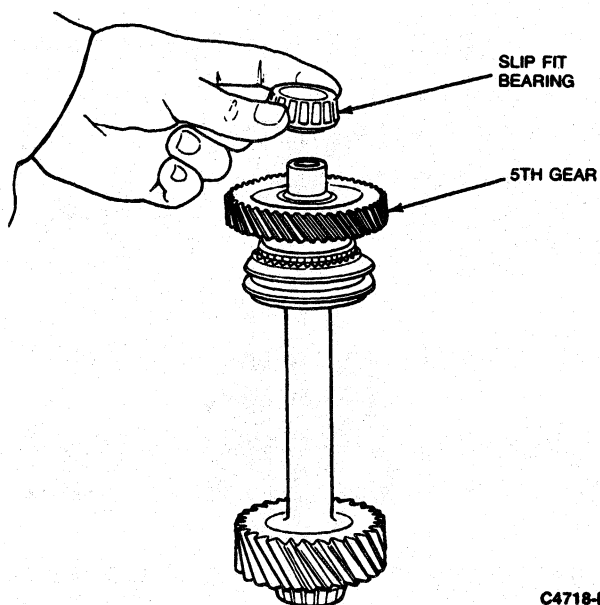
NOTE: Make sure bearings are seated against the shoulder of the main shaft. Make sure bearings are placed on the proper end, as labeled during disassembly. Rotate each gear on the shaft to check for binding or roughness.

NOTE: Make sure that the synchronizer sleeves are in NEUTRAL position.

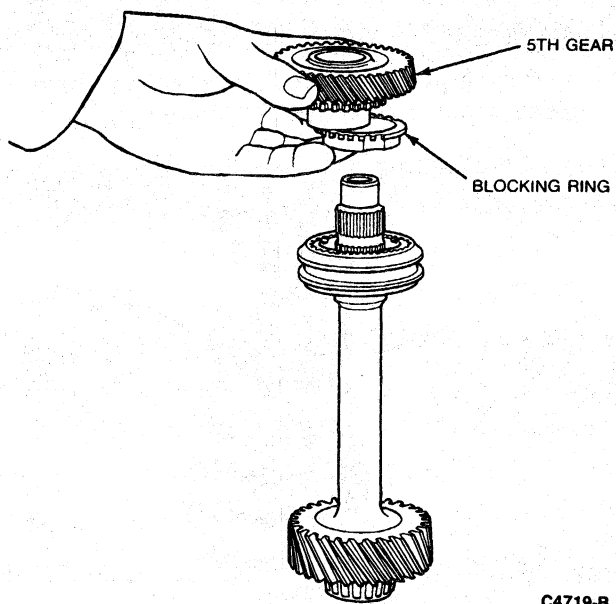


**DISASSEMBLY AND ASSEMBLY (Continued)****5th Gear Shaft Assembly****Disassembly**

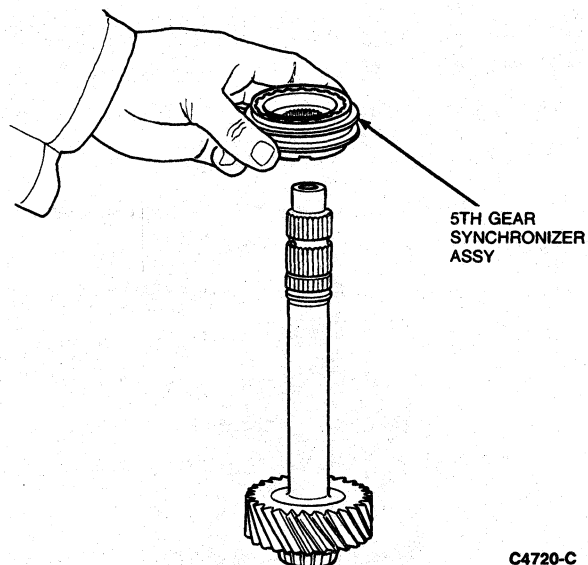
1. Remove the slip fit bearing from the 5th gear end of the shaft and label it for proper installation.



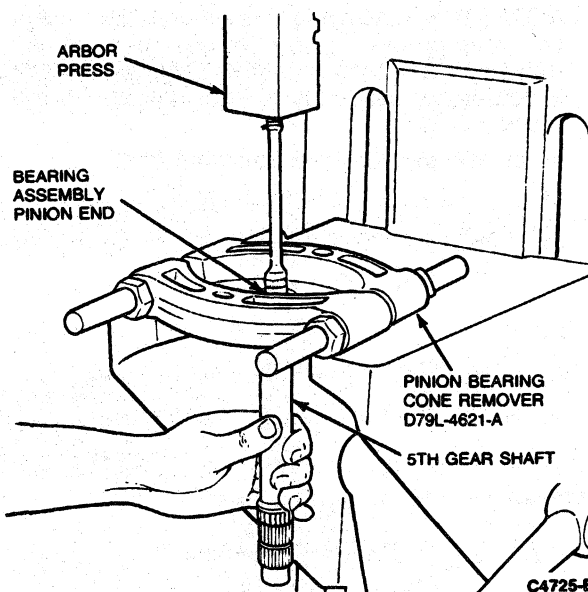
2. Remove the 5th gear and blocking ring.



3. Remove the 5th gear synchronizer assembly.



4. Remove the press fit bearing from the pinion end of the shaft, using Pinion Bearing Cone Remover D79L-4621-A or equivalent.

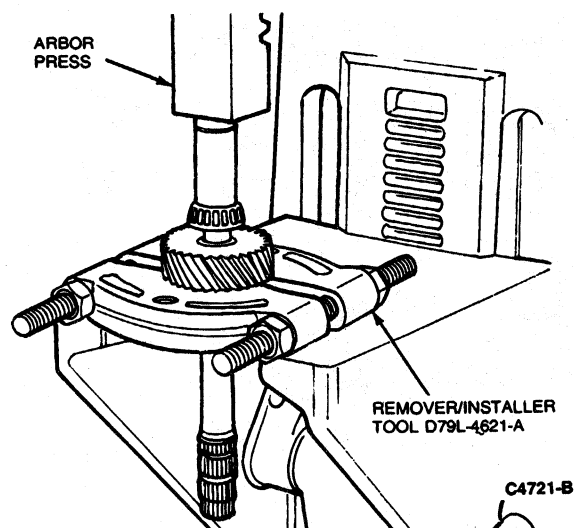


## DISASSEMBLY AND ASSEMBLY (Continued)

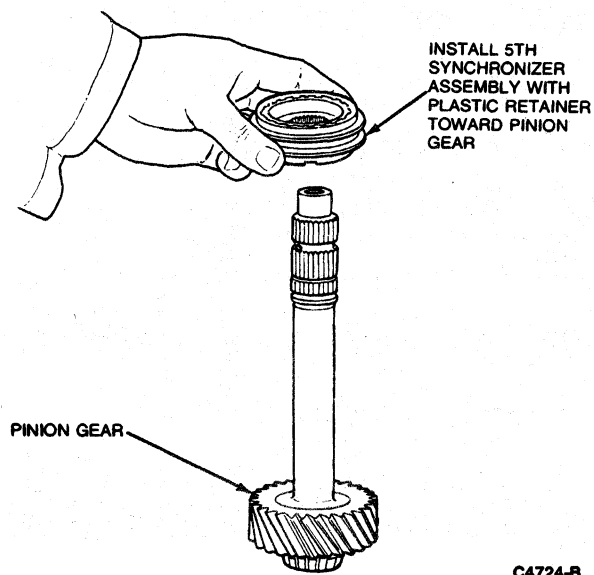
**Assembly**

NOTE: Prior to assembly, thoroughly clean all parts and inspect their condition. Lightly oil the gear bore with either Motorcraft Type F (ESW-M2C233-F) or Motorcraft DEXRON® II transmission fluid or equivalent.

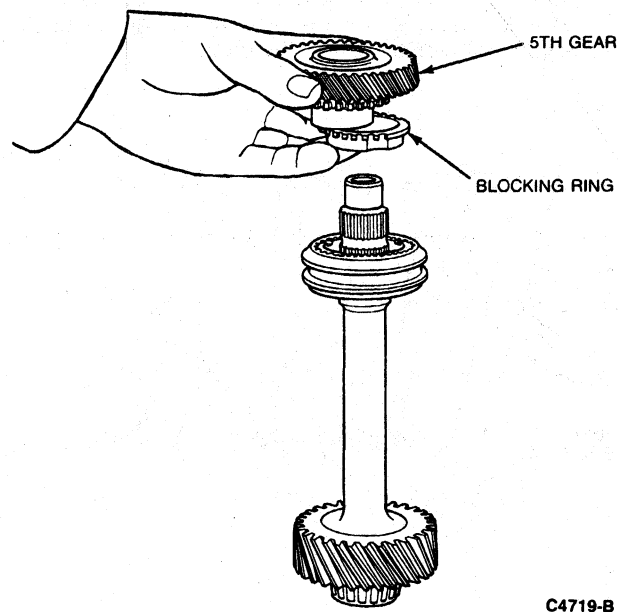
1. Press the bearing onto the pinion gear end of the 5th gear shaft.



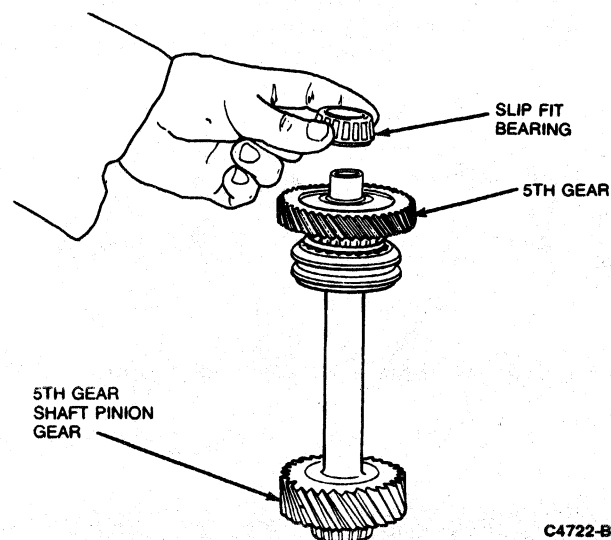
2. Install the 5th synchronizer assembly with the plastic insert retainer facing the pinion gear.



3. Install the 5th gear and blocking ring.

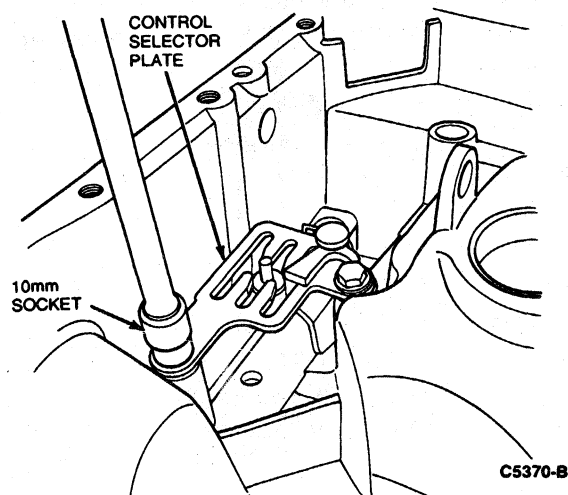


4. Install the slip fit bearing on the 5th gear end of the shaft.

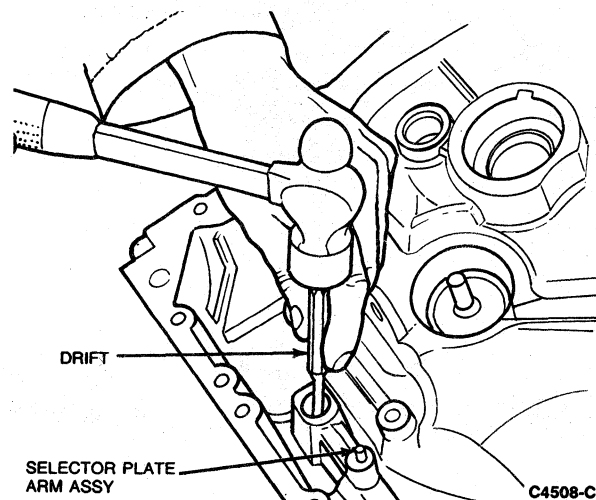


**DISASSEMBLY AND ASSEMBLY (Continued)****Clutch Housing****Disassembly**

1. Using a 10mm socket wrench, remove the two control selector plate attaching bolts and remove the plate from the case.

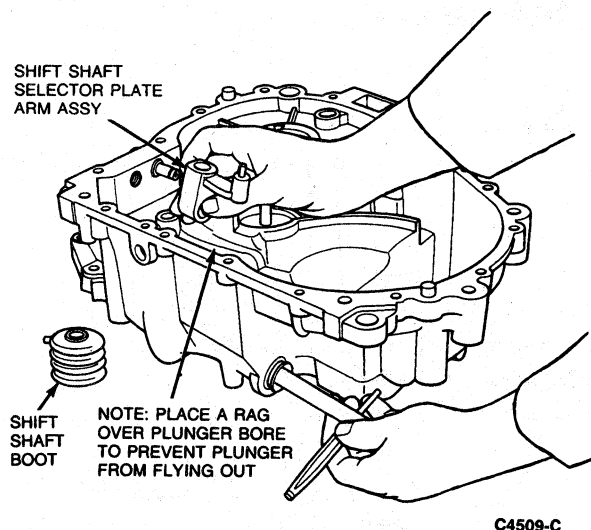


2. With the input shift shaft in the center detent position, using a drift, drive the spring pin through the selector plate arm assembly and through the input shift shaft into the recess in the clutch housing case.

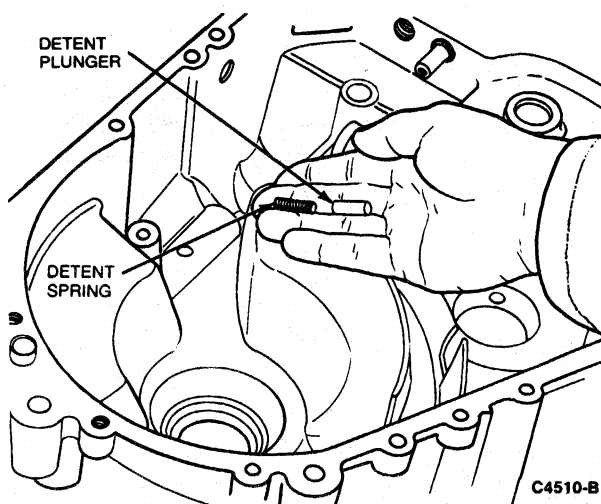


3. Remove the shift shaft boot. Using a drift, rotate the input shift shaft 90 degrees, depressing the detent notches inside the housing and pull input shift shaft out.

Remove the input shift shaft selector plate arm assembly and the spring pin.



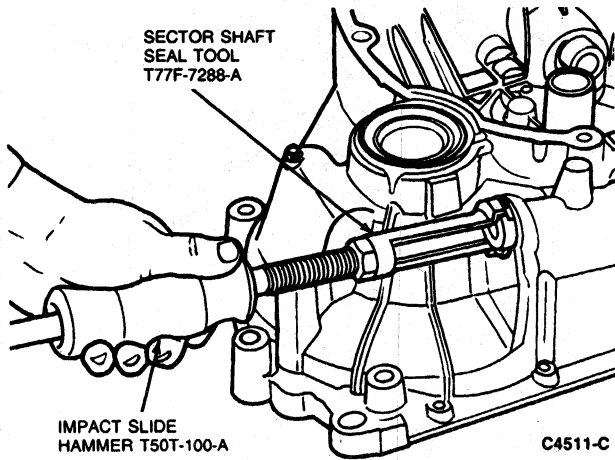
4. Using a pencil magnet, remove the input shift shaft detent plunger and spring and label for proper installation.



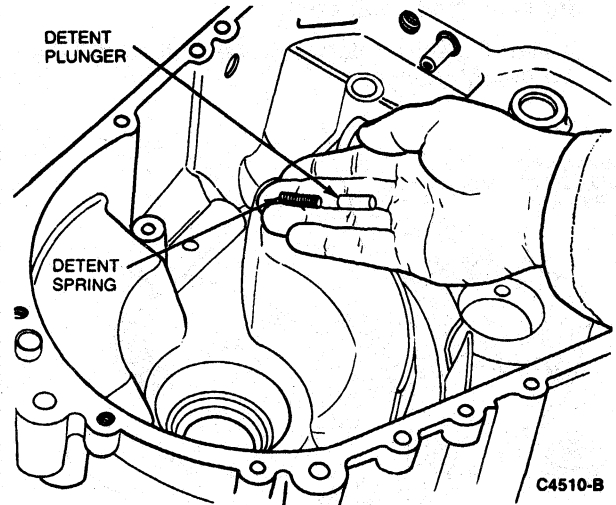


## DISASSEMBLY AND ASSEMBLY (Continued)

5. Using Sector Shaft Seal Tool T77F-7288-A and Impact Slide Hammer T50T-100-A or equivalent, remove the transmission input shift shaft oil seal assembly.



2. Install the input shift shaft detent spring and plunger in the clutch housing case.

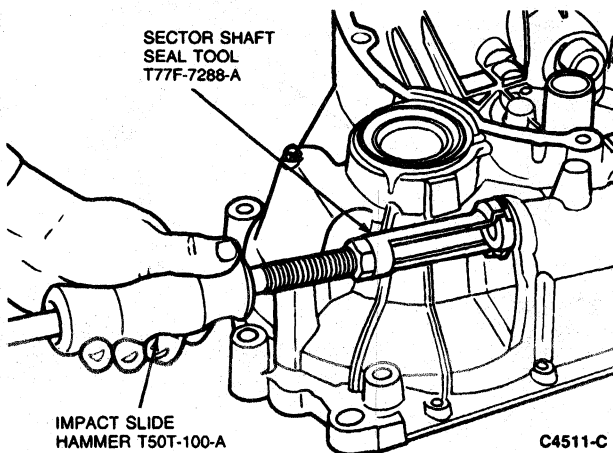


## Assembly

NOTE: Prior to assembly, thoroughly clean all parts and inspect their condition. Lightly oil all parts and bore with Motorcraft Type F (ESW-M2C233-F) or Motorcraft DEXRON® II transmission fluid or equivalent.

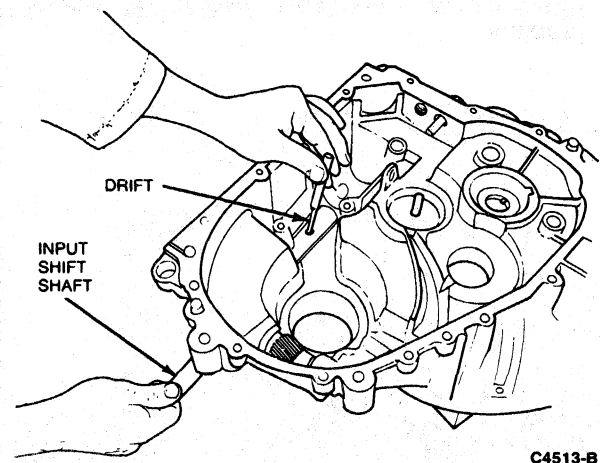
1. Grease the seal lip of a new shift shaft oil seal.

Using Sector Shaft Seal Tool T77F-7288-A and Impact Slide Hammer T50T-100-A or equivalent, install a new input shift shaft oil seal assembly.



3. Using a small drift, force the spring and plunger down into its bore while sliding the input shift shaft into its bore and over the plunger.

**CAUTION:** Be careful not to cut the shift shaft oil seal when inserting the shaft.

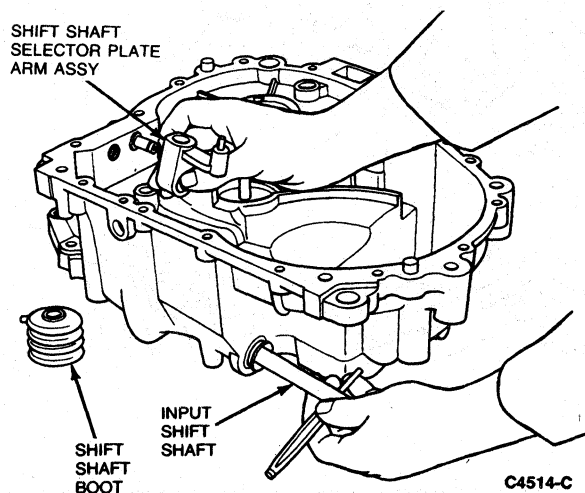
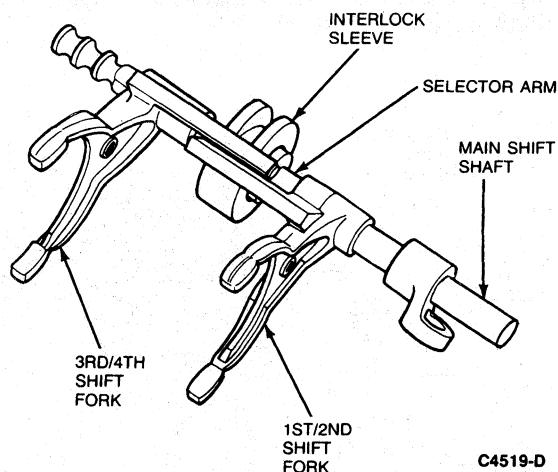


**DISASSEMBLY AND ASSEMBLY (Continued)**

4. Install the selector plate arm in its working position and slide the shaft through the selector plate arm.

Align the hole in the selector plate arm with the hole in the shaft and install the roll pin. Install the input shift shaft boot.

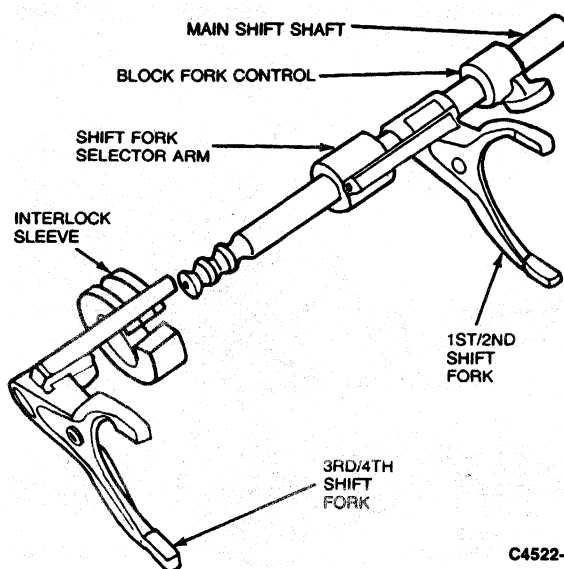
**NOTE:** Be sure notches in the shift shaft face the detent plunger.

**Main Shift Control Shaft****Disassembly**

1. Rotate the 3rd/4th shift fork on the shaft until the notch in the fork is located over the interlock sleeve.

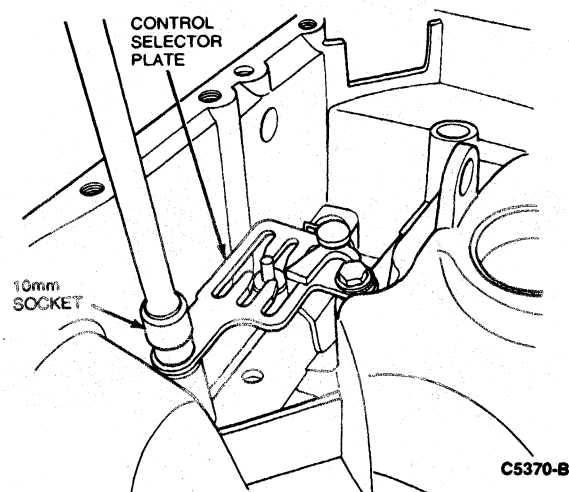
Rotate the 1st/2nd shift fork on the shaft until the notch in the fork is located over the shift fork selector arm finger.

With the forks in position, slide the 3rd/4th fork and interlock sleeve off the shaft.



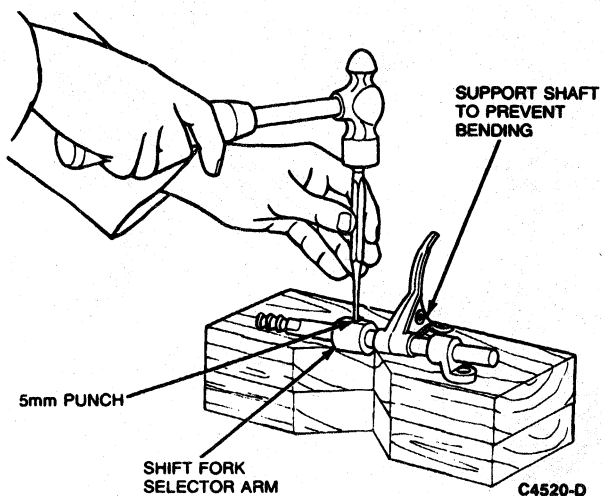
5. Install the control selector plate. Using a 10mm socket wrench, tighten the attaching bolts to 8-11 N·m (6-8 lb-ft) (pin in selector arm must ride in cut-out of gate in the selector plate).

Move input shift shaft through the selector plate positions to make sure everything works properly.

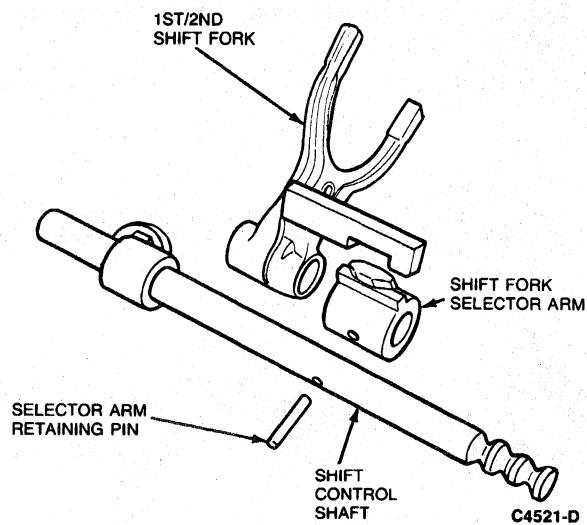


**DISASSEMBLY AND ASSEMBLY (Continued)**

2. Using a 5mm punch, remove the selector arm retaining pin.

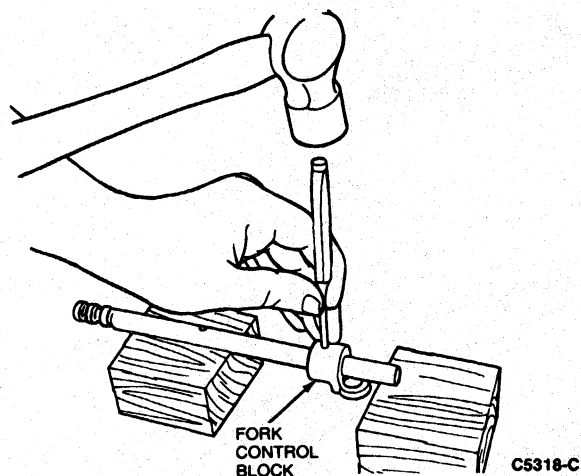


3. Remove the shift fork selector arm and 1st/2nd shift fork from the shaft.



4. Using a 5mm punch, remove the fork control block retaining pin.

Remove the fork control block from the shift control shaft.

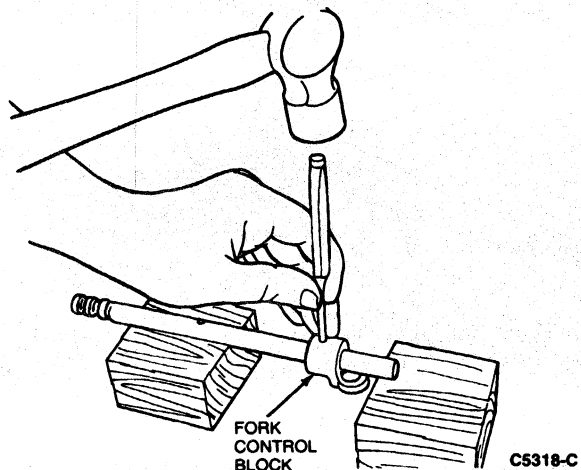
**Assembly**

**NOTE:** Prior to assembly of the main shaft control shaft, thoroughly clean all parts and inspect their condition. Lightly oil all parts with Motorcraft Type F (ESW-M2C233-F) or Motorcraft DEXRON® II or equivalent transmission fluid.

1. Slide fork control block onto the shift control shaft.

Align the hole in the block with the hole in the shaft and install the fork control block pin using a 5mm punch.

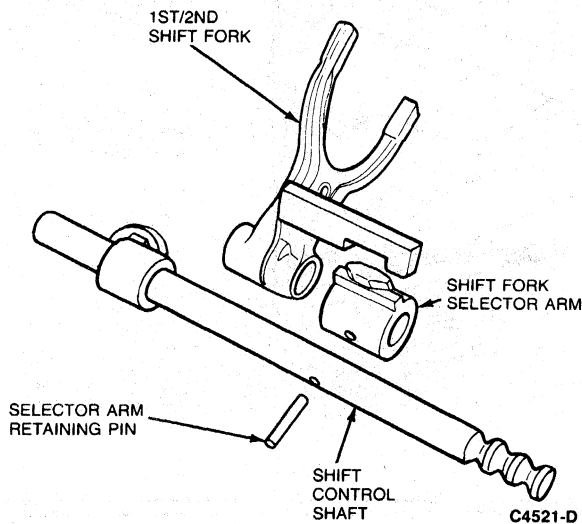
**NOTE:** With pin installed in control block, off-set must point towards end of shaft.



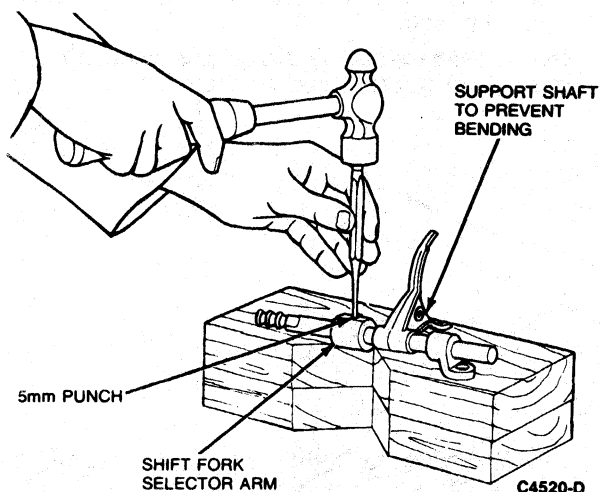
**DISASSEMBLY AND ASSEMBLY (Continued)**

2. Install the 1st/2nd shift fork and the selector arm on the shaft.

NOTE: The 1st/2nd shift fork is thinner than the 3rd/4th shift fork.

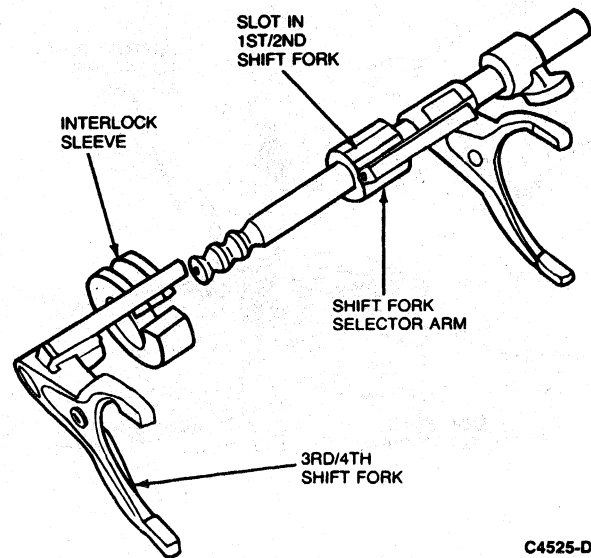


3. Align the hole in the shift fork selector arm with the hole in the shaft and install the retaining pin.



4. Position the slot in the 1st/2nd fork over the fork selector arm finger.

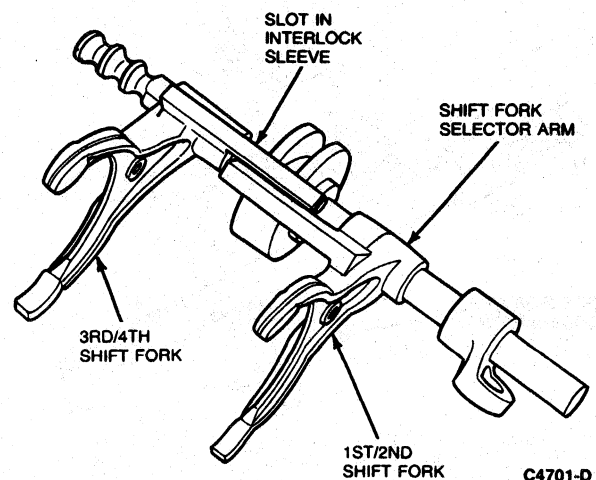
Position the slot in the 3rd/4th fork over the interlock sleeve.



Slide the 3rd/4th fork and interlock sleeve onto the main shift control shaft.

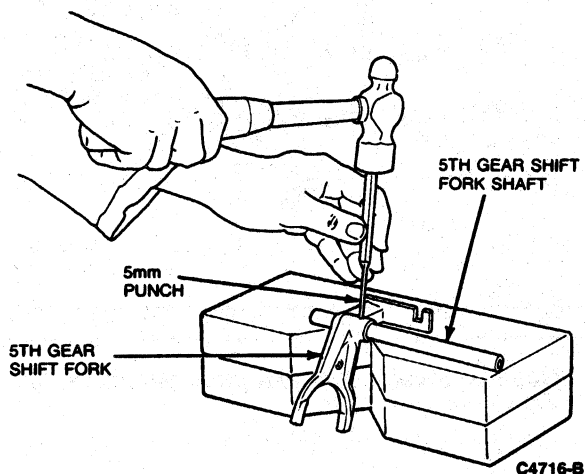
Align the slot in the interlock sleeve with the spline on the shift fork selector arm and slide the sleeve and 3rd/4th fork into position.

NOTE: When assembled, forks should be aligned.

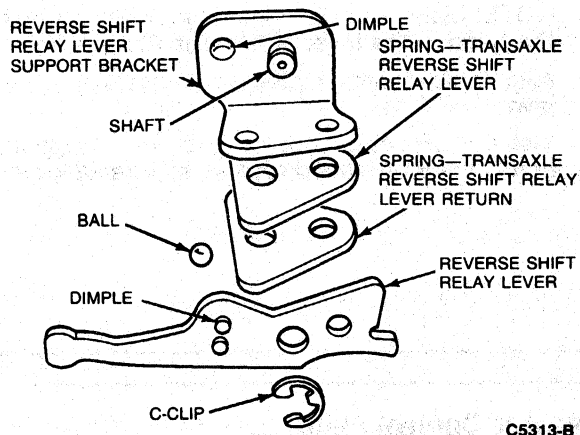


**DISASSEMBLY AND ASSEMBLY (Continued)****5th Gear Shift Control****Disassembly**

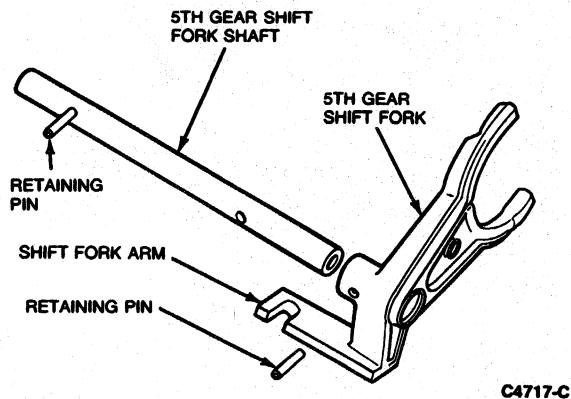
1. Using a 5mm punch, remove the roll pin.
2. Slide the fork from the shaft.



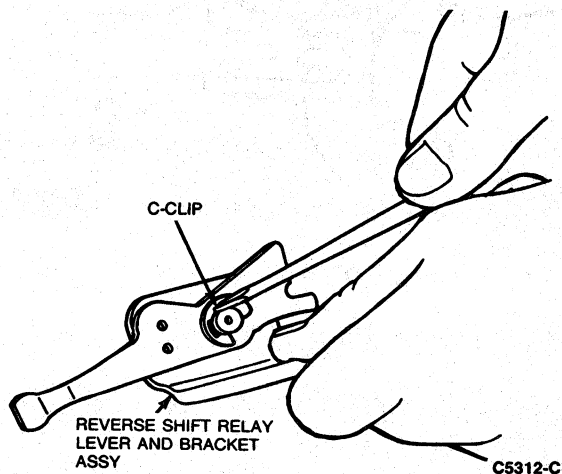
3. Slide the reverse shift relay lever off the support shaft and remove the steel ball and springs between them.

**Assembly**

1. Holding the shaft with the hole on the left, install the 5th gear shift fork so that the protruding arm is pointing toward the long end of the shaft.
2. Install the roll pin.

**Reverse Shift Relay Lever and Bracket****Disassembly**

1. Using a small screwdriver, remove the C-clip retaining ring from the reverse shift relay support bracket.



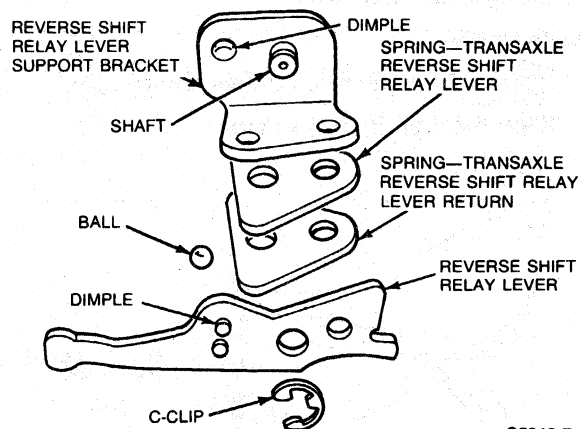
**DISASSEMBLY AND ASSEMBLY (Continued)****Assembly**

1. Place the ball in the pocket provided in the support bracket.
2. Slide the reverse relay lever onto the support bracket pin.

NOTE: Make sure the lever is installed so that the bend in the lever is towards the bracket.

Align the ball with dimples on reverse shift relay lever.

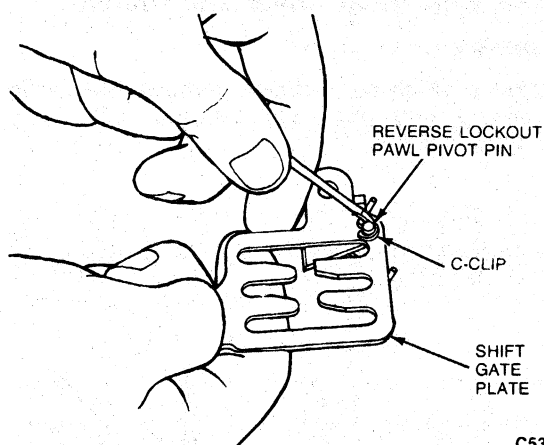
3. Install C-clip onto reverse shift lever support bracket shaft to retain reverse shift relay lever.



C5313-B

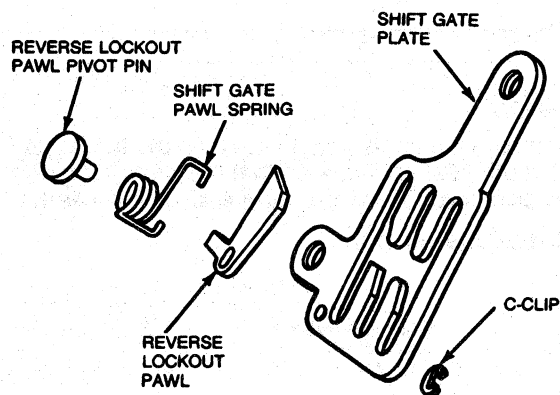
**Selector Control Plate****Disassembly**

1. Using a small screwdriver, remove C-clip retaining reverse lock out pawl pivot pin to shift gate plate.



C5314-B

2. Remove reverse lock out pawl, pin and spring from shift gate plate.

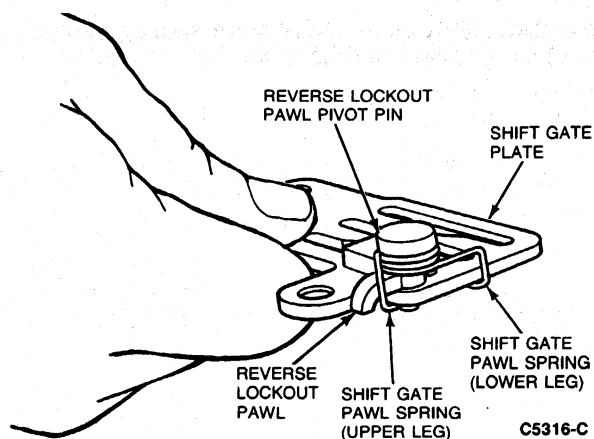


C5315-C

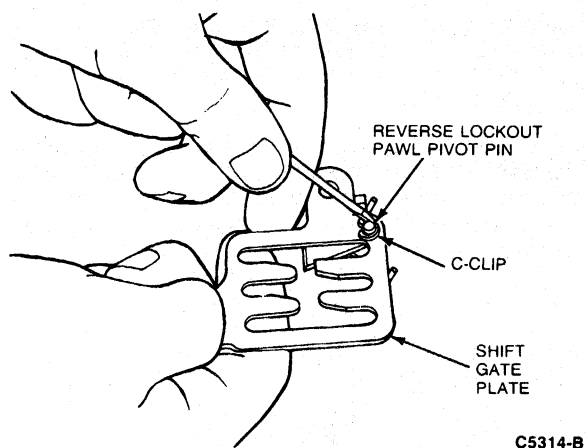
**DISASSEMBLY AND ASSEMBLY (Continued)****Assembly**

1. Install reverse lock out pawl, pin, and spring.

**NOTE:** Make sure the lower leg of the spring rests against the shift gate plate and the upper leg of the spring rests against the reverse lock out pawl. Also make sure spring is against shoulder of reverse lock out pivot pin and does not interfere with pin seating against reverse lock out pawl.

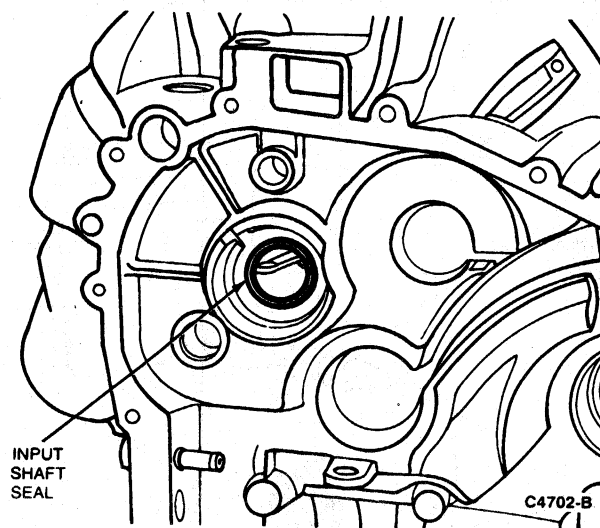


2. Install C-clip to reverse lock out pawl pivot pin.

**MAJOR SERVICE OPERATIONS****Input Cluster Shaft Seal Assembly****Removal**

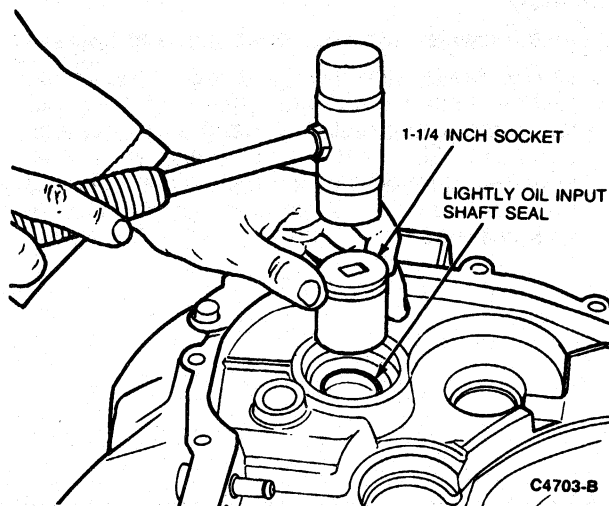
Using Input Shaft Seal Remover T77F-7050-A or equivalent and a hammer, remove the input shaft seal, working from outside the case.

Position the remover against the seal by placing it in the slot cut in the case.



**MAJOR SERVICE OPERATIONS (Continued)****Installation**

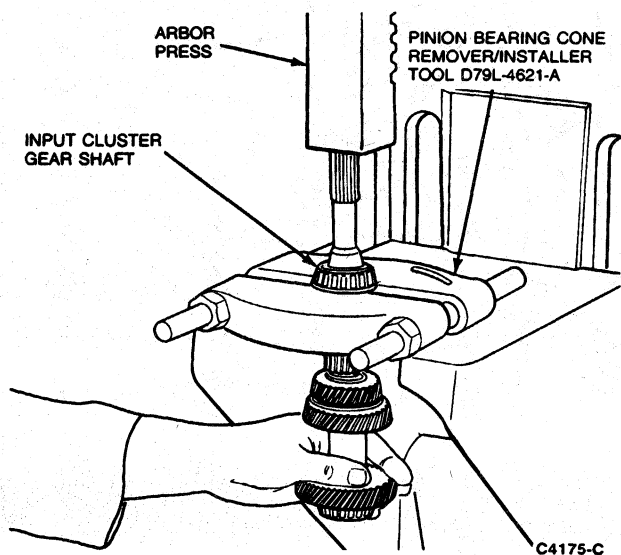
To install, lightly oil the input shaft seal and using a 1 1/4-inch socket and hammer, tap into place.

**Input Cluster Shaft Bearings****Removal**

NOTE: Inspect the bearings and replace them only if worn or damaged.

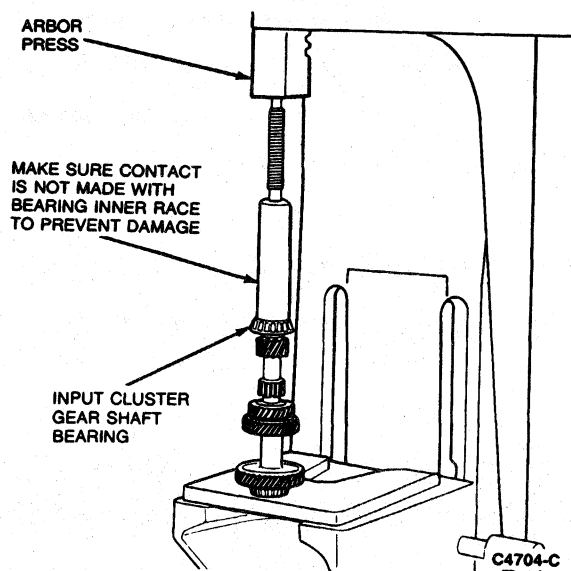
Remove the bearing cone and roller assemblies using Pinion Bearing Cone Remover/Installer D79L-4621-A or equivalent and an arbor press.

NOTE: Label bearings for proper installation.

**Installation**

NOTE: Prior to installation of the bearings, thoroughly clean the bearings and inspect their condition. Lightly oil the bearings with Motorcraft Type F (ESW-M2C233-F) or Motorcraft DEXRON® II or equivalent transmission fluid.

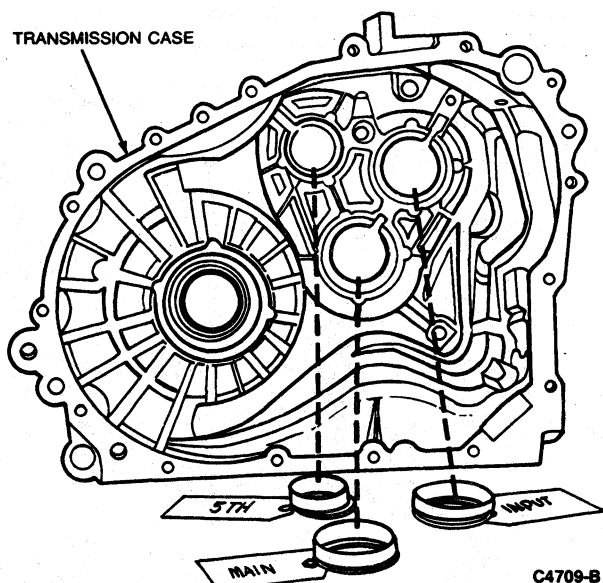
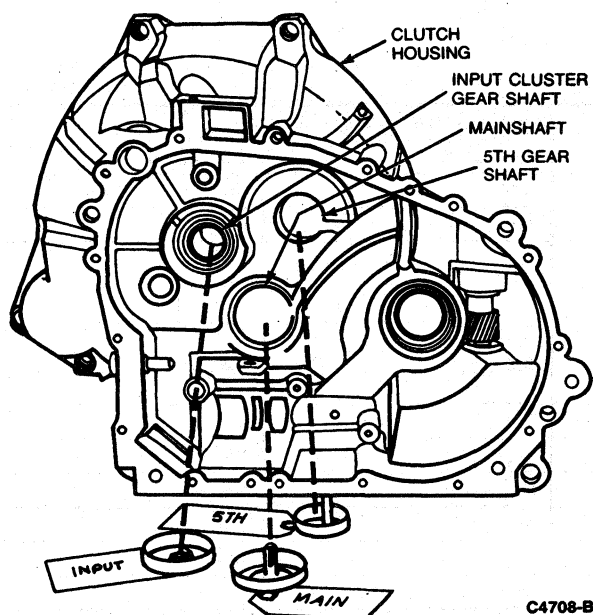
Using Pinion Bearing Cone Remover/Installer D79L-4621-A or equivalent and an arbor press, install the bearing on the shaft. Make sure the bearings are pressed on the proper end as labeled during disassembly.





**MAJOR SERVICE OPERATIONS (Continued)****Bearing Cups**

The input cluster shaft, the main shaft and the 5th gear driveshaft are supported at each end by tapered roller bearings. The cups, which support the bearings in the case, are located: three in the transmission case and three in the clutch housing.

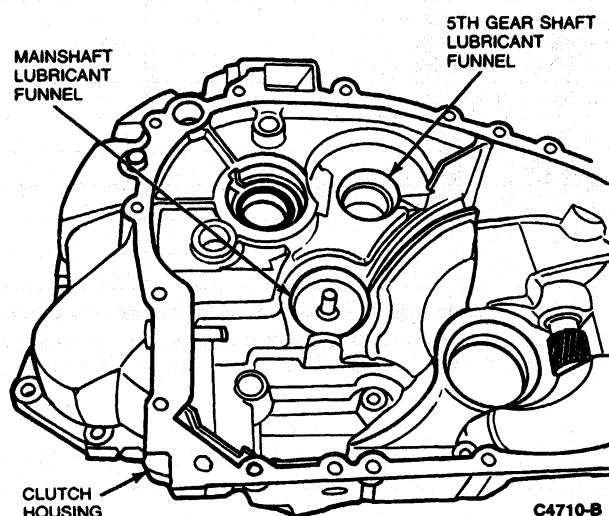


Shims, to preload the tapered roller bearings, are located behind the bearing cups in the transmission case only. It is important to keep the shim with its matching cup during disassembly. It is equally important to label the bearing cups if they are removed from the case.

After removal of the main shaft bearing and the 5th gear shaft bearing cups from the clutch housing, the funnels can be removed from the bearing cup bores.

The funnels direct lubricant to a drilled hole in the center of the mainshaft and the 5th gear driveshaft. The lubricant flows through these shafts, where it lubricates the rotating gears.

**NOTE:** Prior to installation, thoroughly clean the bearing cups, their bores, and the shims and funnels. Inspect the condition of all parts. Lightly grease the bearing cups.

**Preload Shims**

Preload on the input cluster shaft, main shaft and 5th gear driveshaft bearings is maintained by shims. These preload shims are located behind the bearing cups in the transmission case.

If the bearing cups are removed from the case for any reason, it is very important to keep the bearing cup and its matching shim together. It is also very important to label the bearing cups as they are removed from the transmission case or clutch housing.

Maintaining the proper bearing cup to shim relationship and proper bearing cup labeling will ensure the correct bearing preload when the transaxle is assembled.

**MAJOR SERVICE OPERATIONS (Continued)**

A replacement bearing preload shim will be provided for service and should be installed in place of the original shim as outlined in the Service Shim chart.

When repairs require the use of the service shim (refer to Service Shim chart), discard the original shim. Do not use more than one shim per shaft.

If parts are replaced other than the parts listed in the Service Shim chart, then the original shims should be re-used.

**SERVICE SHIM CHART**

Parts Replaced	Shims Replaced With Service Shim		
	Input Cluster Shaft	Main Shaft	5th Gear Shaft
1 Input Cluster Bearing	Yes	No	No
2 Input Cluster Bearings	Yes	No	No
1 Input Cluster Bearing 1 Mainshaft Bearing 1 5th Gear Shaft Bearing	Yes	Yes	Yes
2 Input Cluster Bearings 2 Mainshaft Bearings 2 5th Gear Shaft Bearings	Yes	Yes	Yes
1 Mainshaft Bearing	No	Yes	No
2 Mainshaft Bearings	No	Yes	No
1 5th Gear Shaft Bearing	No	No	Yes
2 5th Gear Shaft Bearings	No	No	Yes
Clutch Housing Assembly	Yes	Yes	Yes
Transaxle Case Assembly	Yes	Yes	Yes

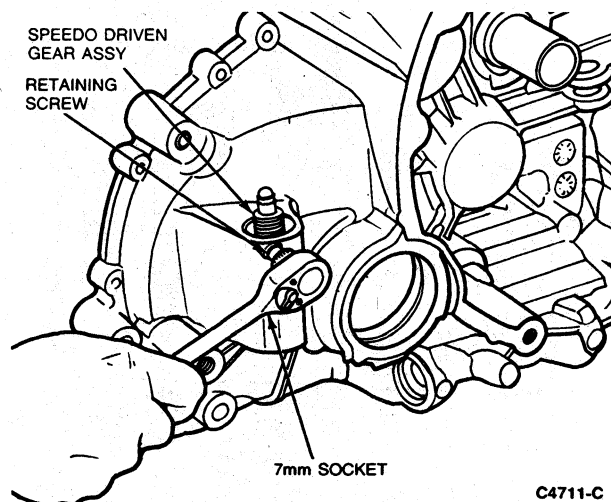
**NOTE:** The shims must be installed only under the bearing cups at the transaxle case end of the three shafts.

**NOTE:** The use of a nominal thickness service shim eliminates the need for gauging bearing clearances prior to reassembly. While this method produces wider variations of bearing settings than are present in factory assembled units, the extreme possible settings have been tested and found to be acceptable.

CC4264-A

**Speedometer Driven Gear****Removal**

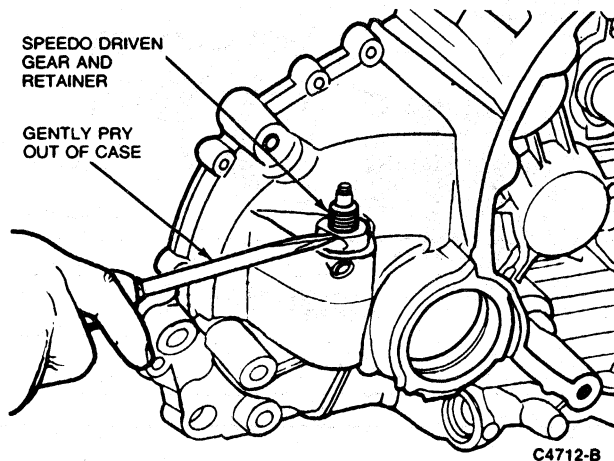
- Using a 7mm socket, remove the retaining screw from the speedo driven gear retainer assembly.



C4711-C

## MAJOR SERVICE OPERATIONS (Continued)

- Using a screwdriver, pry on the speedo retainer to remove both the speedo gear and retainer assembly from the clutch housing case bore.



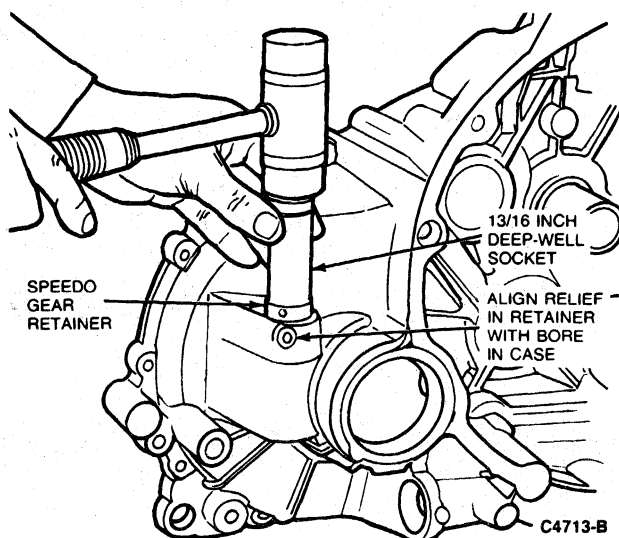
If necessary, carefully pry from the inside of the case on the bottom of the speedo gear, pushing the speedo gear and retainer from their bore. Be careful not to make contact with teeth on the speedo gear.

### Installation

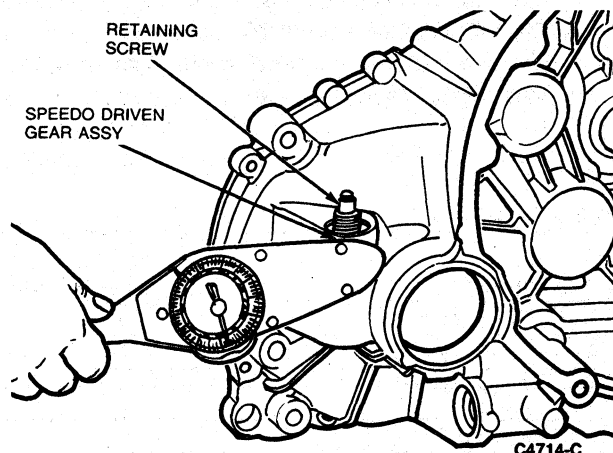
**NOTE:** Prior to installation, clean all speedometer gear parts and the retainer's bore in the case. Inspect all parts.

- Lightly grease the (25mm X 2.6) O-ring seal on the speedo driven gear retainer.

Align the relief in the retainer with the attaching screw bore and using a 13/16 inch deep-well socket, tap the assembly into its bore.



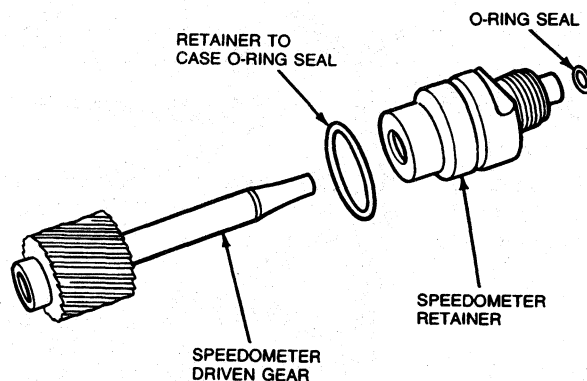
- Using a 7mm socket and torque wrench, tighten the retaining screw to 2-3 N·m (12-24 lb-in).



### Speedometer Driven Gear

#### Disassembly and Assembly

- Carefully remove the O-ring seal from the stem end of the speedo driven gear.
- Slide the speedo driven gear from the retainer.

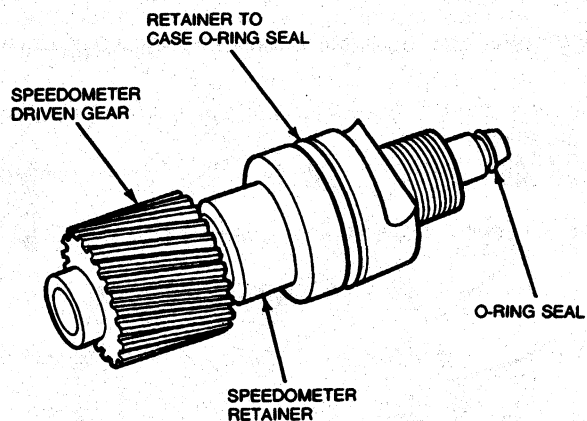


**MAJOR SERVICE OPERATIONS (Continued)**

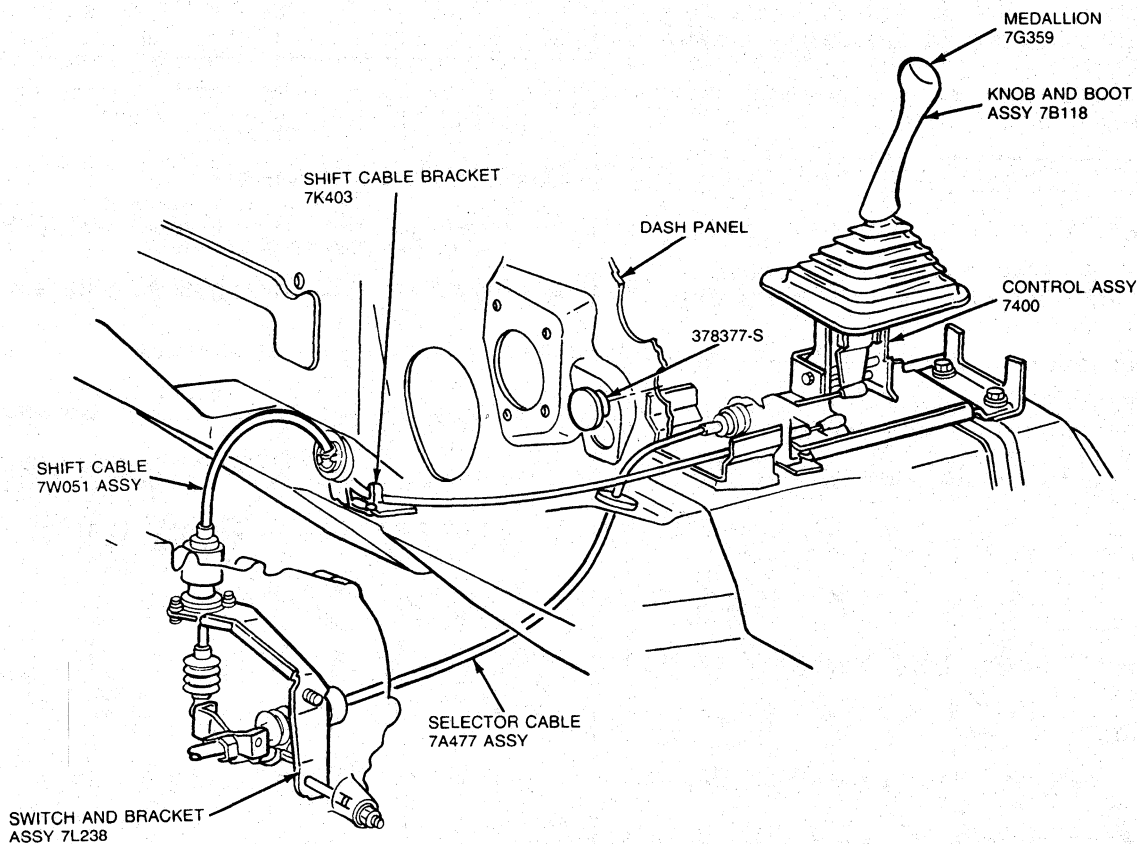
3. Carefully remove the O-ring seal from its groove in the retainer.

NOTE: Prior to assembly of the speedometer driven gear, clean all parts thoroughly. Inspect all parts and replace if damaged. Lightly grease the O-ring on the retainer.

To assemble the speedometer driven gear, reverse Steps 1, 2 and 3.



C5388-A

**External Gear Shift Linkage**

C5451-B

**MAJOR SERVICE OPERATIONS (Continued)****Shift Knob/Boot and Control Assembly****Removal**

1. Remove snap-in shift knob graphics medallion by prying out with a sharp object. **Be careful not to cut rubber edge of shift knob.** Disconnect the shift knob from the shift lever by removing screw which is under the medallion.
2. Remove console applique surrounding the shift boot to expose the four screws which connect the boot to the top of the console. Slide boot/knob assembly off shift lever.
3. Remove console to expose shifter assembly. Remove four bolts holding shifter to floorpan. Pry two clips holding shift cables to control assembly and pry cable sockets off control assembly pivot balls using a screwdriver. Do not bend or kink cable core rods.
4. Remove cables from shifter and remove shifter assembly.

**Installation**

1. Feed loose ends of cables into control assembly slots making sure the cables are routed properly. A green paint mark on the shifter and crossover cable will assist. Attach control assembly to floorpan J-nuts with four bolts. Tighten to 5.5-8.0 N·m (48-70 lb-in).
2. Seat cable insulators into shifter slots and install new "U" clips using mallot. Snap cable sockets onto shifter pivot balls using pliers.
3. Install console.
4. Slide boot/knob assembly over shift lever. Attach to console with 4 screws. Tighten to 1.6-2.4 N·m (14-21 lb-in).
5. Attach shift knob to shift lever with one screw. Tighten to 5.0-9.0 N·m (44-80 lb-in). Install shift knob graphics medallion and console applique.

**Shift Cables, Brackets and Clamp Assemblies****Removal**

1. Remove console, shifter and boot/knob assembly as outlined.
2. Fold carpet back from the dash panel to expose the shift cables and cable sealing grommets.
3. Remove rear seat heating duct.
4. Loosen two screws and remove cable bracket.
5. Pull cable sealing grommets loose from floorpan and dash panel.

6. Raise vehicle on a hoist. Refer to the Pre-Delivery manual, Section 50-04.
7. Under the vehicle, remove two retainers that attach cables to the switch and bracket assembly.
8. Pry cable sockets off clamp assembly pivot balls and slide cable isolators out of bracket slots.
9. Loosen two bolts holding switch and bracket assembly to transaxle case and remove.
10. Loosen the nut holding clamp assembly onto transaxle input shift shaft and slide off the shaft.
11. From inside the vehicle pull the shift cables through the sheet metal holes and remove from vehicle.

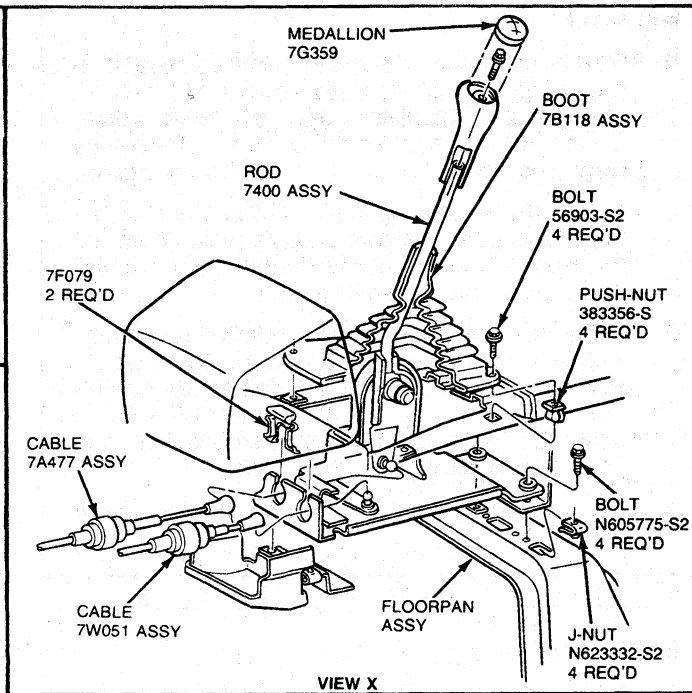
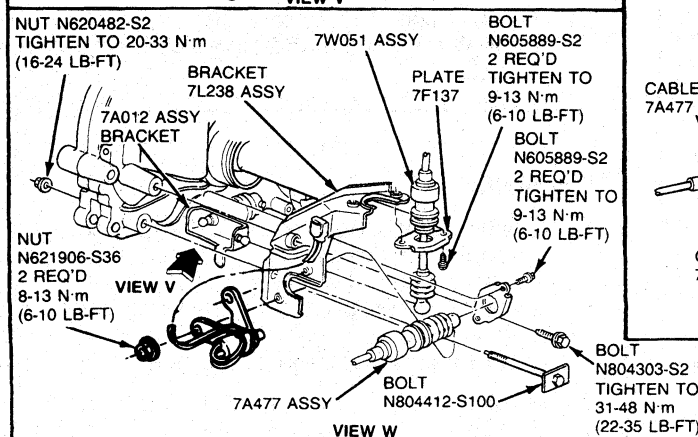
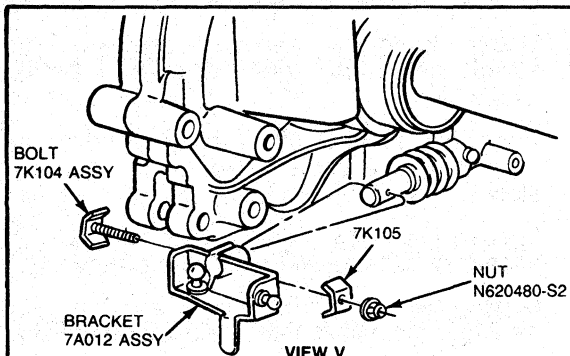
**Installation**

1. From inside the vehicle, feed shift cables through sheet metal holes. The crossover cable goes through the dash panel hole and the selector cable goes through the tunnel hole. The ends of the cables with boot protectors must be pushed through the holes.
2. Seat cable grommets in sheet metal holes.
3. Install cable bracket using two screws. Tighten to 1.9-2.5 N·m (17-22 lb-in). Make sure crossover cable is secured under the hook on the bracket.

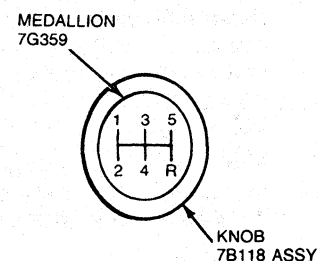
NOTE: A white mark on the cable will assist in where to clip cable under hook.

4. Install rear seat heat duct and fold carpet back over the cables.
5. Install shifter, shift boot/knob assembly and console as outlined.
6. Under the vehicle, install clamp assembly onto transaxle input shift shaft. Tighten the nut to 9-13 N·m (6.6-9.5 lb-ft).
7. Install switch and bracket assembly to transaxle case. Tighten the M12 bolt to 31-47.5 N·m (22-35 lb-ft) and the M10 bolt and nut to 22-33 N·m (16-24 lb-ft). Connect upshift light top gear switch wire connector. Connect top gear switch to bracket using two nuts. Tighten bracket retaining nuts to 9-13 N·m (6-10 lb-ft).
8. Feed shift cables into slots on switch and bracket assembly and secure the cables with two retainers and four bolts. Tighten to 9-13 N·m (6.6-9.5 lb-ft).
9. Snap the cable sockets onto clamp assembly pivot balls using pliers.

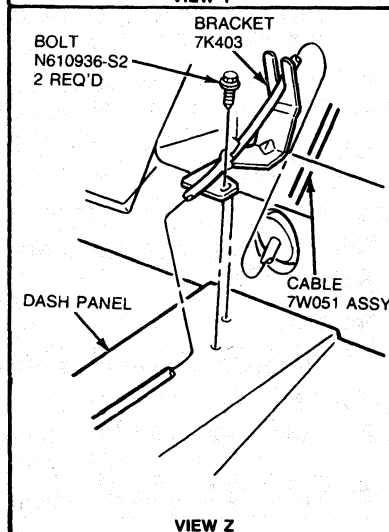
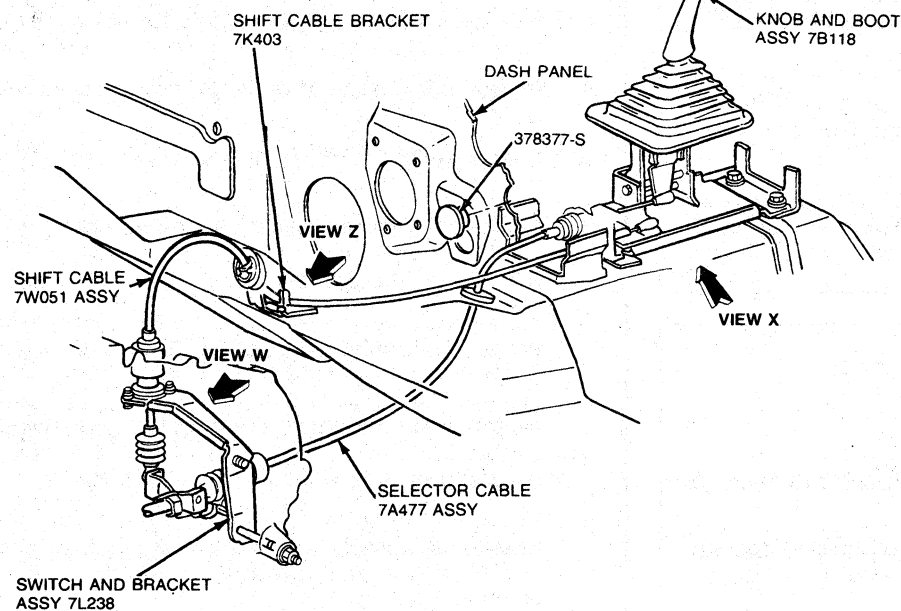
## MAJOR SERVICE OPERATIONS (Continued)



VIEW X



VIEW Y



VIEW Z

C5452-B

**MAJOR SERVICE OPERATIONS (Continued)****In-Vehicle Service****Backup Lamp Switch****Removal**

1. Disconnect the electrical lead.
2. Using a 22mm wrench, remove the switch.

**Installation**

1. Apply Pipe Sealant with TEFLON® D8AZ-19554-A or equivalent to the threads of the backup lamp switch in a clockwise direction and install.
2. Tighten to 19-24 N·m (14-18 lb-ft).
3. Connect the electrical lead.

**Speedometer Cable Retainer and Driven Gear****Removal**

1. Clean off top of speedometer cable retainer.
2. With a 7mm wrench, remove the screw which holds the retainer in its bore.
3. Carefully pull up on the speedometer cable, pulling the cable retainer and the speedometer driven gear assembly from its bore.
4. Unscrew the speedometer cable from the retainer.

**Installation**

1. Lightly grease the O-ring on the cable retainer.
2. With a 13/16 inch deep well socket, gently tap the cable retainer and driven gear assembly into its bore while lining the groove in the retainer with the screw hole in the side of the clutch housing case.
3. With a 7mm socket and torque wrench, install the screw. Tighten to 5-8 N·m (4-6 lb-ft).

**Transaxle Fluid Level Check**

Transaxle fluid level checks must be made with the vehicle level and the engine turned off. The fluid level can be checked by removing the fill plug with a 3/8 inch extension and ratchet. The correct fluid will be even with the bottom edge of the filler plug opening or within 6.35mm (1/4-inch) of this level. If the fluid is low, add either Motorcraft Type F (ESW-M2C233-F) or Motorcraft DEXRON® II, or equivalent transmission fluid.

**CLEANING AND INSPECTION****Transaxle Case****Inspection**

NOTE: Avoid unnecessary or prolonged exposure of the input and differential seals to any solvents used to clean the transaxle case.

1. Inspect the transaxle case and clutch housing case for cracks, worn or damaged bearing bores, damaged threads, or any other damage that could affect the operation of the transaxle.

NOTE: Casting imperfections sometimes look like cracks.

2. Inspect the transaxle case and clutch housing case mating surfaces for small nicks or burrs that could cause misalignment of the two halves. Remove all small nicks or burrs with a fine stone or file.
3. Inspect the tapered roller bearings. Refer to Tapered Roller Bearings Diagnosis.
4. Check the input cluster shaft for chipped teeth, cracks, scores or bent reverse gear teeth.
5. Check the reverse idler gear and reverse sliding gear for chipped, broken or bent teeth. Check the reverse idler gear for bushing damage. Check wear of the reverse idler gear shaft. It is normal for the front of the teeth to show wear; this does not interfere with proper function.
6. Check the teeth, splines and journals of the main shaft for damage.
7. Check all other gears for chipped, broken or worn teeth. Check for eroded clutching teeth and damaged cone surfaces. These clutching teeth will normally show rounding of the points, which does not interfere with normal operation.
8. Check the synchronizer sleeves for free movement on their hubs. Make sure the alignment marks are properly indexed. Check for damaged clutching teeth. (These splines normally show wear at the points, but this does not interfere with synchronizer function). Check for position of insert springs.
9. Inspect the synchronizer blocking rings for wear marks on the spline and back face, which indicates that the ring was bottoming on the gear face, due to wear of the blocker ring.

**Aluminum Transaxle Case Service**

If a transaxle case thread is damaged, helicoil repair kits may be purchased. To repair a damaged thread, the following procedures should be carefully followed:

NOTE: The case threads which retain the following, should not be repaired:

- Fork interlock sleeve retaining pin
- Backup lamp switch
- Reverse relay lever pivot pin
- Detent plunger retainer screw
- Control selector plate

**CLEANING AND INSPECTION (Continued)**

1. Using the same drill size as the thread outside diameter, drill out the damaged threads. For example, use an 8mm drill for an 8mm X 1.5 thread.
2. Select the proper special tap and tap the drilled hole. The tap is marked for the size of the thread being repaired. The special tap marked 8mm X 1.5 will not cut the same thread as a standard 8mm X 1.5 tap. It does cut a thread large enough to accommodate the insert and after the insert is installed, the original thread size (8mm X 1.5) is restored.
3. Select the proper coil inserting tool. These tools are marked with the thread size being repaired. Place the insert on the tool and adjust the sleeve to the length of the insert being used. Press the insert against the face of the tapped hole. Rotate the tool clockwise and wind the insert into the hole until the insert is 1/2 turn below the face.
4. Working through the insert, bend the insert tang straight up and down until it breaks off at the notch.
5. Improperly installed inserts can be removed with an extractor tool. Place the extractor tool in the insert so that the blade rests against the top coil, 1/4 to 1/2 turn away from the end of the coil. Tap the tool sharply with a hammer so that the blade will cut into the insert. Exert downward pressure on the tool and turn it counterclockwise until the insert is removed.

**Flywheel****Manual-Shift Transaxle****Inspection**

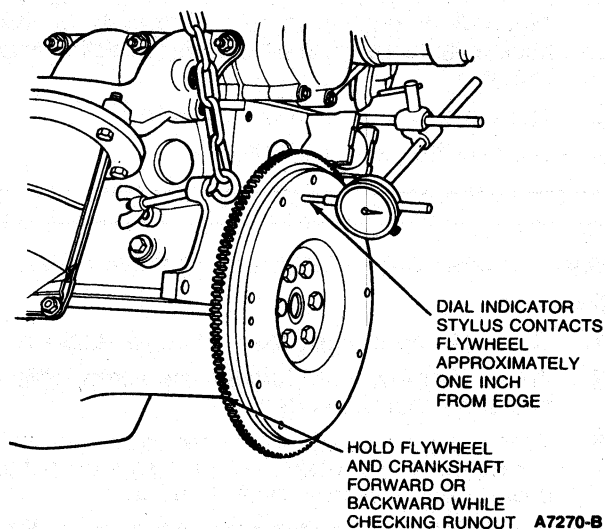
Inspect the flywheel for cracks, heat check, or other damage that would make it unfit for further service. Machine the friction surface of the flywheel if it is scored or worn. If it is necessary to remove more than 1.143mm (0.045-inch) of stock from the original thickness, replace the flywheel.

Inspect the ring gear for worn, chipped, or cracked teeth. If the teeth are damaged, replace the ring gear.

With the flywheel installed on the crankshaft, check the flywheel face runout as outlined.

**Flywheel Runout**

1. Remove spark plugs.
2. Install Dial Indicator TOOL-4201-C or equivalent so indicator points rest on face of ring gear adjacent to gear teeth.



3. Hold flywheel and crankshaft forward or backward as far as possible to prevent crankshaft end play from being indicated as flywheel runout.
4. Set indicator dial on zero mark. Turn flywheel one complete revolution while observing total indicator reading (TIR). If TIR exceeds specification, flywheel and ring gear assembly must be replaced.
5. If clutch face runout exceeds specification, remove flywheel and check for burrs between flywheel and face of crankshaft mounting flange. If no burrs exist, check runout of crankshaft mounting flange. Replace flywheel or machine crankshaft flywheel mounting face sufficiently to true-up the surface. If mounting flange runout exceeds specification, replace it or install it on flywheel. Refer to Flywheel Ring Gear for replacement procedure.



## SPECIFICATIONS

## TRANSMISSION LUBRICANT

Type	Level	Capacity	
		Liters	Pints
Motorcraft Type "F" or DEXRON® II	To Bottom of Filler Hole	2.9	6.1

CC4265-C

## INSTALLATION OF TRANSAXLE

Component	N-m	Lb-Ft
Transaxle to Engine Bolts	①	①
Air Manage Valve Bracket Bolt to Transaxle	38-42	28-31
Switch Actuator Bracket Bolt	9-13	7-10
Control Arm to Steering Knuckle	50-60	37-44
Rear Mounting Bolts	47-68	35-50
Trans. Mounting Stud	52-56	38-41
Front Mount Bracket Bolts	34-47	25-35
Stiffener Brace Bolts	38-51	28-38
Starter Stud Bolts	41-54	30-40
Roll Restrictor Nuts	34-40	25-30
Shift Stabilizer Bar to Transaxle Case	31-47	23-35
Speedometer	3.4-4.5	2.5-3.5

① RWB-BF, RWB-BJ models: All bolts 34-47 N-m (25-35 lb-ft). RWB-BH, RWB-BK models (diesel engine applications): M14 x 1.5 x 60 88-102 N-m (65-75 lb-ft) hex flange head bolt (N802458-S2). M14 x 1.5-M8 x 88-102 N-m (65-75 lb-ft) 1.25 x 73 hex flange shoulder stud (N803210-S2). M10 x 1.5 x 50 34-47 N-m (25-35 lb-ft) hex flange head bolt (N605805-S2).

CC5462-A

## GEAR RATIOS

Transmission Model	1st	2nd	3rd	4th	5th	Rev.	Final Drive
RWB-BF	3.60	2.12	1.39	1.02	0.75	3.62	3.73
RWB-BJ	3.60	2.12	1.39	1.02	0.77	3.62	3.33

CC5457-A

## TORQUE SPECIFICATIONS

## ASSEMBLY OF TRANSAXLE — ALL VEHICLES

Component	N-m	Lb-Ft
Transaxle Case-to-Clutch Housing	18-24	13-18
Reverse Idler Shaft-to-Case	21-27	15-20
Fork Interlock Sleeve Pin	16-20	12-15
Detent Plunger Retainer Screw	7.5-11	6-8
Backup Lamp Switch	16-20	12-15
Control Selector Plate	8-11	6-8
Speedo Retaining	2-3	1.5-2
Reverse Shift Relay Lever Bracket	8-11	6-8
Filler Plug	12-20	9-15
Clutch Release Fork to Shaft	40-41	30-41
Shift Lever Cover Screws	2-3	1.5-2.0

CC4171-C

## TORQUE SPECIFICATIONS

## INSTALLATION OF SHIFT CONTROLS

Component	N-m	Lb-In
Switch and Bracket-to-Transaxle Assembly Nut	20-33	16-24 (Lb-Ft)
Shift Cable Retainers-to-Switch and Bracket Assembly Bolts	9-13	28-84
Shift Cable Guide Bracket-to-Tunnel Screws	1.9-2.5	17-22
Boot and Knob Assembly-to-Console Screws	1.6-2.4	14-21
Shift Control Assembly-to-Tunnel Bolts	5.5-8.0	49-70
Shift Cable Clamp-to-Transaxle Input Shaft Nut	9-13	28-84
Shift Knob-to-Shift Lever Screw	5-9	44-79

CC5453-B

## SPECIAL SERVICE TOOLS

Tool Number	Description
T50T-100-A	Impact Slide Hammer
T81P-1177-A	Differential Seal Installer
T81P-1177-B	Shipping Plugs
D83P-4026-A	Halfshaft Remover
T81P-4026-A	Differential Rotator
D79L-4621-A	Pinion Bearing Cone Remover/Installer
T77F-7050-B	Input Shaft Seal Remover
T77F-7288-A	Sector Shaft Seal Tool

CC4268-E

## ROTUNDA EQUIPMENT

Model	Description
014-00210	Transmission Jack

CC6386-A



# AUTOMATIC TRANSMISSION

**GROUP**  
**17**  
 (70000)

SECTION TITLE	PAGE	SECTION TITLE	PAGE
SHIFT CONTROL LINKAGE .....	17-02-1	TRANSAXLE, AUTOMATIC—AXOD .....	17-15-1
TRANSAXLE—ATX .....	17-25-1		

## SECTION 17-02 Shift Control Linkage

SUBJECT	PAGE	SUBJECT	PAGE
<b>ADJUSTMENTS</b>		<b>REMOVAL AND INSTALLATION (Cont'd.)</b>	
Control Linkage .....	17-02-1	Shift Control Cable Assembly .....	17-02-4
<b>DIAGNOSIS</b> .....	17-02-8	Shift Knob .....	17-02-3
<b>REMOVAL AND INSTALLATION</b>		Shift Lever and Housing Assembly .....	17-02-3
Bezel Assembly .....	17-02-3	<b>SPECIFICATIONS</b> .....	17-02-9
Floor Shift .....	17-02-3	<b>VEHICLE APPLICATION</b> .....	17-02-1
Indicator Bulb .....	17-02-4		

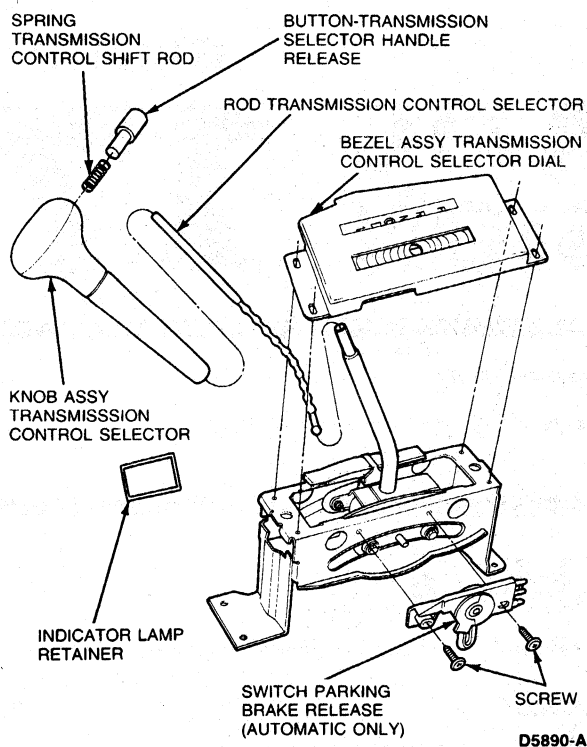
### VEHICLE APPLICATION

Taurus/Sable.

### ADJUSTMENTS

#### Control Linkage

The control linkage adjustments must be performed in the order in which they appear.

**ADJUSTMENTS (Continued)****Transmission, AXOD****Floor or Column Shift**

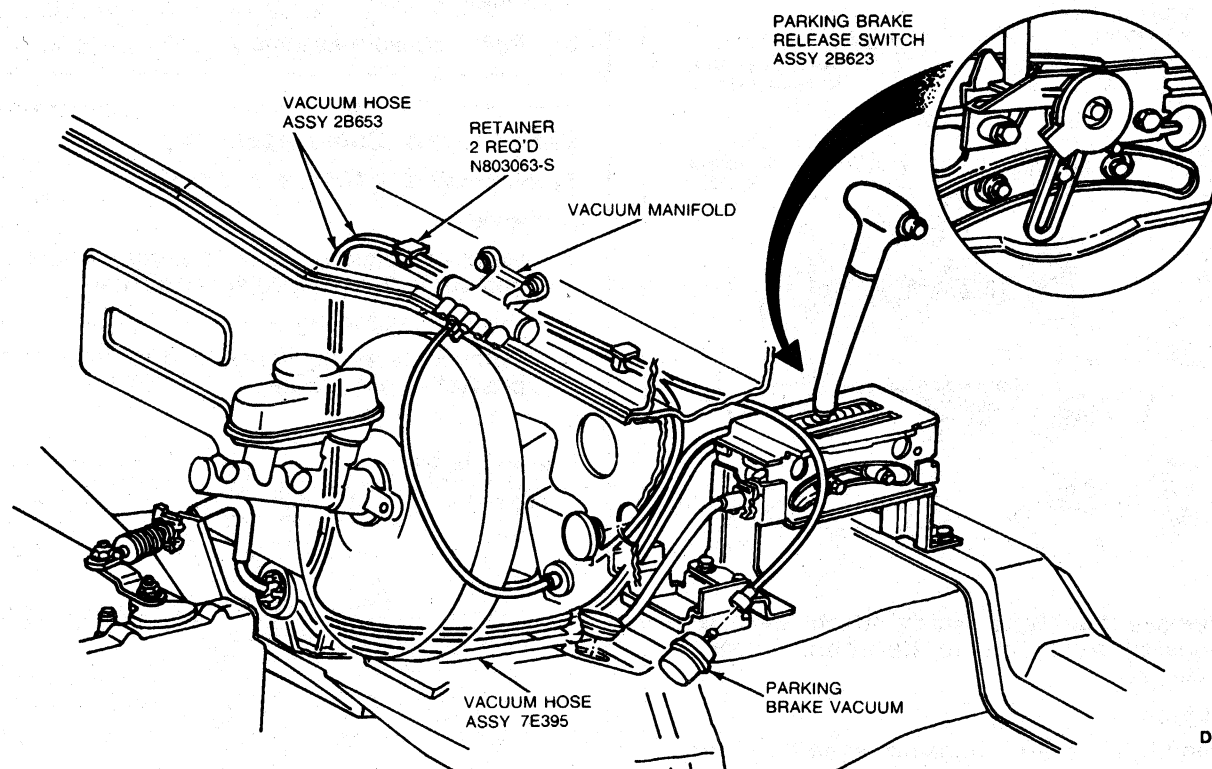
1. Position selector lever in OVERDRIVE position against rearward stop. The shift lever must be held in the rearward position while linkage is being adjusted.
2. Loosen manual lever to control cable retaining nut.
3. Move transaxle manual lever to OVERDRIVE position, second detent from most rearward position.
4. Tighten attaching nut to 14-20 N·m (10-15 lb-ft).
5. Check operation of transaxle in each selector lever position. Ensure that park and neutral start switch are functioning properly.

**Transmission, CLC****Column Shift**

1. Position the selector lever in DRIVE position against drive stop. The shift lever must be held in DRIVE position while linkage is being adjusted.
2. Loosen manual lever to control cable adjustment trunnion bolt.
3. Move transaxle manual lever to DRIVE position, second detent from most rearward position.
4. Tighten adjustment to 12-20 N·m (16-27 lb-ft).
5. Check operation of transaxle in each selector lever position. Ensure that park and neutral start switch are functioning properly.

## REMOVAL AND INSTALLATION

### Floor Shift Transmission, AXOD



D5894-A

### Shift Knob

#### Removal

1. Hold shift knob securely and depress release button.
2. Pull up on shift knob.

#### Installation

1. Hold shift knob securely.
2. Firmly and fully press shift knob onto lever assembly.

### Installation

1. Install bezel assembly over shift lever. Connect indicator bulb harness, and secure bezel assembly to selector housing with four screws.  
NOTE: Care should be taken to ensure that all sides are properly aligned.
2. Install console assembly. Refer to Section 45-31.
3. Install shift knob as outlined.
4. Adjust control linkage.
5. Check transaxle operation for all selector lever detent positions.

### Bezel Assembly

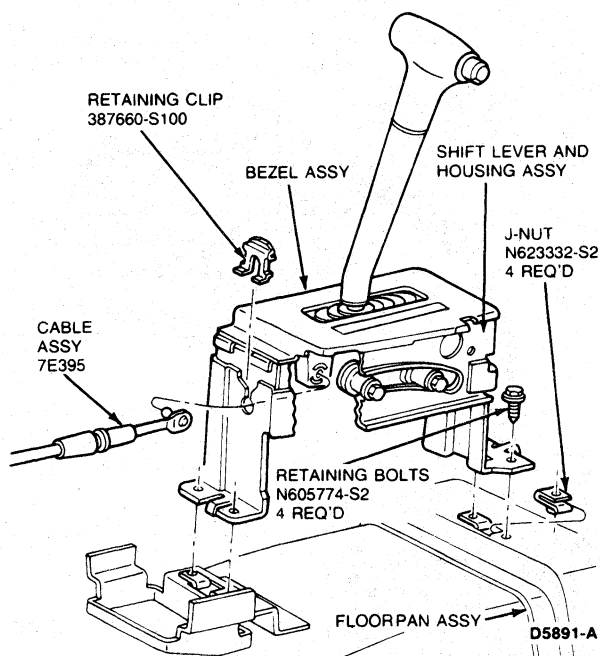
#### Removal

1. Remove shift knob as outlined.
2. Remove console assembly. Refer to Section 45-31.
3. Remove four screws from bezel assembly.
4. Lift bezel assembly slightly. Disconnect indicator bulb harness, and remove bezel assembly.

### Shift Lever and Housing Assembly

#### Removal

1. Remove console assembly.
2. Remove shift knob and bezel assembly as outlined.
3. Remove transmission shift cable retaining clip from lever and housing assembly.
4. Pull the cable from the plastic snap retainer on assembly.

**REMOVAL AND INSTALLATION (Continued)**

5. Remove four bolts which attach lever and housing assembly to floorpan. Remove assembly.

**Installation**

1. Install lever and housing assembly onto floorpan and secure with four bolts. Tighten to 4.1-9.5 N·m (3-7 lb-ft).
2. Position control cable assembly into lever and housing assembly.
3. Snap cable end into plastic snap retainer on the lever housing assembly.
4. Position control cable assembly in lever and housing assembly. Secure by installing cable retaining clip.
5. Position bezel assembly on lever and housing assembly. Secure with four screws.
6. Position console on lever and housing assembly and attach with four screws.
7. Install shift knob as outlined.
8. Adjust control linkage.
9. Check transaxle operation in each selector lever detent position.

**Indicator Bulb****Transmission, AXOD—Floor Shift****Removal**

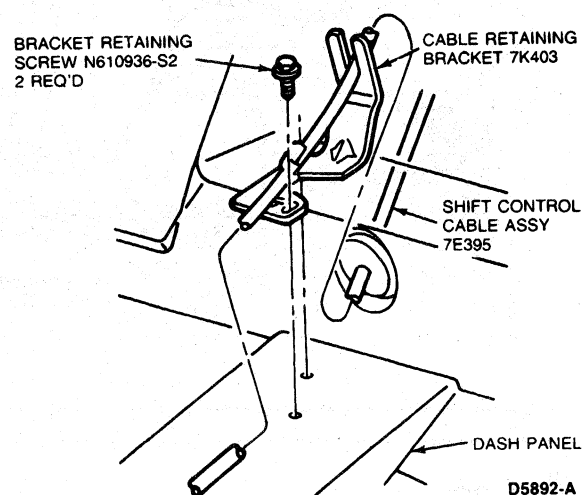
1. Remove console assembly.
2. Using a small screwdriver, dislodge light housing from bezel assembly and remove socket.
3. Remove indicator bulb.

**Installation**

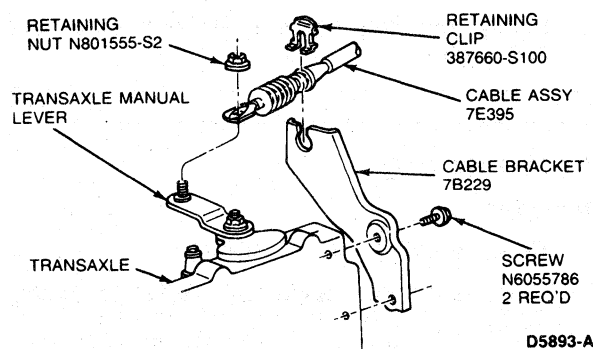
1. Install indicator bulb onto indicator bulb harness.
2. Connect light housing to bezel assembly.
3. Install console assembly.

**Shift Control Cable Assembly****Transmission, AXOD—Floor Shift****Removal**

1. Remove console. Remove control cable clip and cable from plastic snap retainer.
2. Pull back carpeting.
3. Remove retaining screw that secures cable bracket to dash panel.



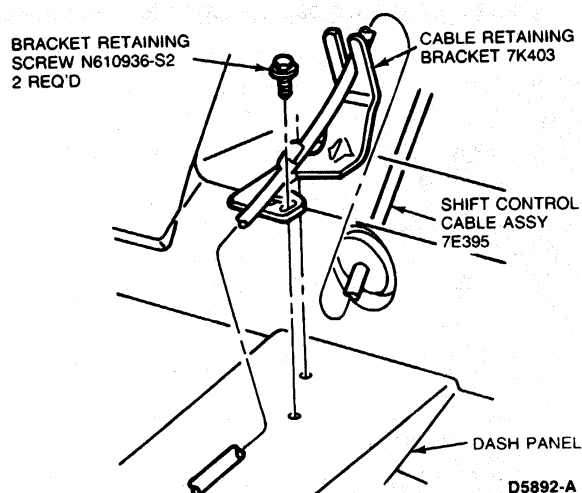
4. Disengage rubber grommet from floorpan by pushing it toward passenger compartment.
5. Remove retaining nut and control cable assembly from transaxle lever.
6. Remove cable retaining clip from cable bracket on transaxle.



7. Remove control cable assembly from bracket.
8. Pull cable through floorpan into passenger compartment.

**REMOVAL AND INSTALLATION (Continued)****Installation**

1. From inside the passenger compartment, feed round end of control cable assembly through floorpan.
2. Press rubber boot on control cable assembly into body panel opening. Install cable bracket and carpeting.
3. Install bushing and control cable assembly into snap retainer on selector lever and housing assembly shaft.
4. Position control cable assembly in selector lever housing assembly. Install spring clip.
5. Install shift knob as outlined.
6. Place selector lever in OVERDRIVE position. The selector lever must be held in this position while attaching other end of control cable assembly. Position cable into cable bracket on transaxle and install retainer clip.
7. Attach cable to transaxle lever and install retaining nut.
8. Shift transaxle lever into OVERDRIVE position, second detent from full rearward position.
9. Place cable end on transaxle manual lever stud, using care to align flats on stud with slot in cable. Start attaching nut.
10. Make sure selector lever has not moved from OVERDRIVE detent, then tighten nut.
11. Check transaxle operation in each selector lever detent position. Ensure park mechanism and neutral start switch function properly.

**Transmission, AXOD—Column Shift**

NOTE: Whenever the cable is removed from the cable retaining brackets for any reason, the cable must be replaced.

NOTE: Whenever a steering column, engine, or transaxle removal is required, **do not** remove shift control cable from the retaining brackets. The bracket must be removed with the cable attached.

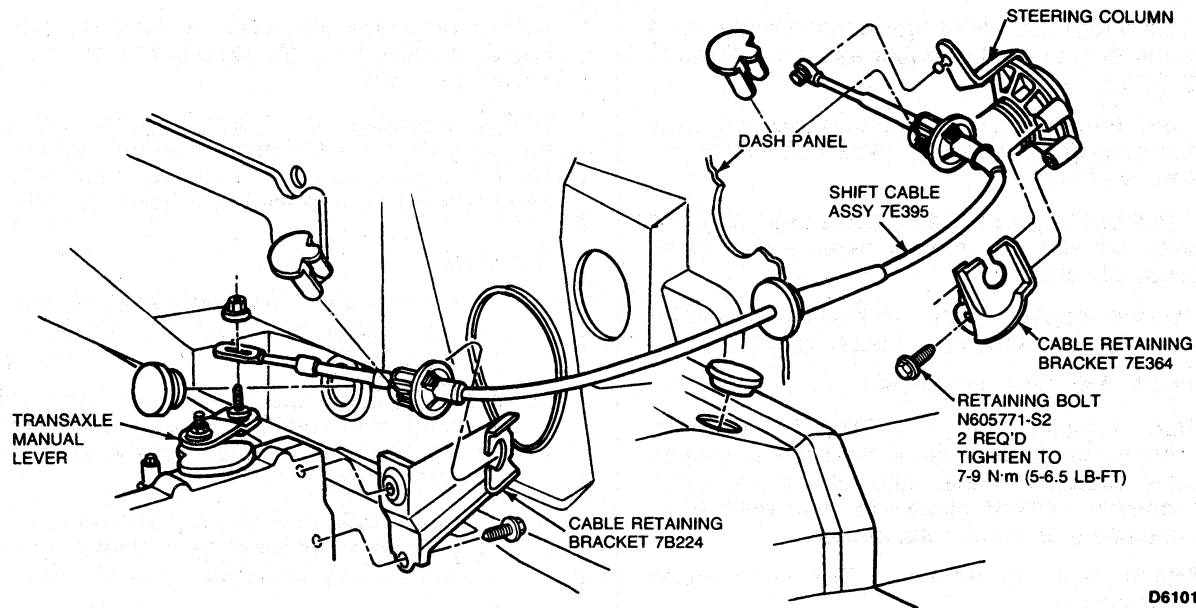
**Removal**

1. From under the instrument panel, remove shift control cable and retaining bracket from steering column.
2. Remove cable plastic terminal from column selector lever pivot ball using a screwdriver, by prying between the cable plastic terminal and selector lever.
3. Remove cable retaining clip and remove cable from retaining bracket by carefully squeezing cable retaining tabs with a pair of pliers.
4. From engine compartment, pry cable grommet from dash panel.
5. Remove nut from transaxle manual shift lever stud.
6. Remove cable retaining clip and remove cable from retaining bracket by carefully squeezing cable retaining tabs with a pair of pliers.
7. Remove shift cable from cable retaining bracket on transaxle and, from the engine compartment, pull cable through dash panel opening.

**Installation**

1. From the engine compartment, feed plastic terminal end of cable through opening in dash panel.
2. Press rubber boot on shift control cable into dash panel.
3. From engine compartment, install cable into cable retaining bracket on transaxle and install cable retaining clip.
4. Place cable on transaxle manual shift lever stud. Install cable retaining nut loosely.
5. From the passenger compartment, install cable-to-steering column retaining bracket onto cable and install cable retaining clip.
6. Install cable and bracket to steering column with two retaining screws. Tighten to 20-33 N·m (15-24 lb-ft).
7. Snap cable plastic terminal to selector lever pivot ball on steering column.
8. Adjust cable control as outlined.

## REMOVAL AND INSTALLATION (Continued)



D6101-B

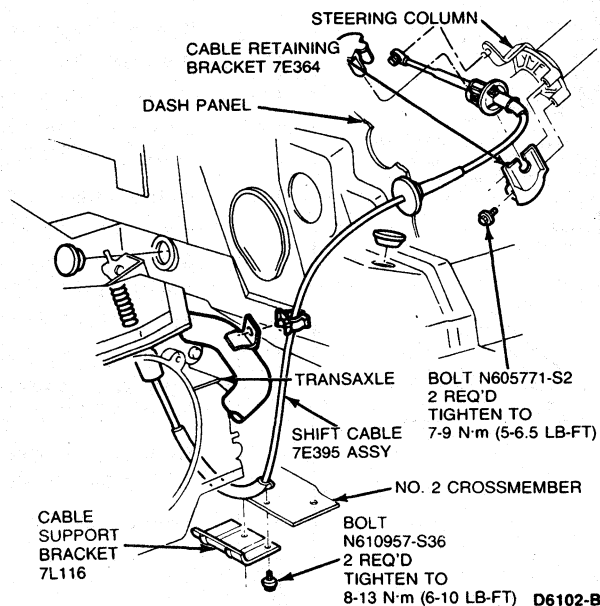
## Transmission, CLC—Column Shift

NOTE: Whenever the shift control cable is removed from the cable retaining brackets for any reason, the cable must be replaced.

NOTE: Whenever a steering column, engine, or transaxle removal is required, **do not** remove shift control cable from the retaining brackets. The bracket must be removed with the cable attached.

## Removal

1. From under the instrument panel, remove shift control cable and retaining bracket from steering column.
2. Remove cable plastic terminal from column selector lever pivot ball, using a screwdriver, by prying between cable plastic terminal and selector lever.
3. Remove cable retaining clip by carefully squeezing cable retaining tabs with a pair of pliers and remove cable from retaining bracket.

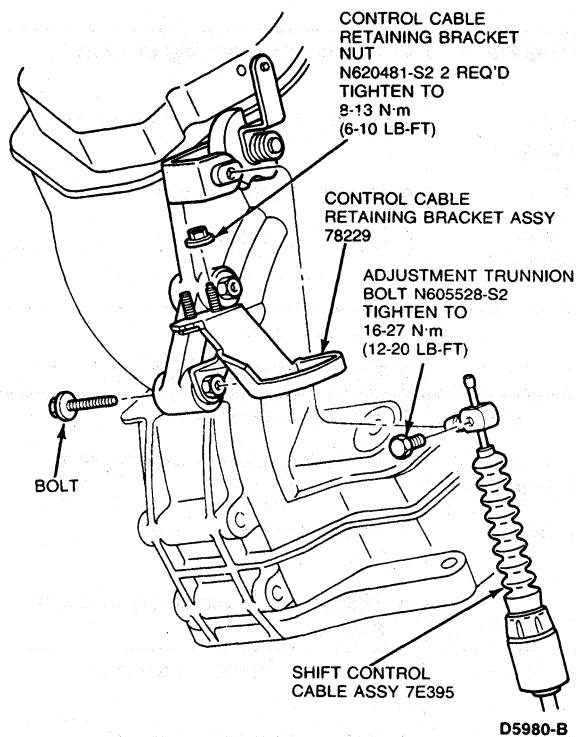


D6102-B



**REMOVAL AND INSTALLATION (Continued)**

4. From the engine compartment, pry cable grommet from dash panel.
5. Remove the adjustment trunnion from transaxle manual shift lever.  
NOTE: A new grommet must be installed in the manual shift lever.
6. Remove shift cable from retaining clip on engine support.
7. Remove cable retaining clip and remove cable from retaining bracket by carefully squeezing cable retaining tabs with a pair of pliers.
8. Remove shift cable from cable retaining bracket on transaxle and, from the engine compartment, pull cable through dash panel opening.

**Installation**

1. From the engine compartment, feed the plastic terminal end of cable through opening in dash panel.
2. Press rubber boot on shift control cable into dash panel.
3. From engine compartment, install cable into cable retaining bracket on transaxle, and install cable retaining clip.
4. Install cable into retaining clip on engine support bracket.
5. Install cable adjustment trunnion into transaxle manual shift lever. Adjustment trunnion retaining bolt should be loose for adjustment.
6. From passenger compartment, install cable-to-steering column retaining bracket onto cable, and install cable retaining clip.
7. Install cable and bracket to steering column with two retaining screws. Tighten to 20-33 N·m (15-24 lb-ft).
8. Snap the cable plastic terminal to selector lever pivot ball on steering column.
9. Adjust cable control as outlined under Adjustments.

**DIAGNOSIS**

Use the diagnosis chart as an aid in determining possible problem sources and necessary service actions for shift control linkage.

**SHIFT CONTROL LINKAGE DIAGNOSIS**

<b>CONDITION</b>	<b>POSSIBLE SOURCE</b>	<b>ACTION</b>
<ul style="list-style-type: none"> <li>• No start in PARK and/or NEUTRAL.</li> </ul>	<ul style="list-style-type: none"> <li>• Transaxle neutral switch out of adjustment.</li> <li>• Transaxle cable retainer bracket loose.</li> <li>• Cable bracket loose from the transmission retainer bracket.</li> <li>• Shift linkage misadjusted.</li> <li>• Clip securing the cable to the housing and lever assembly is loose.</li> </ul>	<ul style="list-style-type: none"> <li>• Readjust transaxle neutral switch.</li> <li>• Secure bracket by tightening two bolts.</li> <li>• Secure bracket by tightening two bolts.</li> <li>• Readjust shift linkage.</li> <li>• Install clip properly.</li> </ul>
<ul style="list-style-type: none"> <li>• PRNDL indicator does not correspond to the transaxle gear.</li> </ul>	<ul style="list-style-type: none"> <li>• Transaxle cable retainer bracket is loose.</li> <li>• Cable bracket loose from the transmission retainer bracket.</li> <li>• Shift linkage misadjusted.</li> <li>• Clip securing the cable to the housing and lever assembly is loose.</li> </ul>	<ul style="list-style-type: none"> <li>• Tighten bolts holding bracket.</li> <li>• Tighten bolts holding bracket.</li> <li>• Readjust shift linkage.</li> <li>• Install clip properly.</li> </ul>
<ul style="list-style-type: none"> <li>• PRNDL does not illuminate.</li> </ul>	<ul style="list-style-type: none"> <li>• Bulb burned out.</li> <li>• Wiring harness damaged.</li> </ul>	<ul style="list-style-type: none"> <li>• Replace bulb.</li> <li>• Install new wiring harness.</li> </ul>
<ul style="list-style-type: none"> <li>• Rattle, noise, buzz, etc.</li> </ul>	<ul style="list-style-type: none"> <li>• Shift knob loose.</li> <li>• Selector lever and housing assembly loose on the floorpan.</li> <li>• Park gear lockout spring not hooked.</li> <li>• Bezel assembly loose.</li> </ul>	<ul style="list-style-type: none"> <li>• Tighten knob locknut.</li> <li>• Tighten housing attaching bolts.</li> <li>• Attach spring properly.</li> <li>• Tighten bezel assembly mounting screws.</li> </ul>
<ul style="list-style-type: none"> <li>• Water enters inside the vehicle.</li> </ul>	<ul style="list-style-type: none"> <li>• Cable assembly grommet not secure to floor pan.</li> <li>• Cable assembly grommet torn.</li> </ul>	<ul style="list-style-type: none"> <li>• Secure grommet to floorpan.</li> <li>• Install new cable assembly.</li> </ul>
<ul style="list-style-type: none"> <li>• Shifter will not release from PARK.</li> </ul>	<ul style="list-style-type: none"> <li>• Knob not fully seated.</li> </ul>	<ul style="list-style-type: none"> <li>• Seat knob.</li> </ul>

CD6106-A

## SPECIFICATIONS

## TORQUE AND LUBRICANT SPECIFICATIONS

Description	N-m	Lb-Ft
Manual Lever to Control Cable Retaining Nut	14-20	10-15
Shift Lever and Housing Assembly	5.5-8	4-6
Control Cable Bracket-to-Column	20-34	15-25
Control Cable Bracket-to-Column	20-33	15-24
Control Cable Bracket-to-Dash Panel	2.0-2.5	17-22 (Lb-In)
Cable Retaining Bracket-to-Column	7-9	5-6.5
Cable Retaining Bracket-to-Transaxle — AXOD	16-27	12-20
Cable Retaining Bracket-to-Transaxle — CLC	8-13	6-10
Cable-to-Transaxle Manual Lever Nut — AXOD	13-27	10-20
Cable Support Bracket — CLC	8-13	6-10
Adjustment Trunnion Bolt — CLC	16-27	12-20
Description	Lubricant	
Adapter to Pivot Bolt Bushing and Pivot Bolt	ESB-M1C119-A	
Lever Assembly Park Pawl		
Adapter Assembly Park Pawl Slot		

CD6105-A

# SECTION 17-15 Transaxle, Automatic—AXOD

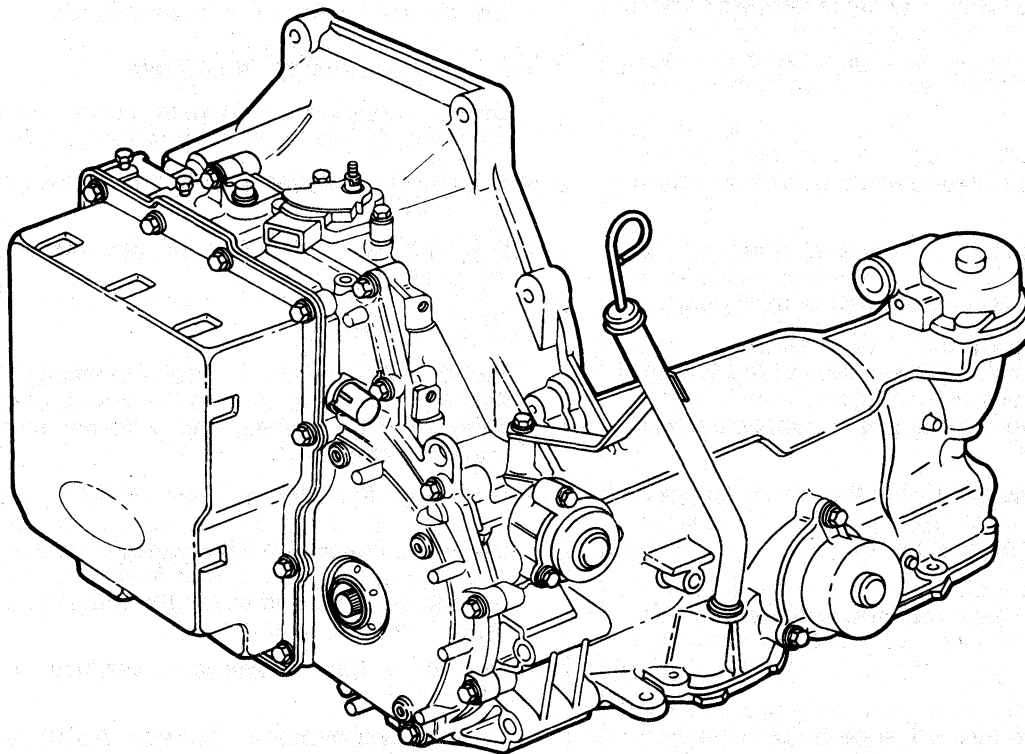
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Case .....	17-15-129	Transaxle Fluid Leakage Checks .....	17-15-12
Converter and Oil Cooler .....	17-15-130	Transaxle Fluid Level Check .....	17-15-11
Forward, Direct, Intermediate and		<b>DISASSEMBLY AND ASSEMBLY</b>	
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Clutch Check .....	17-15-16		

## VEHICLE APPLICATION

Taurus/Sable.

## DESCRIPTION AND OPERATION

The automatic overdrive transaxle (AXOD) is a fully automatic transaxle with four forward speeds and one reverse, in addition to NEUTRAL and PARK.



D6126-A

The AXOD has two planetary gear sets and a combination planetary/differential gear set. Four multiple plate clutches, two band assemblies, and two one-way clutches act together for proper operation of the planetary gear sets.

A lockup torque converter is coupled to the engine crankshaft and transmits engine power to the gear train by means of a drive link assembly (chain) that connects the drive and driven sprockets. The application of the converter clutch is controlled through an electronic control integrated in the on-board EEC-IV system. These controls, along with the hydraulic controls in the valve body, operate a piston plate clutch in the torque converter to provide improved fuel economy by eliminating converter slip when applied.

### Main Components and Functions

#### Torque Converter

- **Torque Converter:** Couples the engine to the turbine shaft. Also, provides torque multiplication and absorbs engine shock of gear shifting.
- **Piston Plate Clutch and Damper Assembly:** Transmits engine power to the turbine from the converter cover during lockup.
- **Converter Cover:** Transmits power from the engine into the converter. Also, the oil pump driveshaft is splined to the converter cover.
- **Turbine:** Splined to the drive sprocket turbine shaft, and driven by fluid from the impeller.
- **Impeller:** Driven by the converter cover, together with the reactor it supplies torque multiplication.
- **Reactor:** Also called the "stator," it contains a one-way clutch to hold it stationary only when "reaction" is required. Also causes hydraulic reaction during torque and multiplication.

**DESCRIPTION AND OPERATION (Continued)****Gear Train**

- **Forward Clutch:** Locks the driven sprocket to the low one-way clutch.
- **Low One-Way Clutch:** Transmits torque from the driven sprocket to the sun gear of the forward planetary gear set in first gear, and provides engine braking in third gear in connection with the forward clutch.
- **Overdrive Band:** Holds the sun gear of the forward planetary gear set stationary in fourth gear (overdrive).
- **Direct Clutch:** Locks the sun gear of the planetary assembly of the forward planetary gear set to the direct one-way clutch in third gear.
- **Direct One-Way Clutch:** Transmits torque from the driven sprocket to the sun gear of the forward planetary gear set in third gear, and provides engine braking in manual low in connection with the direct clutch.
- **Intermediate Clutch:** Locks the driven sprocket to the planetary assembly of the forward planetary gear set in second and third gear.
- **Reverse Clutch:** Holds the planetary assembly of the forward planetary gear set, and the ring gear of the rear planetary gear set stationary in reverse gear.
- **Planetary Gears:** Two gear sets are used to provide the four forward speeds, plus reverse, dependent upon clutch and/or band applications.
- **Parking Gear:** Allows the output (axle) shaft to be mechanically locked by the parking pawl anchored in the case.
- **Low-Intermediate Band:** Holds the sun gear of the rear planetary gear set stationary in manual low, first and second gears.
- **Final Drive Sun Gear:** Transfers torque from the transmission output to the final drive planetary assembly.

- **Final Drive Planet:** Drives the differential assembly.
- **Differential Assembly:** Drives the front axle shafts and provides the differential action if driving wheels are turning at different speeds.

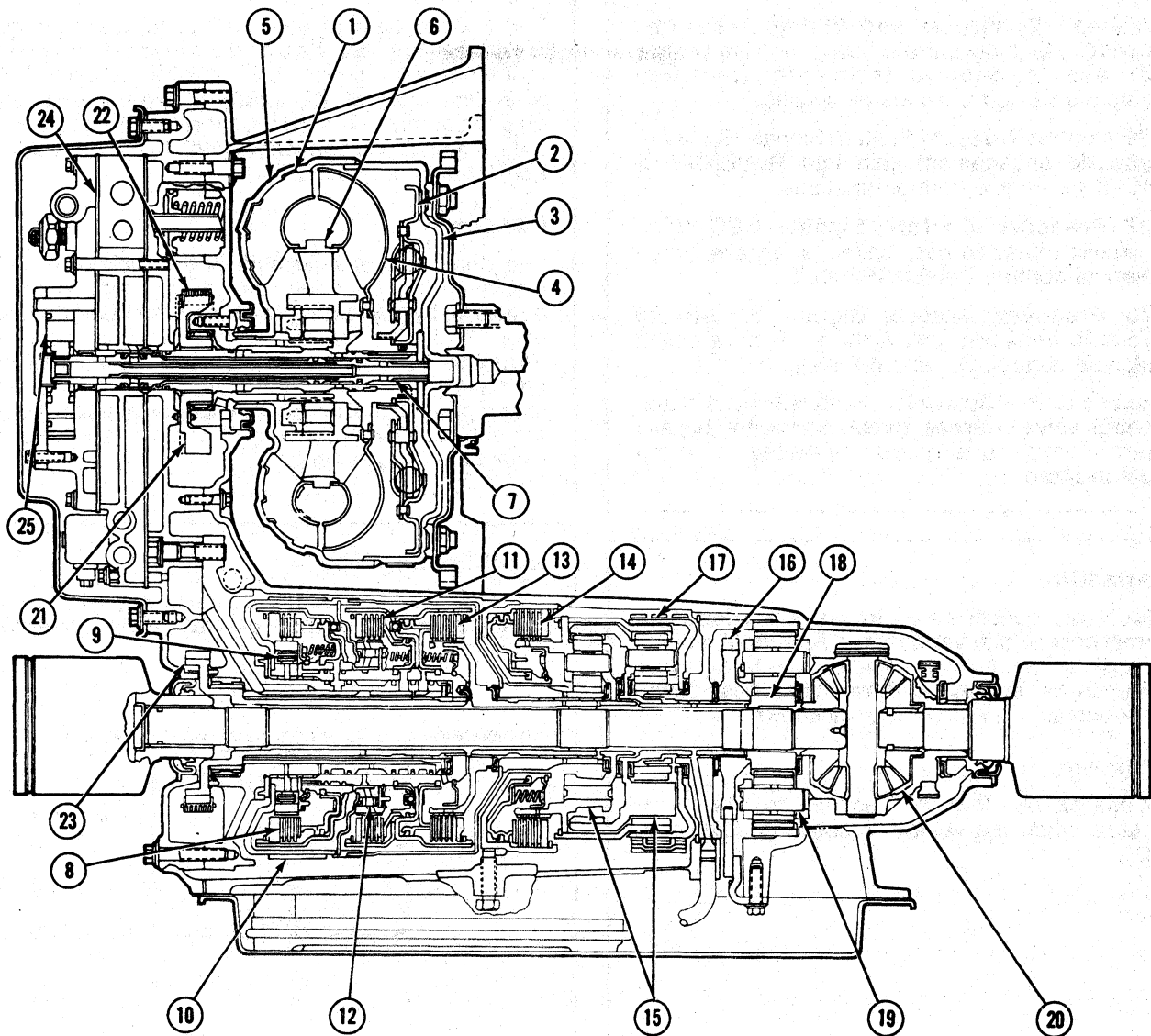
**Torque Converter to Gear Train**

- **Drive Sprocket:** Transmits power from the converter to the drive link assembly (chain).
- **Drive Link Assembly (Chain):** Connects drive and driven sprockets.
- **Driven Sprocket:** Transmits converter power to the gear train.

**Hydraulic System**

- **Valve Body:** (Main Control Assembly) directs fluid (oil) under pressure to the torque converter, band servos, clutches, and governor to control transaxle operation.
- **Oil Pump:** Provides a supply of fluid (oil) under pressure to operate, lubricate, and cool the transaxle. The oil pump is a variable capacity vane and rotor pump with output flow proportional to demand. It is located within the transaxle control valve and pump assembly.
- **Overdrive Servo:** Applies overdrive band in fourth gear.
- **Low-Intermediate Servo:** Applies low-intermediate band in manual low, first and second gears.
- **Governor:** Provides a "road speed" signal to the hydraulic control system for shift control, and is driven by a gear on the differential assembly.
- Two reservoir areas are used to control oil level, dependent upon fluid temperature. Along with the lower sump, a fluid reservoir is located in the lower section of the valve body cover. As fluid temperature in the reservoir increases, a thermostatic element closes, retaining fluid in the upper reservoir.

## DESCRIPTION AND OPERATION (Continued)



## LEGEND:

- |   |  |
|---|--|
| 1. TORQUE CONVERTER   | 13. INTERMEDIATE CLUTCH                |
| 2. CONVERTER CLUTCH (PISTON PLATE CLUTCH AND DAMPER ASSEMBLY) | 14. REVERSE CLUTCH                     |
| 3. CONVERTER COVER  | 15. PLANETARY GEARS                    |
| 4. TURBINE  | 16. PARKING GEAR                       |
| 5. IMPELLER   | 17. LOW/INTERMEDIATE BAND              |
| 6. REACTOR  | 18. FINAL DRIVE SUN GEAR               |
| 7. OIL PUMP DRIVESHAFT  | 19. FINAL DRIVE PLANET                 |
| 8. FORWARD CLUTCH   | 20. DIFFERENTIAL ASSEMBLY              |
| 9. LOW ONE-WAY CLUTCH   | 21. DRIVE SPROCKET                     |
| 10. OVERDRIVE BAND  | 22. DRIVE LINK ASSEMBLY (CHAIN)        |
| 11. DIRECT CLUTCH   | 23. DRIVEN SPROCKET                    |
| 12. DIRECT ONE-WAY CLUTCH                                     | 24. VALVE BODY (MAIN CONTROL ASSEMBLY) |
|   | 25. OIL PUMP                           |

**DESCRIPTION AND OPERATION (Continued)****Electrical Component Function**

- **Bulkhead Connector and Wiring Assembly:** Provides electrical current flow path from vehicle harness to internal transaxle electrical components and provides oil sealing.
- **NPS Neutral Pressure Switch:** Signals EEC-IV of transaxle engagement shift into REVERSE or DRIVE for engine control functions.
- **3/2 Pressure Switch:** Signals EEC-IV of hydraulic transaxle gear shifts for bypass clutch solenoid control. Detects 3-2 shift.
- **4/3 Pressure Switch:** Signals EEC-IV of hydraulic transaxle gear shifts for bypass clutch solenoid control. Detects 4-3 shift.
- **Bypass Clutch Solenoid:** Controls bypass clutch control valve. Applies torque converter bypass clutch when energized; releases it when de-energized.

**Torque Demand**

The second type of downshift is torque demand. The torque demand downshift occurs (automatically) during part throttle acceleration when the demand for torque is greater than the engine can provide at that gear ratio. The transaxle will disengage the converter clutch to provide added acceleration, if applied.

**Kickdown**

The third type of downshift is the kickdown. For maximum acceleration the driver can force a downshift by depressing the accelerator pedal to the floor. A forced downshift into second gear is possible below 88 km/h (55 mph). Below approximately 40 km/h (25 mph) a forced kickdown to first gear will occur. All shift speeds specifications are subject to variation due to tire size and engine calibration requirements.

**Downshifts**

Under certain conditions the transaxle will downshift automatically to a lower gear range without moving the shift selector lever. There are three such categories of automatic downshifts: coastdown, torque demand, and forced or kickdown shifts.

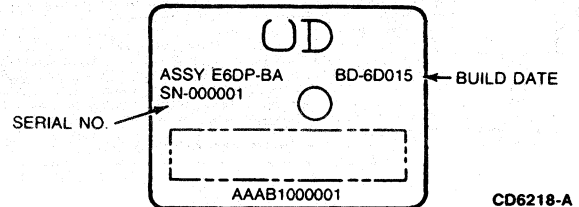
**Coastdown**

The coastdown downshift occurs as the name indicates, when the vehicle is coasting down to a stop.

**Identification Tag**

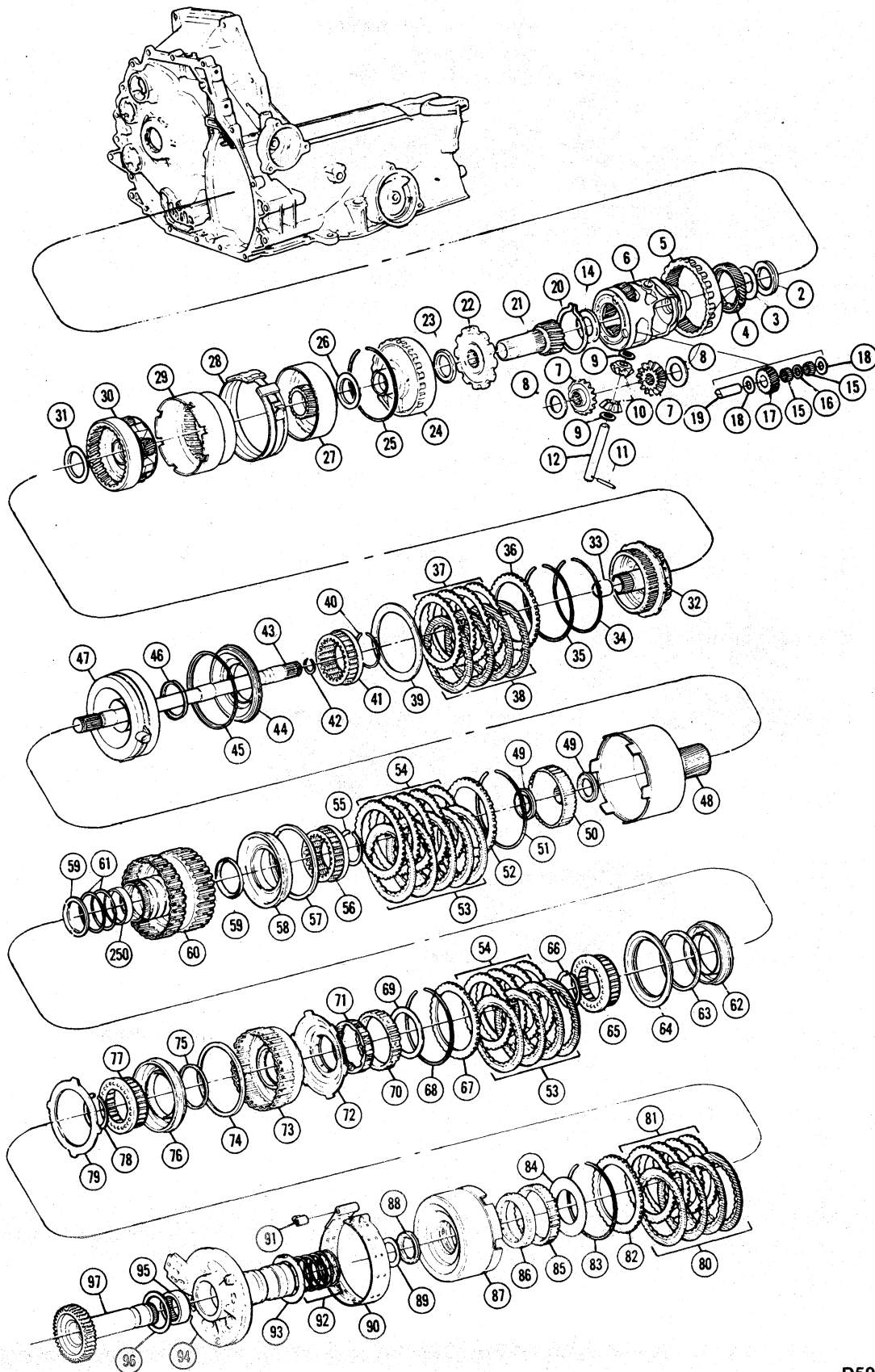
When servicing the automatic transaxle, refer to the identification tag located on top of the converter housing.

TRANSMISSION ASSY NO. MIRROR IMAGE PRINT MODEL AND NO.



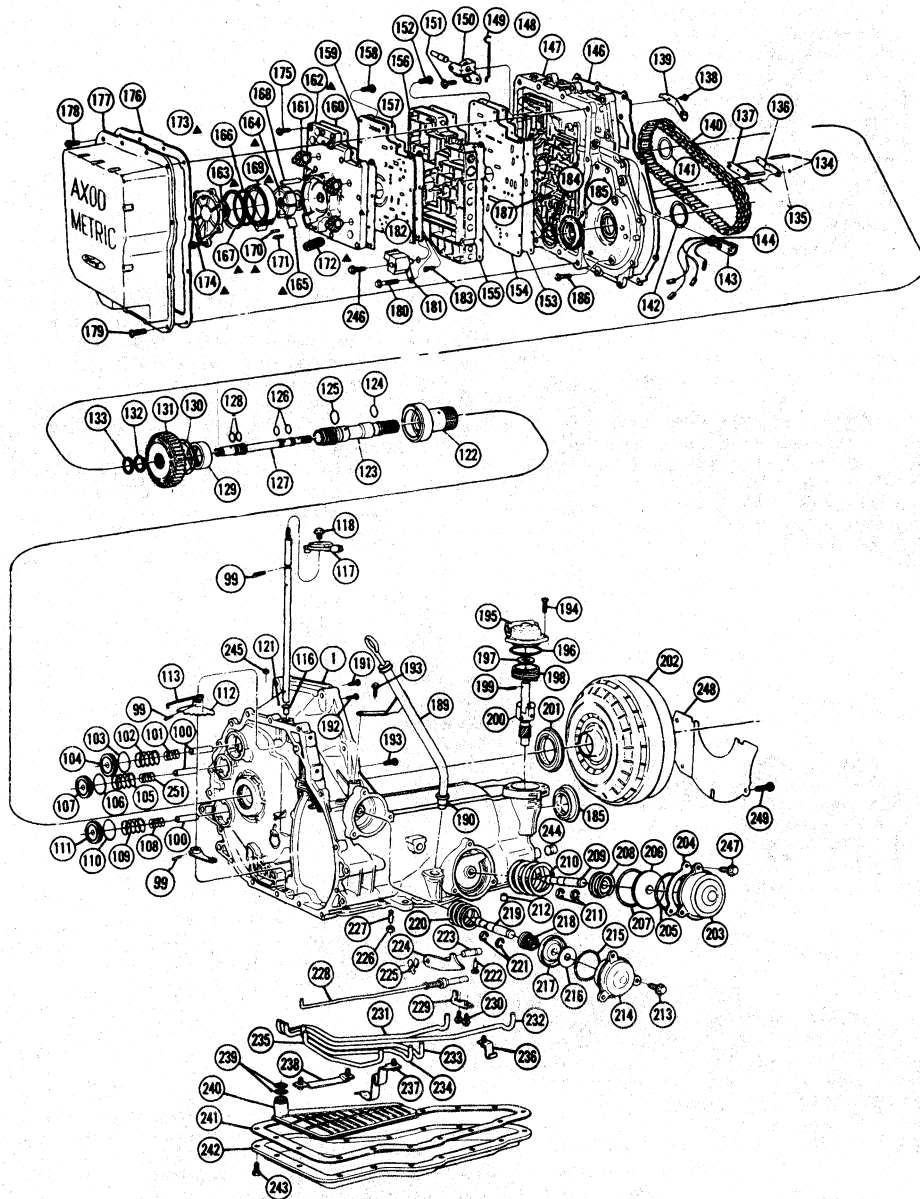


## DESCRIPTION AND OPERATION (Continued)



D5983-A

## DESCRIPTION AND OPERATION (Continued)



D5982-B

## DESCRIPTION AND OPERATION (Continued)

## LEGEND:

1. 7005	CASE ASSY	51. 7G346	RING P INTERM CLUTCH PLATE (SEL FIT)
2. 7G112	BRG & RACE ASSY — DIFF CARRIER THRUST (#19)	52. 7B455	PLATE — CLUTCH PRESSURE (INTERM)
3. 7G103	WASHER — DIFF CARRIER THRUST (#18 — SEL FIT)	53. 7B164	PLATE ASSY — CL INT SPLINE (USED IN INTERM & DIRECT CLUTCH) AS REQ'D
4. 7G237	GEAR — GOVERNOR DRIVE	54. 7E314	PLATE — CLUTCH EXT SPLINE (USED IN INTERM & DIRECT CLUTCH) AS REQ'D
5. 7G334	GEAR — FINAL DRIVE RING	55. N803175-S	RING — 72.0 RET STYLE SU EXT (RET INTERM CL SPG & RET TO CYL)
6. 4205	CASE — TRANSAXLE DIFF GEAR	56. 7G297	SUPT & SPRING ASSY — INTERM CLUTCH
7. 4236	GEAR — DIFF SIDE (2 REQ'D)	57. 7G243	SEAL — INTERM CLUTCH — OUTER
8. 4228	WASHER — DIFF SIDE GEAR THRUST (2 REQ'D)	58. 7E005	PISTON — INTERM CLUTCH
9. 4230	WASHER — RR AXLE DIFF PINION THRUST (2 REQ'D)	59. 7G240	SEAL — INTERM/DIR CL INNER (2 REQ'D)
10. 4215	PINION — REAR AXLE DIFF (2 REQ'D)	60. 7G120	CYLINDER ASSY — DIR/INTERM CLUTCH
11. 67638-S	PIN — COILED SPRING (RETAINS DIFF PINION SHAFT)	61. 7G102	SEAL — INTERM & DIR CL HUB 2 REQ'D
12. 4211	SHAFT — DIFF PINION	62. 7F254	PISTON ASSY — DIRECT CLUTCH
13.		63. 7G241	SEAL — DIRECT CLUTCH — OUTER
14. 7G107	BRG & RACE ASSY — FINAL DRIVE CARRIER (#17)	64. 7G341	RING — DIRECT CLUTCH (PISTON)
15. 7G216	BRG — FINAL DRIVE PLANET GEAR NEEDLE (168 REQ'D)	65. 7G298	SUPT & SPRING ASSY — DIRECT CLUTCH
16. 7G217	SPACER — FINAL DRIVE PLANETARY GEAR (4 REQ'D)	66. N803176-S	RING — 77.0 RET STYLE SU EXT (RET DIR CL SPG & RET TO CYL)
17. 7G214	GEAR — FINAL DRIVE PLANET (4 REQ'D)	67. 7B455	PLATE — CLUTCH PRESSURE (DIRECT)
18. 7G215	WASHER — FINAL DRIVE PLANETARY GEAR THRUST (8 REQ'D)	68. 7G347	RING — DIR CL PLATE (SEL FIT)
19. 7G213	SHAFT — FINAL DRIVE PINION (4 REQ'D)	69. N803054-S	RING — 152.26 RET INT (RET DIR CL PRESS PLATE TO CYL)
20. N803202-S	RING — 77.3 RET EXT (RETAIN PINION SHAFTS INTO CARRIER)	70. 7G116	WASHER — DIR CLUTCH THRUST (#7)
21. 7G193	GEAR ASSY — FINAL DRIVE SUN	71. 7G125	RACE — DIR ONE-WAY CL — OUTER
22. 7A233	GEAR — PARKING	72. 7G158	CLUTCH ASSY — DIRECT ONE-WAY
23. 7G106	BRG & RACE ASSY — FINAL DRIVE GEAR THRUST (#16)	73. 7D424	RACE & BSHG ASSY — DIR OWC — INNER
24. 7A130	SUPPORT ASSY — PLANET REAR	74. 7G243	CYLINDER ASSY — FWD CLUTCH
25. N803197-S	RING — 150.7 RET INT (USED AS REAR SUPPORT RET RING)	75. 7G242	SEAL — FWD CLUTCH — OUTER
26. 7G178	BRG & RACE ASSY — SUN GEAR THRUST — RR (#15)	76. 7L140	SEAL — FWD CLUTCH — INNER
27. 7B459	GEAR & DRUM ASSY — RR SUN	77. 7G299	PISTON — FORWARD CLUTCH
28. 7D034	BAND ASSY — LOW & INTERM	78. N803053-S	SUPT & SPRING ASSY — FWD CLUTCH
29. 7G211	GEAR — REAR RING	79. 7G159	RING — 85.0 RET TYPE SU EXT (RET FWD CL SPG & RET TO CYL)
30. 7G224	GEAR ASSY — PLANET REAR	80. 7E311	SPRING — FORWARD CLUTCH WAVE
31. 7G177	BRG. & RACE ASSY — PLANET THRUST — CENTER (#13)	81. 7E314	PLATE ASSY — FWD CL INT SPLINE (FRICTION) AS REQ'D
32. 7G218	PLANET ASSY — FRONT	82. 7B066	PLATE — FWD CL EXT SPLINE (STEEL) AS REQ'D
33. 7G220	BUSHING — FRT PLT GR CARRIER	83. N803054-58S	PLATE — FWD CL PRESSURE
34. 7G290	RETAINING RING — SHELL — REAR	84. 7D076	RING — 152.26 RET INT (FWD) SEL FIT (RET FWD CL PRESS PLT)
35. N803049-52S	RING — 153.9 RET INT (RETAIN REV CL PRESS PLATE TO CYL) — SEL FIT	85. 7G205	WASHER — FWD CLUTCH THRUST (#6)
36. 7D408	PLATE — REV CLUTCH PRESSURE	86. 7G206	RACE — LOW OWC — OUTER
37. 7E312	PLATE ASSY — REV CL INT SPLINE (FRICTION) 4 REQ'D	87. 7G207	CLUTCH ASSY — LOW ONE-WAY
38. 7E315	PLATE — REV CL EXT SPLINE (STEEL) 4 REQ'D	88. 7G128	DRUM ASSY — OVERDRIVE
39. 7F154	SPRING — REV CLUTCH CUSHION	89. 7G273	BRG & RACE ASSY — DIR CL HUB (#9)
40. N803048-S	RING — 67.0 RET TYPE SU EXT (RET REV CL SPG & RET TO CYL)	90. 7F196	WASHER — DRIVEN SPROCKET
41. 7G335	SUPT & SPRING ASSY — REV CLUTCH	91. 7G343	SUPT THRUST — RR (#8) SEL FIT
42. N803200-S	RING — 27.0MM RET EXT (RET DIFF CARRIER OUTPUT SHAFT)	92. 7D019	BAND ASSY — OVERDRIVE
43. 7G251	SHAFT — DIFF OUTPUT	93. 7D014	RETAINER — O/D BAND
44. 7D402	PISTON — REVERSE CLUTCH	94. 7G166	SEAL — FWD CLUTCH CYL (5 REQ'D)
45. 7D403	SEAL — REV CLUTCH PISTON — OUTER	95. 7G247	WASHER — SUPPORT THRUST — FRT (#5) SEL FIT
46. 7D404	SEAL — REV CLUTCH PISTON — INNER	96. 7G115	SUPPORT ASSY — DRIVEN SPROCKET
47. 7F341	CYLINDER — REV CLUTCH	97. 7G132	BRG ASSY — DRIVEN SPROCKET
48. 7G304	GEAR & SHELL ASSY — FRT SUN	98. 7A256	WASHER — DRIVEN SPROCKET THRUST (#4)
49. 7G239	BRG & RACE ASSY — FRT SUN GR THRUST (#10 & #11) — 2 REQ'D		SPROCKET ASSY — DRIVEN
50. 7F221	HUB — INTERM CLUTCH		LEVER ASSY — MANUAL CONTROL

## DESCRIPTION AND OPERATION (Continued)

99.	N646319-S2	PIN — 4MM X 20 SPG COILED STD (2-USED AS MAN CNTL SHFT PIN)	150.	7F291	LEVER ASSY — THROTTLE CONTROL
100.	7G094	SHAFT — SHIFT ACCUM PISTON (3 REQ'D)	151.	N605771-S	BOLT — M6-1.0 X 14 HEX FLG HD (2-ATT TV. LVR ASSY TO CHAIN COVER)
101.	7G326	SPRING — 1-2 SHIFT ACCUM — INNER	152.	N804129-S	SCREW — M6 X 1.0 X 14 PAN HD (2-ATT VLV BDY SEP PLT TO VLV BDY)
102.	7G267	SPRING — 1-2 SHIFT ACCUM — OUTER	153.	7C155	GASKET — CONTROL ASSY
103.	7G095	SEAL — 1-2 SHIFT ACCUM — PISTON	154.	7G348	PLATE ASSY — VALVE BODY SEP
104.	7G133	PISTON — 1-2 SHIFT ACCUM	155.	7D100	GASKET — CNTL VLV BODY SEP PLATE
105.	7G266	SPRING — 3-4 SHIFT ACCUM	156.	7A100	CONTROL ASSY — MAIN
106.	7F248	SEAL — 3-4 SHIFT ACCUM — PISTON	157.	7A136	GASKET — PUMP ASSY
107.	7F246	PISTON — 3-4 SHIFT ACCUM	158.	N605771-S	SCREW — M6 X 1.0 X 14 PAN HD. (3 — PUMP SEP PLATE TO PUMP BODY)
108.	7G301	SPRING — DRIVE SHIFT ACCUM — INNER	159.	7A142	PLATE — OIL PUMP BODY SEP
109.	7G300	SPRING — DRIVE SHIFT ACCUM — OUTER	160.	7G331	GASKET — OIL PUMP BODY SEP PLATE
110.	7G275	SEAL — DRIVE SHIFT ACCUM — PISTON	161.	7E440	SWITCH ASSY — OIL PRESSURE (3 REQ'D)
111.	7G274	PISTON — DRIVE SHIFT ACCUM	▲ 162.	7A104	BODY BRG & SEAL ASSY — OIL PUMP
112.	7A115	LEVER ASSY — MANUAL DETENT	▲ 163.	7G287	RING — OIL PUMP VANE SUPPORT (2 REQ'D)
113.	7N049	ROD — MAN CONTROL VALVE ACTU	▲ 164.	7A146	ROTOR — OIL PUMP
114.	7C493	SHAFT — MANUAL CONTROL	▲ 165.	7G286	VANE — OIL PUMP (7 REQ'D)
115.	7G100	PIN — SHAFT RET (USED AS MAN LVR SHAFT RET PIN)	166.	7G281	SEAL — OIL PUMP BORE RING SIDE
116.	7F337	SEAL ASSY — MAN CONTROL	▲ 167.	7G282	SUPPORT — OIL PUMP BORE RING SIDE SEAL
117.	7A247	SWITCH ASSY — GR SHIFT NEUTRAL	▲ 168.	N803499-S	PIN — 8MM X 37.7 STRAIGHT HRDN
118.	N804196-S100	BOLT — M6 — 1.0 X 28 HEX FLG HD (2-NEUT START SWITCH TO CASE)	▲ 169.	7R194	RING — OIL PUMP BODY
119.	7B186	LEVER — MANUAL CONTROL — OUTER	▲ 170.	7G284	SUPPORT — OIL PUMP BORE RING RADIAL SEAL
120.	7341	INSULATOR — GEAR SHIFT ARM	171.	7G283	SEAL — OIL PUMP BORE RING RADIAL
121.	7B148	TAG — IDENTIFICATION	▲ 172.	7G285	SPRING — OIL PUMP BORE RING
122.	7N825	SUPPORT ASSY — STATOR	▲ 173.	7G187	COVER & SLEEVE ASSY — OIL PUMP
123.	7F213	SHAFT — TURBINE	▲ 174.	N605892-S2	BOLT — M6 X 1.0 X 20 HEP FLG PLT (6 REQ'D) ATT PUMP COVER TO PUMP BODY
124.	87022-S96	SEAL — O-RING (FRT TURBINE SHAFT TO DRIVE SPRKT)	175.	N606026-S	BOLT — HEX FLG HD (22-ATT PUMP BODY & MAIN CONTR TO CHAIN COVER)
125.	7G091	SEAL — TURBINE SHAFT — REAR	176.	7F396	GASKET — MAIN CONTROL COVER
126.	7G093	SEAL — PUMP SHAFT — REAR (2 REQ'D)	177.	7F395	COVER — MAIN CONTROL
127.	7R190	SHAFT ASSY — OIL PUMP DRIVE	178.	N605789-S2	BOLT — M8-35.0 HEX FLG HD (12-ATT CHAIN COVER TO CASE)
128.	7G092	SEAL — PUMP SHAFT — FRONT	179.	N605903-S2	BOLT — M8-1.25 X 25 HEX FLG HD (12-ATT MAIN CTL CVR TO CHN CVR)
129.	7G233	BRG ASSY — DRIVE SPROCKET	180.	N606022-S	BOLT — M6-1.00 X 40 HEX FG HD (3-ATT VLV BDY TO CHN CVR&SOL ASY)
130.	7G099	WASHER — DRIVE SPROCKET THRUST (#2)	181.	7G136	SOLENOID ASSY — BY-PASS CLUTCH
131.	7G129	SPROCKET ASSY — DRIVE	182.	N802928-S	SEAL — 6.07 X 1.79 O-RING (BY-PASS SOLENOID SEAL)
132.	N803178-S	RING — 26.36 RET STY SU EXT (RET TURB SHAFT TO DRIVE SPRKT)	183.	7G308	SCREEN ASSY — BY-PASS CLUTCH SOLENOID
133.	7G090	SEAL — TURBINE SHAFT — FRONT (METAL)	184.	N804139-S	CIRCLE CLIP — OUTPUT SHAFT RETAINER (RETAINS CV JOINT)
134.	7G089	COLLAR — OIL LEVEL THERMO RETAIN	185.	1177	SEAL ASSY — DIFF (2 REQ'D)
135.	N804184-S	PIN — 4MM X 22 COILED (LOCATING BY-METAL ELEMENT; (3) REG)	186.	N606042-S2	BOLT — M8-1.25 X 45 HEX FLG HD (2-ATT VLV BDY TO CHN CVR&SOL ASY)
136.	7G191	ELEMENT — OIL LEVEL	187.	N803807-S	BOLT — M10-1.50 X 45 HEX (ATT CHAIN COVER TO DRIVEN SUPPORT)
137.	7G190	THERMOSTATIC	188.	7A020	INDICATOR ASSY — OIL LEVEL
138.	N605771-S	PLATE — OIL LEVEL THERMOSTAT — VALVE	189.	7A228	TUBE ASSY — OIL FILLER
139.	7E332	BOLT — M6 X 16 HEX FLG HD (ATT DET SPRING ASSY TO CHAIN COVER)	190.	7N243	GROMMET — OIL FILLER
140.	7G249	SPRING ASSY — MAN VLV DETENT	191.	N605789-S	BOLT — M10-1.50 X 45 HEX (ATT CHAIN COVER TO DRIVEN SUPPORT)
141.	7G099	CHAIN ASSY — DRIVE	192.	N803727-S	BOLT — M6 X 1.00 X 30 HEX FLG HD (4-ATT CASE TO CHAIN COVER)
142.	7G096	WASHER — DRIVE SPROCKET THRUST (#1)	193.	N802996-S	SCREW — M6-1.0 X 20 PAN HD (6-ATT CASE TO STATOR SUPPORT)
143.	7G276	WASHER — CHAIN COVER THRUST (#3)	194.	N605892-S2	BOLT — (2-GOVERNOR COVER TO CASE)
144.	N802927-S	BULKHEAD ASSY — WIRING CONN			
145.	7034	SEAL — 17.12 X 2.62 O-RING (WIRE HARNESS TO CASE)			
146.	7G303	VENT ASSY — CASE			
147.	7G188	GASKET — CHAIN COVER			
148.	N802684S100	COVER ASSY — CHAIN			
149.	7G164	CONN ASSY — 5/16 TUBE X 1/4 EX PIPE PLUG (2 REQ'D)			
		LINK — THROTTLE CONTROL LEVER			

**DESCRIPTION AND OPERATION (Continued)**

195.	7A301	COVER — GOVERNOR	223.	7D071	SHAFT — PARK PAWL
196.	N803201-S	SEAL — 63.2 X 1.80 O'RING (USED AS GOV. COVER SEAL)	224.	7A441	PAWL — PARKING BRAKE
197.	7G173	BRG & RACE ASSY — GOV THRUST	225.	7D070	SPRING — PARK PAWL RETURN
198.	17285	GEAR — SPEEDO DRIVE (7TLH)	226.	N803849-S	SCREW — M12 X 1.75MM SET HD
199.	N804123-S2	PIN — 3.3 X 22 SPG SLOT HVY (USED AS SPEEDO GEAR DRIVE PIN)	227.	N620015-S	SCRET (REV CL ASSY LOCATOR BLT)
200.	7C053	GOVERNOR ASSEMBLY	228.	7D410	NUT — M12 X 1.75 HEX (REV CL ASSY LOCATOR BOLT)
201.	7F401	SEAL ASSY — CONV IMP HUB	229.	7G101	ROD ASSY — PARK PAWL
202.	7902	CONVERTER ASSY — 10-1/4	230.	N605787-S	ACTUATING
203.	7D027	COVER — LOW/INTERM BAND	231.	7G084	ABUTMENT — PARK PAWL
204.	7D026	SERVO	232.	7G086	ACTUATING
205.	7F427	GASKET — LOW/INTERM BAND	233.	7G087	BOLT — M8-1.25 X 25 HEX FLG HD (2-ATT ABUTMENT ASSY TO CASE)
206.	7D022	SERVO	234.	7G088	TUBE — REAR LUBE OIL TRANSFER
207.	7G152	SEAL — LOW/INTERM BAND	235.	7G199	TUBE — GOV FEED OIL TRANSFER
208.	7G150	PISTON — LOW/INTERM BAND	236.	7G353	TUBE — SERVO APPLY OIL
209.	7D023	SERVO	237.	7G353	TRANSFER
210.	7D028	RETAINER & SPRING ASSY — LOW/INTERM SERVO	238.	7G353	TUBE — SERVO REL OIL TRANSFER
211.	N804195-S2	ROD — LOW/INTERM SERVO PISTON (SEL FIT)	239.	N804292	TUBE — REV CL APPLY OIL
212.	7G085	SPRING — LOW/INTERM SERVO	240.	7G186	TRANSFER
213.	N605892-S2	PISTON	241.	7A191	BRKT ASSY — TUBE SUPPORT — GOV FEED
214.	7F204	RING — 11MM RET TYPE RB EXT (2-ATT L/I SERVO PISTON)	242.	7A264	BRKT ASSY — TUBE SUPPORT — REV CLUTCH
215.	7G185	SEAL ASSY — RR LUBE TRANSFER TUBE	243.	N605903-S2	BRKT ASSY — TUBE SUPPORT MAIN
216.	7G280	BOLT — (3-ATT O/D SERVO COVER TO CASE)	244.	N802947-S	SEAL — 23.46 X 2.62 O'RING (2-USED ON OIL FILTER)
217.	7G244	COVER — O/D BAND SERVO	245.	373907-S2	FILTER ASSY — OIL
218.	7G279	SEAL — O/D SERVO COVER	246.	N605771-S	GASKET — OIL PAN
219.	7F203	RETAINER — O/D SERVO PISTON	247.	N605892-S2	PAN OIL
220.	7F201	PISTON & SEAL ASSY — O/D SERVO	248.	7986	BOLT — M8-1.25 X 14 HEX FLG HD (17-ATT OIL PAN TO CASE)
221.	97413-S	RETAINER & CUSHION SPRING ASSY — O/D SERVO	249.	N605890-S2	PLUG — 13.9MM CUP
222.	7G100	ROD — O/D SERVO PISTON (SEL FIT)	250.	7G123	NUT — 1/4 SPRING (RETAIN I.D. TAG)
		SPRING — O/D SERVO RETURN	251.	7F288	BOLT — M6 X 16 HEX FLG HD (ATT SOLENOID ASSY TO VLV BODY)
		RING — RET EXT ROD O/D SERVO (2 USED ON O/D SERVO ROD)			BOLT — (3-ATT L/I SERVO COVER TO CASE)
		PIN — SHAFT RETAINER (USED AS PARK PAWL SHAFT RETURN PIN)			COVER — CONV HSG LOWER
					BOLT — (ATT CONV HSG CUR TO CASE)
					BUSHING — DIR/INTERM CLUTCH
					CYLINDER
					SPRING — 3-4 SHIFT ACCUM-INNER

CD5989-A

**ADJUSTMENTS****Throttle Valve (TV) Cable**

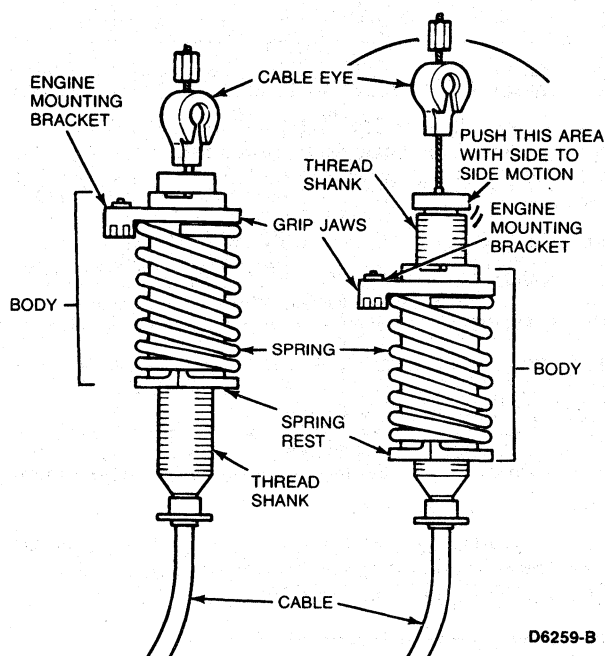
The throttle valve (TV) cable normally does not need adjustment. The cable should be adjusted only if one of the following components are replaced:

- Main control assembly.
- Throttle valve cable.
- Throttle valve cable engine mounting bracket.
- Throttle control lever link or lever assembly.
- Engine throttle body.
- Transaxle assembly.

## ADJUSTMENTS (Continued)

1. Connect TV cable eye to throttle control lever link and attach cable boot to chain cover.
2. With TV cable mounted in engine bracket, make sure threaded shank is fully retracted. To retract shank, hold spring rest and wiggle top of thread shank while pressing shank through spring.
3. Attach end of TV cable to throttle body.
4. Rotate throttle lever to WOT position and release.

NOTE: Threaded shank must show movement or "ratchet" out of grip jaws. If no movement is observed, inspect TV cable system for broken or disconnected components and repeat procedure.



D6259-B

## DIAGNOSIS AND TESTING

Troubleshooting the automatic transaxle is simplified by using the proven method of diagnosis. One of the most important things to remember is that there is a definite procedure to follow. Do not attempt short cuts or assume that someone else has done the critical checks or adjustments.

The following procedures are recommended for checking and/or verifying that the various components are adjusted and operating properly.

Rotunda model 014-00737 or equivalent tester, also may be used for testing an automatic transaxle, if available.

### Transaxle Fluid Level Check

**CAUTION:** Vehicle should not be driven if fluid level is below the "DO NOT DRIVE" hole.

### Transaxle—Operating Temperature

The automatic transaxle fluid level can only be established at an operating temperature of 66°C-77°C (150°F-170°F) (dipstick is hot to the touch). The operating temperature may be obtained by driving 24-32 km (15-20 miles) of city-type driving with the outside temperature above 10°C (50°F).

### Transaxle—Room Temperature

NOTE: The AXOD transaxle cannot have fluid level established at room temperature.

Fluid level can only be checked at room temperature 21°C-35°C (70°F-95°F) (dipstick cool to the touch) to verify that the level is above the "Do Not Drive" mark. If fluid level is below, then add only enough fluid to bring the level above the "Do Not Drive" mark. Operating temperature must be obtained, as outlined to establish correct fluid level, if any fluid is added during room temperature check.

### Dipstick Reading

The fluid level on the dipstick should be within the cross hatched area at operating temperature. The fluid level on the dipstick should read above the holes "Do Not Drive" at room temperatures.

Check the fluid as follows:

1. With the transaxle in PARK, engine at idle rpm, foot brakes applied, and vehicle on level surface, move the transaxle selector lever through each range, allowing time in each range to engage transaxle. Return to PARK, applying parking brake fully, and block the wheels. Do not turn off the engine during the fluid level check.
2. Clean all dirt from the transaxle fluid dipstick cap before removing the dipstick from the filler tube.
3. Pull the dipstick out of the tube, wipe it clean, and push it all the way back into the tube. Ensure it is fully seated.
4. Pull the dipstick out of the filler tube again, and check the fluid level.

NOTE: The fluid level indication on the dipstick will be different at operating temperature and room temperature. For the correct fluid level reading on the dipstick, follow the appropriate instructions stated previously.

## DIAGNOSIS AND TESTING (Continued)

Before adding fluid, ensure that the correct type will be used. If in doubt, check the Vehicle Certification Label affixed to the LH front door lock face panel or door pillar for the Transaxle Code. Also, the fluid is stamped on the indicator.

**CAUTION: If vehicle has been operated for an extended period at high speed, or in city traffic in hot weather, or vehicle is being used to pull a trailer, to obtain an accurate reading, the fluid has to cool, usually approximately 30 minutes after engine has been turned off.**

**CAUTION: Use of a fluid other than specified could result in transaxle malfunction and/or failure.**

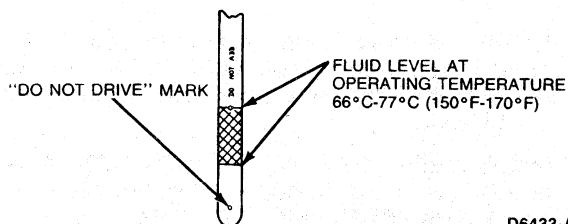
If necessary, add enough fluid through the filler tube to raise the level to the correct position. Do not overfill the transaxle. This will result in foaming, loss of fluid through the vent, and possible transaxle malfunction. If overfill occurs, excess fluid must be removed.

5. Install the dipstick, ensuring it is fully seated in the tube.

Overfill can cause the fluid to foam and spill out through the vent, resulting in a transaxle malfunction.

Underfill can result in transaxle loss of engagement or slipping. This condition is most evident in cold weather or when the vehicle is parked or being driven on a hill.

If the transaxle fluid level is checked when the fluid is at room temperature, the dipstick could indicate that fluid should be added if the dipstick is misread. If fluid is added at this time, an overfill condition could result when the fluid reaches operating temperatures of 66°C-77°C (150°F-170°F) (dipstick hot to touch).



D6433-A

### Transaxle Fluid Condition Check

1. Make the normal fluid check as outlined.
2. Observe color and odor of the fluid. It should be red; not brown or black. Odor can sometimes indicate an overheating condition or clutch disc or band failure.
3. Use an absorbent white facial tissue to wipe the dipstick. Examine the stain for evidence of solids (specks of any kind) and for antifreeze signs (gum or varnish on dipstick).

If specks are present in the oil or there is evidence of antifreeze, the transaxle oil pan must be removed for further inspection. If fluid contamination or transaxle failure is confirmed by further evidence of coolant or excessive solids in the oil pan, the transaxle must be disassembled and completely cleaned and serviced. This includes cleaning the torque converter and transaxle cooling system. It would be a waste of time to perform any further checks before cleaning and servicing the transaxle. During disassembly and assembly, all overhaul checks and adjustments of clearances and end play must be made. After the transaxle has been serviced, all diagnosis tests and adjustments listed in the Diagnosis charts must be completed to ensure that the problem has been corrected.

### High or Low Fluid Level

A fluid level that is too high will cause the fluid to become aerated. Aerated fluid will cause low control pressure, and the aerated fluid may be forced out the vent.

A fluid level that is too low can affect the operation of the transaxle. Low level may indicate fluid leaks that could cause transaxle damage.

### Transaxle Fluid Leakage Checks

Check the vehicle speed sensor and speedometer cable connection at the transaxle. Replace the rubber seal if necessary.

Leakage at the oil pan gasket often can be stopped by tightening the attaching bolts to specification. If necessary, replace the gasket.

Check the governor cover seal.

Check the chain cover-to-case gasket.

Check the bulkhead connector to chain cover. Replace bulkhead assembly, if necessary.

Check output shaft seals. Replace if necessary.

Check the fluid filler tube connection at the transaxle case. If leakage is found here, install a new grommet.

Check the fluid lines and fittings between the transaxle and the cooler in the radiator tank for looseness, wear, or damage. If leakage cannot be stopped by tightening a fluid line tube nut, replace the damaged parts. Refer to Oil Cooler and Steel Lines. When oil is found to be leaking between the case and the cooler line fitting, tighten the fitting to maximum specification. **Do not try to stop the oil leak by increasing the torque beyond specification. This may cause damage to the case threads.** If the leak continues, replace the cooler line fitting and tighten to specification. The same procedure should be followed for oil leaks between the radiator cooler and cooler line fittings.



**DIAGNOSIS AND TESTING (Continued)**

Check the engine coolant in the radiator. If transaxle fluid is present in the coolant, the cooler in the radiator is probably leaking.

The cooler can be further checked for leaks by disconnecting the lines from the cooler fittings and applying 345-517 kPa (50-75 psi) air pressure to the fittings. Remove the radiator cap to relieve the pressure build up at the exterior of the oil cooler tank. If the cooler is leaking and/or will not hold pressure, the cooler must be replaced.

If leakage is found at either the throttle control cable grommet or the manual lever shaft, replace either or both seals.

Oil soluble aniline or fluorescent dyes premixed at the rate of 2.5ml (1/2 teaspoon) of dye powder to 0.23L (1/2 pint) of transaxle fluid have proven helpful in locating the source of fluid leakage. Such dyes may be used to determine whether an engine oil or transaxle fluid leak is present, or if the fluid in the oil cooler leaks into the engine coolant system. A black light must be used with the fluorescent dye solution.

Check the power steering gear system. The power steering gear system is positioned over the rear of the transaxle and is filled with transmission fluid. Leaks from the power steering gear may pool on the transaxle before dripping onto the ground, thus giving the appearance of being a transaxle fluid leak.

Inspect both components carefully before disassembling either. If the power steering gear (system) is found to be leaking, refer to Section 13-46.

**Oil Cooler and Steel Lines**

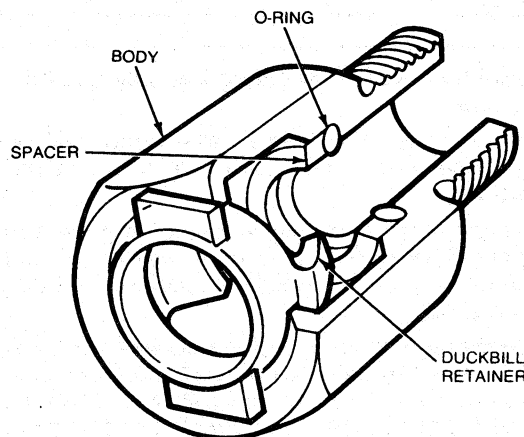
When fluid leakage is found at the oil cooler (in radiator), the cooler must be replaced. Refer to Section 27-03 for oil cooler replacement procedures.

When oil cooler steel lines need replacing, each replacement line must be fabricated from the same size steel line as the original. Using the old line as a guide, bend the new line as required. Add the necessary fittings and install the line. After the fittings have been tightened to specification, add fluid as needed and check for leaks.

**NOTE:** The cooler lines that are attached to the transaxle are a push connect design and must be removed with a special tool. The cooler lines attached to the radiator use the conventional nut and flare fittings.

**Service Procedures****Oil Cooler Steel Lines Using Push Connect Fittings—Transaxle End Only**

1. If leakage is noted at the transaxle end of the cooler line(s) and the line appears to be in good condition, remove the affected cooler line from its push connect fitting using Cooler Line Disconnect Tool T86P-77265-AH or equivalent, and remove and discard the fitting from the transaxle. Replace the fitting with push connect fitting N802684-S100 or equivalent and install the cooler line in the fitting by aligning the end of line with bore of fitting. Push line into fitting; a click should be heard when the retainer engages the tube bead. Pull back on tube to ensure full engagement. Check for leakage. If leakage is noted, replace line. Again, remove line and fitting from transaxle.



D4559-B

**NOTE:** For description on how to use Cooler Line Disconnect Tool T86P-77265-AH or equivalent, refer to Cooler Line Disconnect Tool Usage.

2. Install angled flare fitting E2SZ-7D273-A or equivalent in the transaxle. Tighten fitting to 24-31 N·m (18-23 lb-ft).
3. Cut approximately 76-102mm (3-4 inches) from the existing cooler line.
4. Using new cooler line steel tubing (equivalent of SAEJ526 welded low carbon lead/tin coated 5/16-inch OD) cut a piece of sufficient length and shape it to connect the existing line to the new flare fitting.



**DIAGNOSIS AND TESTING (Continued)**

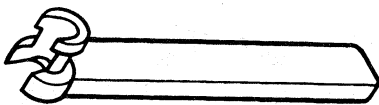
5. Clean all cut ends of both lines with the blade edge of the cutting tool to avoid line restrictions. Clean metal particles from the tube ends.
6. Install flare nut 87944-S8 or equivalent on the transaxle end of the new cooler line section.
7. Connect the new cooler line section to the existing cooler line using a piece of 5/16-inch fuel line hose and two worm drive hose clamps. Use a sufficient length of fuel line hose to achieve a 38-51mm (1 1/2-2 inches) overlap of the ends of the cooler lines.
8. Connect the cooler line to the flare fittings and tighten to 16-24 N·m (12-18 lb-ft).

**Cooler Line Disconnect Tool Usage Push Connect Fittings—Transaxle End Only**

For transaxle cooler line service, Cooler Line Disconnect Tool T86P-77265-AH or equivalent is required. The illustration shows the tool end and its proper orientation for disassembly of tube from fitting. The purpose of the tool is to spread the "duck bill" retainer to disengage the tube bead. The following steps are necessary for use of the tool.

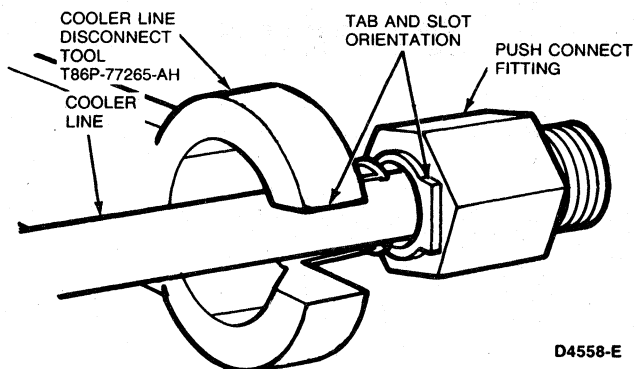
To facilitate use of the tool, clean the road dirt from the fitting before inserting the tool into the fitting. Also, it is important to avoid any contamination of the fitting and transaxle, dirt in the fitting could cause an O-ring leak.

NOTE: On some applications, it may not be possible to insert the removal tool into the fitting due to vehicle component interference. If this condition exists, the fitting must be removed from the case without disconnecting the cooler line. The fitting should be replaced with a new one, if this is done. Turning the fitting without removing the cooler line may damage the internal O-ring of the fitting causing a leak.



D6418-A

1. Slide the tool over the tube.
2. Align the opening of the tool with one of the two tabs on the fitting "duck bill" retainer.

**Cooler Line Disconnect Tool**

D4558-E

3. Firmly insert tool into fitting until it seats against the tube bead. (A definite click should be heard).
4. With thumb held against the tool, firmly pull back on tube until it disengages from fitting.

**CAUTION: Do not attempt to separate cooler line from fitting by prying with another tool. This will break the plastic insert in fitting and bend the cooler lines at the junction to the fitting.**

Before assembly of the lines in the fitting, visually inspect the plastic retainer in the fitting for a broken tab. If a tab is broken, the fitting must be replaced. Also visually inspect the cooler lines to ensure they are not bent at the junction of the fitting.

Tube assembly is accomplished by inserting the tube into the fitting until the retainer engages the tube bead. (A definite click should be heard). Pull back on the tube to ensure full engagement.

**Fluid Leakage in Converter Area**

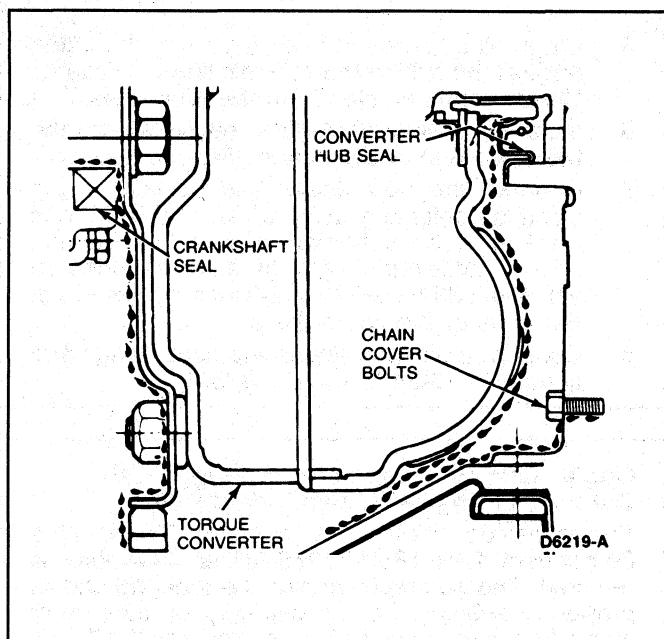
In diagnosing and correcting fluid leaks in the converter area, use the following procedures to locate the exact cause of the leakage. Leakage at the front of transaxle, as evidenced by fluid around the converter housing, may have several sources. By careful observation, it is possible in many instances, to pinpoint the source of the leak before removing the transaxle from the vehicle. The paths which the fluid can take to reach the bottom of the converter housing are as follows:

1. Fluid leaking by the converter hub seal lip will tend to move along the drive hub and onto the back of the impeller housing. Except in the case of a total seal failure, fluid leakage by the lip of the seal will be deposited on the inside of the converter housing only, near the outside diameter of the housing.
2. Fluid leakage by the outside diameter of the converter hub seal and the case will follow the same path which the leaks by the inside diameter of the seal follow.
3. Fluid leakage from the converter to flywheel stud weld will appear at OD of converter on back face of flywheel, and in the converter housing only near the flywheel. If a converter to flywheel stud leak is suspected, remove converter and pressure check as outlined.
4. Engine oil leaks are sometimes improperly diagnosed as transaxle front pump seal leaks. The following areas of possible leakage should also be checked to determine if engine oil leakage is causing the problem.
  - a. Leakage at the rocker arm cover may allow oil to flow over the converter housing or seep down between the converter housing and cylinder block causing oil to be present in or at the bottom of the converter housing.

**DIAGNOSIS AND TESTING (Continued)**

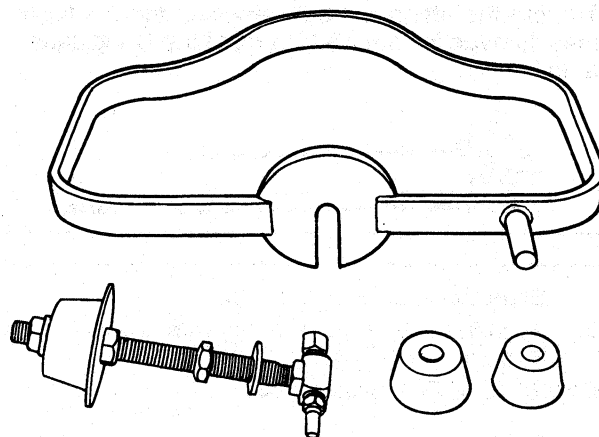
- b. Oil gallery plug leaks will allow oil to flow down the rear face of the block to the converter housing.
  - c. Leakage at the crankshaft seal will work back to the flywheel, and then into the converter housing.
5. The following procedures should be used to determine the cause of the leakage before service is made.
    - a. Remove the transaxle dipstick and note the color of the fluid. Original factory fill fluid is dyed red to aid in determining if leakage is from the engine or transaxle. Unless a considerable amount of makeup fluid has been added or the fluid has been changed, the red color should assist in pinpointing the leak.
    - b. Remove the converter housing cover. Clean off any fluid from the top and bottom of the converter housing, front of the transaxle case, and rear face of the engine and oil pan. Clean the converter area by washing with a suitable nonflammable solvent, and blow dry with compressed air.
    - c. Wash out converter housing and the front of the flywheel. The converter housing may be washed out using cleaning solvent and a squirt-type oil can. Blow all washer areas dry with compressed air.
    - d. Start and run the engine until the transaxle reaches its normal operating temperature. Observe the back of the block and top of the converter housing for evidence of fluid leakage. Raise the vehicle on a hoist. Refer to Pre-Delivery manual, Section 50-04. Run the engine at fast idle, then at engine idle, occasionally shifting to the DRIVE and REVERSE ranges to increase pressure within the transaxle.

Observe the front of the flywheel, back of the block (in as far as possible), and inside the converter housing and front of the transaxle case. Run the engine until fluid leakage is evident and the probable source of leakage can be determined.

**Converter Leakage Check**

If welds on the torque converter indicate leakage, remove the converter and make the following check.

Assemble Rotunda Torque Converter Leak Test Kit 021-00047 or equivalent to the converter. Test the converter for leaks, following the direction supplied with the Kit.

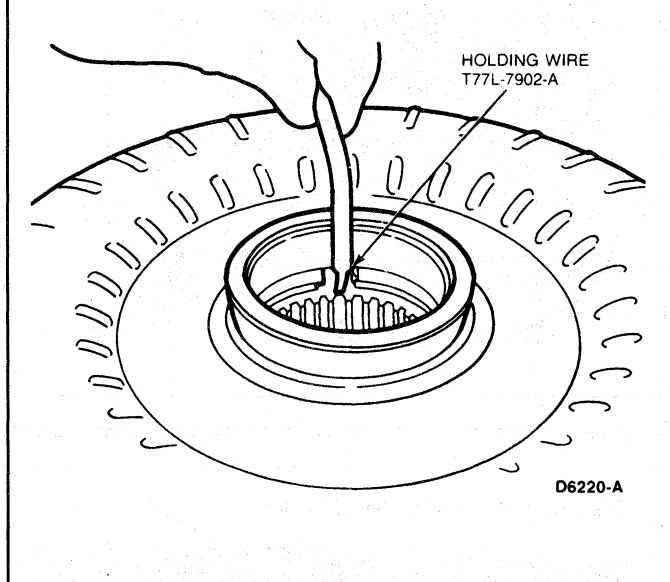


ROTUNDA TORQUE CONVERTER  
LEAK TEST KIT 021-00047

D4568-C

**DIAGNOSIS AND TESTING (Continued)****Torque Converter Reactor One-Way Clutch Check**

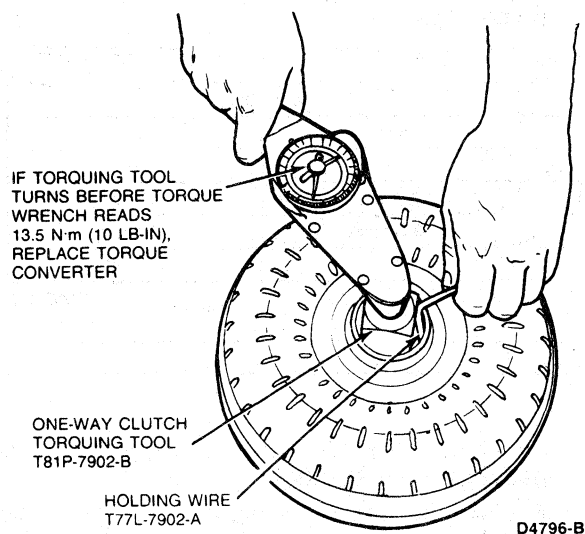
1. Position Holding Wire T77L-7902-A or equivalent in thrust washer slot.



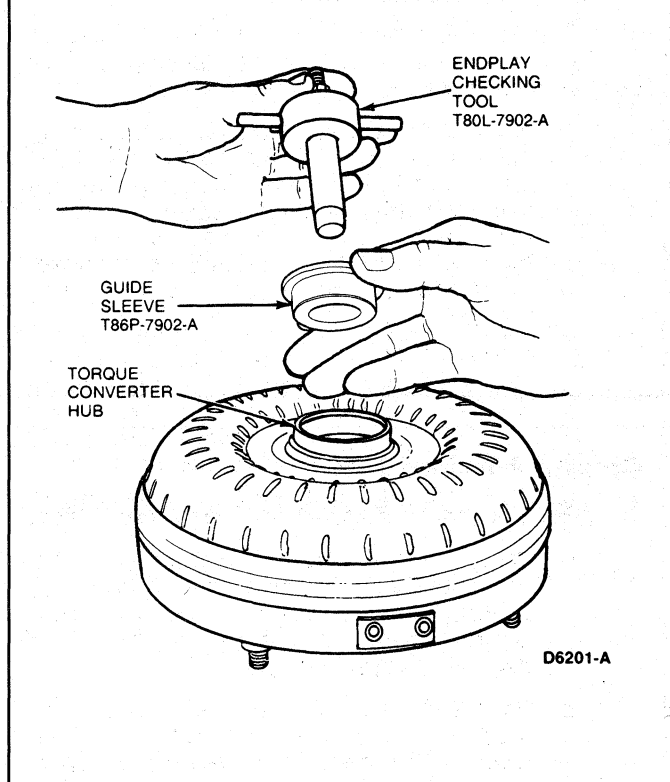
2. While holding wire in position install One-Way Clutch Torquing Tool T81P-7902-B or equivalent in reactor spline.

Continue holding wire and turn torquing tool counterclockwise with a torque wrench.

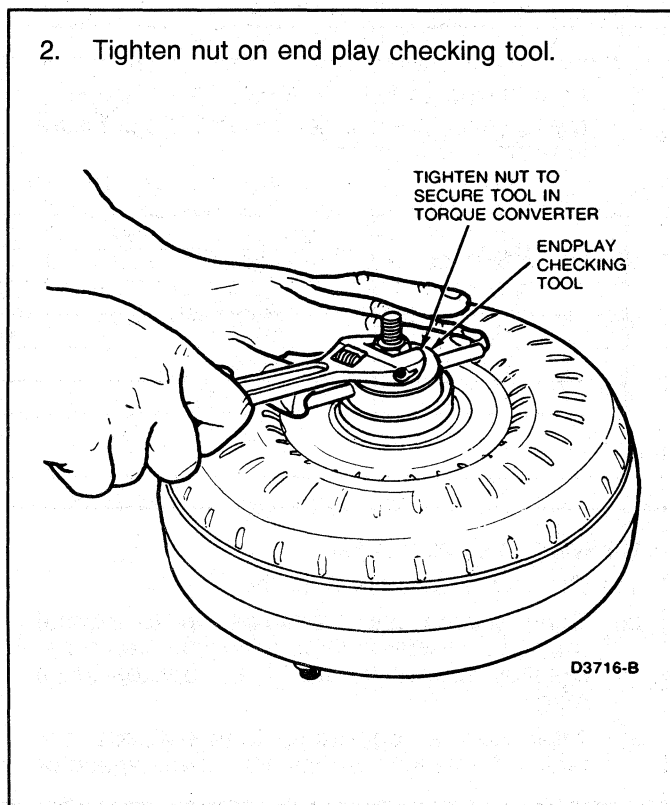
If torquing tool begins to turn before torque wrench reads 13.5 N·m (10 lb-ft), replace converter.

**Torque Converter End Play Check**

1. Position End Play Checking Tool T80L-7902-A and Guide Sleeve T86P-7902-A or equivalent in torque converter hub.



2. Tighten nut on end play checking tool.

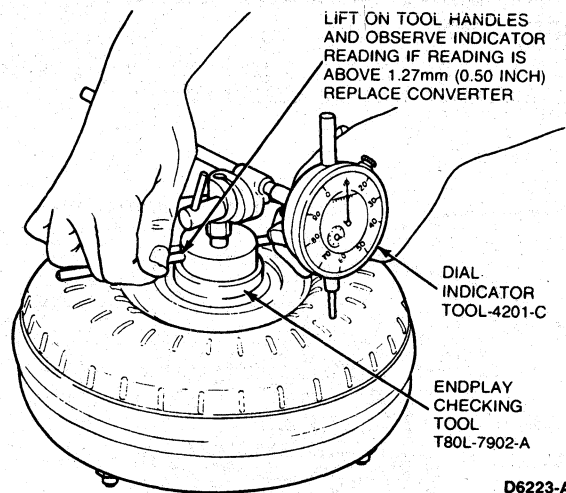


**DIAGNOSIS AND TESTING (Continued)**

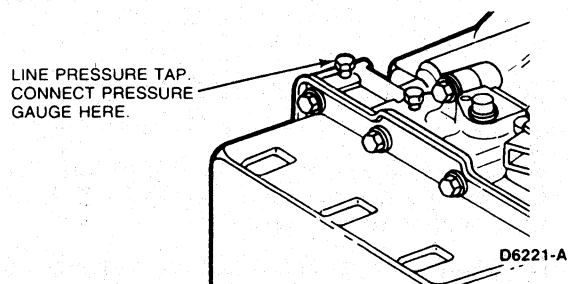
3. Mount Dial Indicator TOOL-4201-C or equivalent on end play checking tool.

With stylus contacting converter shell and with indicator zeroed, lift on checking tool handles.

If indicator reading is above 1.27mm (0.05 inch), replace the converter.

**Control Pressure Test**

1. Connect pressure gauge to line pressure tap.



2. Start engine and check line pressures. Refer to the following chart to determine if line pressure is within specification.

3. If line pressure is not within specification, perform air pressure checks and service main control system.

Range	Idle		WOT Stall	
	kPa	psi	kPa	psi
P, N	558-655	81-95	—	—
R	641-1048	93-152	1669-1924	242-279
Ⓓ, D	558-655	81-95	1089-1262	158-183
L	772-1165	112-169	1089-1262	158-183

CD6222-A

**Converter Clutch Test**

- Connect a tachometer to the vehicle.
- Bring engine and transaxle up to normal operating temperature by driving the vehicle at highway speeds for about 15 minutes in Ⓓ range.
- After normal operating temperatures are reached, maintain a constant vehicle speed of

about 80 km/h (50 mph), and tap the brake pedal with the left foot.

- Engine rpm should increase when the brake pedal is tapped, and decrease about five seconds after the pedal is released. If this does not occur, refer to Converter Clutch Diagnosis.

**DIAGNOSIS AND TESTING (Continued)****Stall Test**

The stall test checks the operation of the following items:

- Converter one-way clutch
- Forward clutch
- Low one-way clutch
- Reverse clutch
- Low-intermediate band
- Engine performance

NOTE: The stall test should only be performed with the engine and transaxle at normal operating temperatures.

**WARNING: APPLY THE SERVICE AND PARKING BRAKES FIRMLY WHILE PERFORMING EACH STALL TEST.**

1. Connect tachometer to engine.
2. After testing each of the following ranges (D, 1, R), move selector lever to N (NEUTRAL) and run engine for about 15 seconds to allow converter to cool before testing next range.

**CAUTION: Do not maintain WOT in any gear range for more than 5 seconds.**

Press accelerator to floor (WOT) in each range. Record rpm reached in each range. Stall speeds should be 1950-2275 rpm.

**CAUTION: If engine rpm recorded by tachometer exceeds maximum specified rpm, release accelerator immediately. Clutch or band slippage is indicated.**

If the stall speeds were too high, refer to the following Stall Speed Diagnosis chart. If the stall speeds were too low, first check engine tune-up. If engine is OK, remove torque converter and check torque converter reactor one-way clutch for slippage.

**STALL SPEED HIGH (SLIP)**

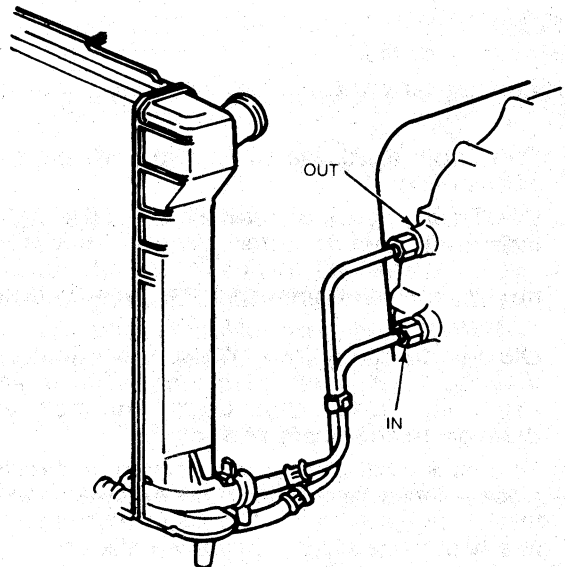
Range	Possible Source
D, 1	<ul style="list-style-type: none"> <li>• Forward Clutch</li> <li>• Low/Intermediate One-Way Clutch</li> <li>• Low/Intermediate Band or Servo</li> </ul>
R	<ul style="list-style-type: none"> <li>• Forward Clutch</li> <li>• Low/Intermediate One-Way Clutch</li> <li>• Reverse Clutch</li> </ul>

CD6125-A

**Transaxle Fluid Cooler Flow Test**

NOTE: The transaxle linkage adjustment, fluid level, and control pressure must be within specification before performing this test. Refer to Section 17-02 for transmission linkage adjustment.

1. Remove dipstick from filler tube.
2. Place funnel in filler tube.
3. Raise vehicle. Refer to Pre-Delivery manual, Section 50-04.
4. Remove cooler return line (lower fitting) from fitting on transaxle case.
5. Connect a hose to cooler return line. Insert other end of hose into funnel in dipstick tube.
6. Start engine and set idle at 1000 rpm with transaxle in NEUTRAL range.
7. Observe fluid flow at funnel. When fluid flow is solid, the flow should be liberal.
8. If the flow is not liberal, stop engine. Disconnect hose from cooler return line and connect it to converter-out line fitting (upper fitting) on transaxle case.
9. Repeat Steps 6 and 7. If flow is now liberal, refer to Section 27-03 for Diagnosis of transmission fluid cooler. If flow is still not liberal, refer to Diagnosis for the following items:
  - Low pump capacity.
  - Main circuit system leakage.
  - Stuck converter drain valve or converter regulator valve.



D6224-A

**Shift Point Tests**

This test verifies that the governor pressure and shift control valves are operating properly.

## DIAGNOSIS AND TESTING (Continued)

### Road Test

1. Bring engine and transaxle up to normal operating temperature.
2. Operate the vehicle with the transmission selector in  $\textcircled{D}$  range.
3. Apply minimum throttle pressure and observe upshift speeds and speed at which converter clutch applies. Refer to Technical Service Bulletin Special Specifications issue.
4. Stop vehicle and move transmission selector to D range. Repeat Step 3. Transaxle will make all upshifts except 3-4 and converter clutch apply should occur above 46 km/h (27 mph).
5. Depress accelerator pedal to floor (WOT). Transaxle should shift from third to second, or third to first depending on vehicle speed and converter clutch should release.

NOTE: With transmission selector in  $\textcircled{D}$  range, a 4-3 WOT downshift can be obtained regardless of vehicle speed.

6. With vehicle speed above 48 km/h (30 mph), move transmission selector from D range to 1 range (LOW) and remove foot from accelerator pedal. Transaxle should immediately downshift to second gear. When vehicle speed drops below 32 km/h (20 mph), transaxle should downshift into first gear.
7. If transaxle fails to upshift and/or downshift as outlined, refer to Diagnosis for Governor Pressure and Shift Control Valves.

At the shift points, the speedometer needle will make a momentary surge, a slight driveline bump may be felt and engine speed will drop without releasing accelerator pedal. If shift speeds are not within specification, perform Governor Check as outlined. If shift points are too low, the shift modulator valves may be the possible cause.

### Air Pressure Checks

A NO DRIVE condition can exist, even with correct transaxle fluid pressure, because of inoperative clutches or bands. An erratic shift can be located through a series of checks by substituting air pressure for fluid pressure to determine the location of the malfunction.

When the selector lever is in a forward gear range ( $\textcircled{D}$ , D, 1), a NO DRIVE condition may be caused by an inoperative forward clutch, low/intermediate one-way or low/intermediate band. No manual low (1) coast could be caused by an inoperative direct clutch or direct one-way clutch.

Failure to drive in R (REVERSE) could be caused by a malfunction of the reverse clutch, forward clutch or low/intermediate one-way clutch.

1. Drain transaxle fluid and remove oil pan.
2. Remove main control cover. Then remove oil pump and main control assembly.
3. Install air pressure test plate with main control assembly-to-chain cover gasket.

### In-Shop Test

The following items can be checked during an in-shop shift test:

- Governor circuits.
- Shift delay pressures.
- Throttle boost.

1. Raise front of vehicle so that front wheels are clear of floor.

**CAUTION: Do not exceed 97 km/h (60 mph) indicated speedometer speed. Indicated speed is one-half of actual tire speed. Do not exceed recommended tire speed rating.**

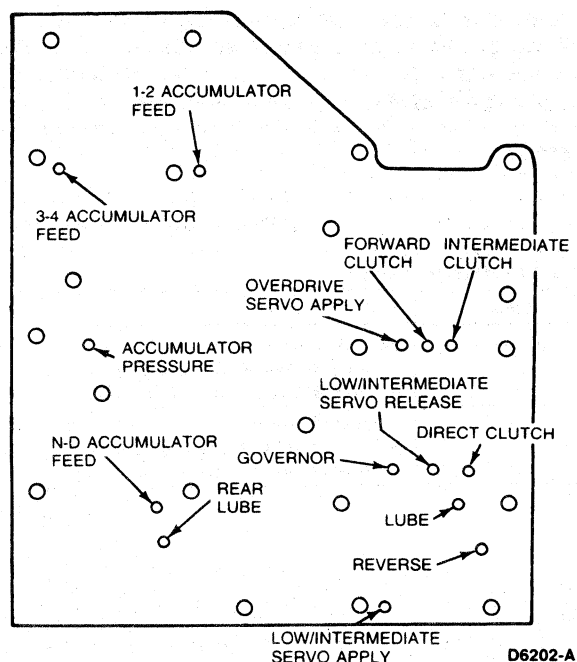
**CAUTION: The suspension should not be allowed to hang free. When the constant velocity joint is run at a very high angle, extra vibrations can occur as well as damage to the seals and joints.**

2. To check shift valves and governor circuit, place selector lever in  $\textcircled{D}$  range. Apply minimum throttle pressure and observe upshift speeds and speeds at which converter locks up.

The transaxle should shift in the following order:

- 1-2
- 2-3
- Converter lockup
- 3-4

NOTE: Converter will remain locked up when transaxle shifts into fourth.



**DIAGNOSIS AND TESTING (Continued)**

4. The inoperative clutches or bands can be located by introducing air pressure into the various test plate passages as follows:

**Forward Clutch**

Apply air pressure to forward clutch test port. A dull thud can be heard, or movement of piston felt when clutch piston is applied. If clutch seal(s) are leaking, a hissing sound will be heard.

**Governor**

Apply air pressure to governor test port and listen for a sharp clicking or whistling noise. The noise indicates proper governor movement.

**Overdrive Servo**

Apply air pressure to overdrive servo apply test port. Operation of servo is indicated by a tightening of overdrive band around overdrive drum. Because of the cushioning effect of the servo release spring, application of band may not be heard or felt. The servo should hold air pressure without leakage and a dull thud should be heard when air pressure is removed, allowing servo piston to return to release position.

**Direct Clutch**

Apply air pressure to direct clutch test port. A dull thud can be heard, or movement of piston felt on case as clutch piston is applied. If clutch seal(s) are leaking, a hissing sound will be heard.

**Intermediate Clutch**

Apply air pressure to intermediate clutch test port. A dull thud can be heard, or movement of piston can be felt on case as clutch piston is applied. If clutch seal(s) are leaking, a hissing sound will be heard.

**Low-Intermediate Servo**

Apply air pressure at low-intermediate servo feed test port. The low-intermediate band should tighten around sun gear of rear planetary gear set. Because of the cushioning effect of the servo release spring, application of band may not be heard or felt.

servo should hold air pressure without leakage and a dull thud should be heard when air pressure is removed, allowing servo piston to return to release position. Apply air pressure to low-intermediate servo release test port while continuing to pressurize the apply port. Servo piston should return to the release position. The band should loosen and a dull thud should be heard. Release the feed test port. The release test port should hold pressure without leakage. Any leakage or failure of piston movement requires servo service.

**Lube and Rear Lube**

Apply air pressure to lube and rear lube test ports. These passages can only be checked for blockage. If either passage holds air pressure, remove service tool plate and check for an obstruction or damage.

**1-2, 3-4, and N-D Accumulators**

Apply air pressure to each accumulator feed port. Accumulator should apply. Because of the cushioning effect of the accumulator release spring, application of accumulator may not be felt or heard. The accumulator should hold air pressure without leakage and a dull thud should be heard when air pressure is removed, allowing accumulator to return to release position.

**Test Results**

If the servos do not operate, disassemble, clean and inspect them to locate the source of the trouble.

If air pressure applied to the clutch passages fails to operate a clutch, or operates clutches simultaneously, remove, and with air pressure, check the fluid passages in the chain cover, driven sprocket support and clutches to detect obstructions.

If air pressure applied to the accumulator passages fails to operate an accumulator, remove, and with air pressure, check the fluid passages in the chain cover to detect obstructions.

**DIAGNOSIS**

Use the following diagnosis charts to diagnose problems in the transaxle.

**DIAGNOSIS — AUTOMATIC TRANSAXLE — AXOD**

CONDITION	POSSIBLE SOURCE	ACTION
Oil Leak	1. Side pan or bottom pan. • Low bolt torque. • Damaged gasket or pan rail. • Distorted pan.	1. Service as required.
	2. TV cable, fill tube or electrical bulkhead connector. • Loose fit/damaged case. • External seal damage/missing.	2. Service as required.
	3. Manual shaft. • Damaged seal.	3. Replace seal.
	4. Governor cover and servo covers. • Damaged O-Ring seal.	4. Replace O-Ring seal.
	5. Converter fittings or pressure taps. • Low torque, damaged threads.	5. Service as required.
	6. Converter or converter seal. • Damaged seal assembly, or garter spring missing. • Converter hub scored. • Weld seam leaking.	6. Service as required.
	7. Halfshaft seals. • Damaged seal assembly, or garter spring missing.	7. Replace seal.
	8. Speedometer cable or speed sensor. • Damaged O-Ring seal.	8. Replace O-Ring seal.
Oil Venting or Foaming	1. Oil level (venting). • Transaxle overfilled.	1. Drain and fill transaxle to proper level.
	2. Transmission fluid. • Contaminated with antifreeze or engine overheating.	2. Determine source of leak. Service as required.
	3. Bi-metallic element stuck open.	3. Replace element.
	4. Oil filter plugged/damaged. • Damaged/missing O-Rings.	4. Replace filter O-Rings and filter.
High or Low Oil Pressure (Verify With Gauge)	1. Oil level. • Oil level too low or too high.	1. Drain or fill transaxle as necessary.
	2. TV cable/linkage. • Improper actuation (travel).	2. Service as required.
	3. Pressure regulator valve or spring. • Nicked scored bore or valve. • Damaged spring.	3. Determine source of damage. Service as required.
	4. Pressure relief valve. • Damaged or missing spring, missing ball.	4. Service as required.



**DIAGNOSIS (Continued)****DIAGNOSIS — AUTOMATIC TRANSAXLE — AXOD — Continued**

<b>CONDITION</b>	<b>POSSIBLE SOURCE</b>	<b>ACTION</b>
High or Low Oil Pressure (Verify With Gauge) — Continued	5. Oil pump assembly. <ul style="list-style-type: none"> <li>• Ring stuck, seals damaged, vanes damaged.</li> <li>• Pump driveshaft broken or damaged.</li> </ul>	5. Determine source of damage. Service as required.
No 1-2 Shift (First Gear Only)	1. Governor assembly. <ul style="list-style-type: none"> <li>• Weights binding.</li> <li>• Springs damaged, misaligned or missing.</li> <li>• Gears damaged.</li> <li>• Governor shaft seal damaged or missing.</li> <li>• Governor valve (ball) stuck or missing.</li> <li>• Governor tube leaking/damaged.</li> </ul>	1. Perform governor test. Service as required.
	2. Intermediate clutch assembly. <ul style="list-style-type: none"> <li>• Clutch plates damaged/missing.</li> <li>• Piston or seals damaged.</li> <li>• Ball check assembly stuck/damaged or missing.</li> <li>• Clutch cylinder damaged.</li> </ul>	2. Determine source of contamination or damage. Inspect welds. Service as required.
	3. Direct/intermediate clutch hub. <ul style="list-style-type: none"> <li>• Seals damaged/missing or holes blocked.</li> </ul>	3. Determine source of contamination or damage. Service as required.
	4. Driven sprocket support. <ul style="list-style-type: none"> <li>• Seals damaged/missing or holes blocked.</li> </ul>	4. Determine source of contamination or damage. Service as required.
	5. 1-2 shift valve. <ul style="list-style-type: none"> <li>• Stuck, nicked or damaged.</li> </ul>	5. Determine source of contamination or damage. Service as required.
	6. 1-2 throttle delay valve. <ul style="list-style-type: none"> <li>• Stuck, nicked or damaged.</li> </ul>	6. Determine source of contamination or damage. Service as required.
	7. 1-2 Accumulator capacity modulator valve. <ul style="list-style-type: none"> <li>• Stuck, nicked or damaged.</li> </ul>	7. Determine source of contamination or damage. Service as required.
	8. No. 9 check ball. <ul style="list-style-type: none"> <li>• Missing or damaged.</li> </ul>	8. Replace check ball.
	9. Control assembly. <ul style="list-style-type: none"> <li>• Bolts too loose or too tight.</li> </ul>	9. Tighten bolts to specification.
	10. Front carrier damaged.	10. Inspect welds. Service as required.
	11. Intermediate clutch tap plug loose/missing. (Located on oil pump body).	11. Service as required.
1-2 Shift Feels Harsh or Soft	1. Oil pressure <ul style="list-style-type: none"> <li>• High or low oil pressure.</li> </ul>	1. Perform control pressure test. Service as required.

## DIAGNOSIS (Continued)

## DIAGNOSIS — AUTOMATIC TRANSAXLE — AXOD — Continued

CONDITION	POSSIBLE SOURCE	ACTION
1-2 Shift Feels Harsh or Soft — Continued	2. 1-2 Accumulator regulator valve. • Valve stuck, nicked or damaged. • Spring missing or damaged.	2. Determine source of contamination or damage. Service as required.
	3. TV cable/linkage. • Improper actuation.	3. Service as required.
	4. 1-2 Accumulator capacity modulator valve. • Valve stuck, nicked or damaged. • Spring missing or damaged.	4. Determine source of contamination or damage. Service as required.
	5. 1-2 Accumulator assembly. • Piston stuck or damaged. • Seal damaged or missing. • Springs damaged or missing.	5. Determine source of contamination or damage. Service as required.
1-2 Shift Speed High or Low	1. Governor pressure. • Weights binding. • Spring damaged, misaligned or missing. • Gear damaged. • Shaft seal, damaged or missing. • Governor lube tube leaking/damaged. • Valve balls damaged, stuck or missing.	1. Perform governor test. Service as required.
	2. TV cable/linkage • Improper actuation.	2. Service as required.
	3. Control assembly: TV control valve, TV plunger, TV line modulator valve, 1-2 throttle delay valve. • Valve(s) stuck, nicked or damaged. • Spring(s) missing or damaged. • Valve balls damaged, stuck or missing.	3. Determine source of contamination. Service as required.
No 2-3 Shift (1-2 Shift OK)	1. Governor assembly. • Weights binding. • Springs damaged. • Gear damaged. • Shaft seal or valve stuck or missing. • Governor tube leaking/damaged. • Valve balls damaged, stuck or missing.	1. Perform governor test. Service as required.

## DIAGNOSIS (Continued)

## DIAGNOSIS — AUTOMATIC TRANSAXLE — AXOD — Continued

CONDITION	POSSIBLE SOURCE	ACTION
No 2-3 Shift (1-2 Shift OK) — Continued	2. Low/Intermediate servo. • Wrong apply rod (too long). • Servo bore or piston damaged. • Piston seals damaged/missing. • Missing/broken return spring or retaining clip.	2. Install correct apply rod, if required. Determine source of contamination. Service as required.
	3. Direct clutch assembly. • Clutch plates damaged/missing. • Piston or seals damaged. • Ball check assembly stuck or missing. • Cylinder damage.	3. Determine source of contamination or damage. Service as required.
	4. Direct/Intermediate clutch hub. • Seals damaged or missing or holes blocked.	4. Determine source of contamination. Service as required.
	5. Driven sprocket support. • Seals damaged or missing or holes blocked.	5. Determine source of contamination. Service as required.
	6. Direct one-way clutch assembly. • Damaged cage/rollers/springs. • Missing rollers. • Misassembled on inner race.	6. Disassemble and inspect. Service as required.
	7. Control assembly. • Bolts too loose or too tight.	7. Tighten to specification.
	8. 2-3 shift valve. • Valve stuck, nicked or damaged.	8. Determine source of contamination. Service as required.
	9. No. 4 check ball missing/damaged.	9. Service as required.
	10. Bypass solenoid. • Not energized during wide open throttle upshift.	10. Refer to Electrical System Diagnosis in this Section.
	11. Case servo release passage. • Blocked.	11. Determine source of blockage. Service as required.
	12. Servo release tube. • Leaking. • Improperly installed.	12. Service as required.
	13. Direct clutch pressure tap plug loose/missing on oil pump body.	13. Service as required.
2-3 Shift Feels Harsh or Soft	1. Low or high oil pressure.	1. Perform control pressure test. Service as required.
	2. Low/intermediate servo. • Wrong apply rod length. • Piston, seal, springs or rod damaged.	2. Install correct apply rod, if required. Determine source of damage. Service as required.

## DIAGNOSIS (Continued)

## DIAGNOSIS — AUTOMATIC TRANSAXLE — AXOD — Continued

CONDITION	POSSIBLE SOURCE	ACTION
2-3 Shift Feels Harsh or Soft — Continued	3. 2-3 servo regulator valve. • Valve stuck, nicked or damaged. • Spring damaged.	3. Determine source of contamination or damage. Service as required.
	4. Backout valve. • Valve stuck, nicked or damaged. • Spring damaged.	4. Determine source of contamination or damage. Service as required.
2-3 Shift Speed High or Low	1. Governor pressure. • Weights binding. • Springs damaged, misaligned or missing. • Gear damaged. • Shaft seal or valve damaged or missing. • Governor tube leaking/damaged. • Valve balls damaged, stuck or missing.	1. Perform governor pressure test. Service as required.
	2. TV cable/linkage. • Improper actuation.	2. Service cable as required.
	3. Control assembly: TV control valve, TV plunger, TV line modulator valve, 2-3 throttle modulator valve. • Valve(s) stuck, nicked or damaged.	3. Determine source of contamination or damage. Service as required.
No 3-4 Shift	1. Governor assembly. • Weights binding. • Spring damaged/misaligned. • Gear damaged. • Shaft seal damaged or missing. • Valve balls damaged, stuck or missing. • Governor lube tube leaking or damaged.	1. Perform governor test. Service as required.
	2. Overdrive band assembly not holding.	2. Perform air pressure test. Service as required.
	3. Overdrive servo assembly. • Wrong apply rod (too long). • Servo bore or piston damaged. • Piston seals damaged or missing. • Missing or broken return spring or retaining clip.	3. Install correct apply rod, if required. Determine source of contamination or damage. Service as required.
	4. Forward clutch assembly. • Damaged return springs/piston.	4. Determine source of damage. Service as required.

## DIAGNOSIS (Continued)

## DIAGNOSIS — AUTOMATIC TRANSAXLE — AXOD — Continued

CONDITION	POSSIBLE SOURCE	ACTION
No 3-4 Shift — Continued	5. Control assembly bolts too loose or too tight.	5. Tighten bolts to specification.
	6. 3-4 shift valve. • Valve stuck, nicked or damaged. • Spring damaged.	6. Determine source of contamination or damage. Service as required.
	7. 3-4 modulator valve. • Valve stuck, nicked or damaged. • Spring missing.	7. Determine source of contamination or damage. Service as required.
	8. 4-3 scheduling valve. • Valve stuck, nicked or damaged. • Spring missing.	8. Determine source of contamination. Service as required.
3-4 Shift Feels Harsh or Soft	1. Oil pressure too high or too low.	1. Perform control pressure test.
	2. 3-4 Accumulator assembly. • Accumulator piston stuck or damaged. • Piston seal missing or damaged. • Springs missing or damaged.	2. Determine source of damage or contamination. Service as required.
	3. No 14 ball check. • Ball missing/damaged.	3. Replace check ball.
3-4 Shift Speed High or Low	1. Governor pressure. • Weights binding. • Spring damaged, misaligned or missing. • Gear damaged. • Shaft seal or valve missing or damaged. • Governor tube leaking.	1. Perform governor test. Service as required.
	2. Control assembly: TV control valve, TV plunger, TV line modulator valve, 3-4 modulator valve. • Valve(s) stuck, nicked or damaged. • Spring(s) missing or damaged.	2. Determine source of contamination or damage. Service as required.
No Converter Clutch Apply	1. Transaxle electrical system or electronic engine control. • No lock-up signal. • By-pass solenoid damaged or inoperative. • Bulkhead connector damaged. • Pinched wires. • 4-3 pressure switch, 3-2 pressure switch inoperative.	1. Refer to Electrical System Diagnosis in this Section.

## DIAGNOSIS (Continued)

## DIAGNOSIS — AUTOMATIC TRANSAXLE — AXOD — Continued

CONDITION	POSSIBLE SOURCE	ACTION
No Converter Clutch Apply — Continued	2. Turbine shaft. • Damaged or missing seals.	2. Service as required.
	3. Bypass clutch control valve. • Bypass clutch control valve stuck. • Bypass plunger stuck.	3. Determine source of contamination. Service as required.
	4. Pump shaft. • Missing or damaged seals. • Missing or damaged cup plug.	4. Determine source of contamination or damage. Service as required.
	5. Valve body pilot sleeve. • Damaged/misaligned.	5. Determine source of damage. Service as required.
Converter Clutch Does Not Release	1. Electronic engine control or transmission electrical system. • No unlock signal. • Bypass solenoid damaged or inoperative. • Bulkhead connector wires damaged.	1. Refer to Electrical System Diagnosis in this Section.
	2. Bypass clutch control valve or plunger valve. • Valve stuck, nicked or damaged.	2. Determine source of contamination. Service as required.
	3. Solenoid filter plug (in main control).	3. Solenoid filter plug (in main control).
4-3 Downshifts Harsh	1. Overdrive servo assembly. • Incorrect servo apply rod length. • Damaged servo piston or seal. • Damaged or missing springs.	1. Install correct apply rod, if required. Determine source of contamination or damage. Service as required.
	2. No converter clutch release.	2. Refer to electrical system diagnosis in this section.
3-2 Downshift Harsh	1. Low/intermediate servo assembly. • Damaged or missing springs. • Incorrect servo apply rod length.	1. Install correct apply rod, if required. Determine source of contamination or damage. Service as required.
	2. 3-2 Control valve. • Valve stuck, nicked or damaged.	2. Determine source of contamination. Service as required.
	3. No. 5 ball check. • Ball missing.	3. Replace ball check.
3-1, 2-1 Downshift Harsh	1. Low/intermediate servo assembly. • Damaged servo piston or seal. • Damaged or missing springs • Incorrect servo apply rod length.	1. Install correct apply rod, if required. Determine source of damage. Service as required.

**DIAGNOSIS (Continued)****DIAGNOSIS — AUTOMATIC TRANSAXLE — AXOD — Continued**

CONDITION	POSSIBLE SOURCE	ACTION
3-1, 2-1 Downshift Harsh — Continued	2. No. 9 ball check. • Ball missing (3-1 only).	2. Replace ball check.
No Drive in Drive Range and No Reverse in Reverse Range	1. Oil level low.	1. Service as required.
	2. Oil pressure. • Pressure too low.	2. Perform control pressure test. Service as required.
	3. Manual linkage. • Misadjusted, disconnected, damaged, broken, bent.	3. Service as required. Refer to Section 17-02.
	4. Oil pump assembly. • Oil pump worn or damaged. • Oil pump drive shaft damaged.	4. Determine source of damage. Service as required.
	5. Drive chain assembly. • Damaged/broken.	5. Determine source of damage. Service as required.
	6. Drive sprocket. • Sprocket shaft to converter turbine spline damaged.	6. Determine source of damage. Service as required.
	7. Driven sprocket. • Sprocket shaft to direct/ intermediate clutch hub damaged.	7. Determine source of damage. Service as required.
	8. Oil filter. • Damaged/missing O-rings. • Plugged O-rings.	8. Service or replace as required.
	9. Forward clutch assembly. • Burned or missing clutch plates. • Damaged piston seals or pistons. • Forward clutch ball check assembly missing or damaged. • Driven sprocket support seals damaged/missing or holes blocked. • Direct intermediate clutch hub seals damaged/missing or holes blocked.	9. Determine source of contamination or damage. Service as required.
	10. Gear set. • Front son. • Front/rear carriers. • Ring gear. • Final drive assembly.	10. Service as required.
No Drive — Reverse OK	1. Low/intermediate band assembly. • Burned. • Broken ends.	1. Determine source of damage. Service as required.

## DIAGNOSIS (Continued)

## DIAGNOSIS — AUTOMATIC TRANSAXLE — AXOD — Continued

CONDITION	POSSIBLE SOURCE	ACTION
No Drive — Reverse OK — Continued	2. Low/intermediate servo assembly. • Wrong apply rod (too short). • Piston/seal/rod damaged.	2. Install correct apply rod, if required. Determine source of contamination. Service as required.
	3. Low/intermediate servo oil tubes. • Damaged (leaking oil). • Damaged case bores.	3. Service as required.
	4. 2-3 Servo valve out of position due to broken or missing cup.	4. Service as required.
	5. Output shaft. • Damaged splines/misassembled with axles.	5. Determine source of damage. Service as required.
	6. Halfshaft. • Damaged splines. • Disengaged from transaxle.	6. Refer to Section 15-22.
No Reverse	1. Reverse clutch. • Burned or missing plates.	1. Determine source of damage. Service as required.
	2. Reverse apply tube. • Leaking. • Improperly installed.	2. Service as required.
No Park Range	1. Damaged park mechanism. • Chipped or broken parking pawl or park gear. • Broken park pawl return spring. • Bent or broken actuating rod. • Manual linkage misadjusted.	1. Determine source of damage. Service as required.
Harsh Neutral to Reverse or Harsh Neutral to Drive	1. Low/intermediate servo assembly. • Damaged or missing springs. • Incorrect servo apply rod length.	1. Install correct apply rod, if required. Determine source of contamination or damage. Service as required.
	2. 3-2 Control valve. • Valve stuck, nicked or damaged.	2. Determine source of contamination. Service as required.
	3. No. 5 ball check. • Ball missing.	3. Replace ball check.
	4. Neutral-drive accumulator assembly. • Accumulator piston stuck. • Accumulator seal damaged or missing. • Accumulator springs damaged or missing.	4. Determine source of contamination. Service as required.
	5. No. 1 ball check. • Ball missing/damaged (harsh reverse).	5. Replace ball.



## DIAGNOSIS (Continued)

## DIAGNOSIS — AUTOMATIC TRANSAXLE — AXOD — Continued

CONDITION	POSSIBLE SOURCE	ACTION
Harsh Neutral to Reverse or Harsh Neutral to Drive — Continued	6. Main control separator plate. • Thermal elements do not close when warm.	6. Service as required.
Transaxle overheats	1. Excessive tow loads.	1. Check Owner's Manual for tow restriction.
	2. Improper fluid level.	2. Perform fluid level check.
	3. Incorrect engine idle or performance.	3. Refer to Engine Diagnosis.
	4. Improper clutch or band application, or oil pressure control system.	4. Perform control pressure test.
	5. Restriction in cooler or lines.	5. Service restriction.
	6. Seized converter one-way clutch.	6. Replace converter.
	7. Dirty or sticking valve body.	7. Clean, service or replace valve body.
Transaxle fluid leaks	1. Improper fluid level.	1. Perform fluid level check.
	2. Leakage at gaskets, seals, etc.	2. Remove all traces of lubrication on exposed surfaces of transaxle. Check the vent for free-breathing. Operate transaxle at normal temperatures and inspect for leakage. Service as required.

CD6136-B

**DIAGNOSIS (Continued)****Electrical System**

The following tests are to be performed if a problem is found with the transaxle. Before these tests are performed, the Electronic Engine Control (EEC IV) Self-Test in the Engine/Emission Diagnosis\* manual should be performed to determine if any service codes for the transaxle appear. If any of the following service codes appear during the self-test, the AXOD drive cycle test for continuous codes should be performed:

**Service Codes**

- **39:** Transaxle converter bypass clutch not operating properly.
- **59:** 4/3 pressure switch circuit failed open.
- **62:** 4/3 and/or 3/2 pressure switch circuit failed closed. If code appears in Key On, Engine Off test, 3/2 circuit failed. If code appears in Engine Running test, 4/3 circuit failed. If code appears in both tests, both circuits must be checked.
- **69:** 3/2 circuit failed open.
- **89:** Transaxle converter bypass clutch solenoid failed always open or always closed.

The following service codes are not transaxle related, but can affect converter clutch bypass operation. Service these components before servicing the transaxle codes:

- **21:** Engine coolant temperature (ECT) sensor out of range.
- **22:** Manifold absolute pressure (MAP) sensor out of range.
- **23:** Throttle position (TP) sensor out of range.
- **24:** Air charge temperature (ACT) sensor out of range.
- **29:** Vehicle speed sensor (VSS) not functioning.
- **74:** Brake On/Off (BOO) switch always open or brake not applied during Engine Running On-demand self-test.
- **75:** Brake On/Off (BOO) switch always closed.

The following service code is for a transaxle component that may cause faulty engine idle speed control if not working properly:

- **57:** Neutral pressure switch (NPS) failed in NEUTRAL (open). The NPS is a normally open switch that closes with hydraulic pressure. Failure of the transaxle to engage in D or R would result in service code 57. Check for proper hydraulic function before testing electrical components.

After performing the EEC-IV Self-Test, the following Drive Cycle for checking AXOD continuous codes must be performed. Perform Drive Cycle on flat terrain or a slight upgrade.

1. Record and zero EEC-IV Self-Test codes.
2. Warm engine to operating temperature.
3. With transaxle in D range, lightly accelerate from a stop to 64 km/h (40 mph), to allow transaxle to shift into third gear. Hold speed and throttle opening steady for a minimum of 15 seconds (30 seconds above 4,000 feet altitude).
4. Shift transaxle to ③ range and accelerate from 64 km/h (40 mph) to 80 km/h (50 mph), to allow transaxle to shift to fourth gear. Hold speed and throttle position steady for a minimum of 15 seconds.
5. With transaxle in fourth and maintaining steady speed and throttle opening (throttle must not be closed), lightly apply and release brakes (to operate brakelamps). Then, hold speed and throttle opening steady for an additional 15 seconds minimum.
6. Brake to a stop and remain stopped for a minimum of 20 seconds with transaxle in ③ range.
7. Perform EEC-IV Self-Test and record continuous codes.

If any of the following continuous codes appear, refer to the Diagnosis chart for that code:

NOTE: If any other continuous codes appear, service those codes first as they could affect the electrical operation of the transaxle.

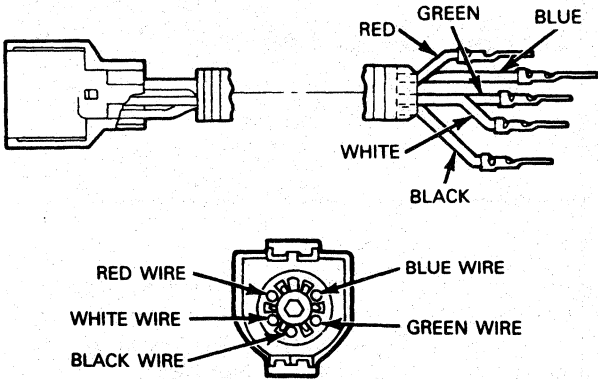
**DIAGNOSIS CHART INDEX**

Service Code	Pinpoint Test
39	A
59	B
62	C
69	D
89	E
57	F

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## DIAGNOSIS (Continued)

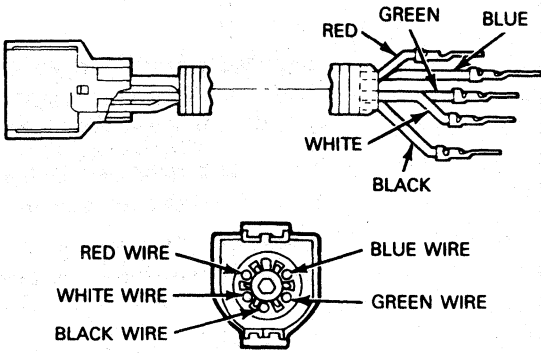
## Transaxle Converter Bypass Clutch Not Applying Properly — Code 39 — Pinpoint Test A

TEST STEP	RESULT	ACTION TO TAKE
<b>A1</b> CHECK HARNESS CONNECTIONS <ul style="list-style-type: none"> <li>• Check that vehicle harness connector is fully engaged on the transaxle connector.</li> <li>• Check that vehicle harness connector terminals are fully engaged in the connector.</li> </ul>	<p>OK →</p> <p>✗ →</p>	<p>GO to A2.</p> <p>SERVICE or REPLACE as required. REPEAT Self-Test.</p>
<b>A2</b> CHECK RESISTANCE OF SOLENOID <ul style="list-style-type: none"> <li>• Install service jumper harness to transaxle bulkhead connector.</li> <li>• Connect ohmmeter positive lead to red wire and negative lead to black wire.</li> <li>• Check resistance.</li> <li>• Resistance should be between 20-40 ohms.</li> </ul>  <p><b>CAUTION:</b> Do not connect a power supply with reversed polarity to these wires or solenoid diode will be damaged.</p>	<p>OK →</p> <p>✗ →</p>	<p>REFER to Engine/Emissions Diagnosis* manual, Volume H Self-Test Section and PERFORM service on codes as required.</p> <p>GO to A3.</p>

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## DIAGNOSIS (Continued)

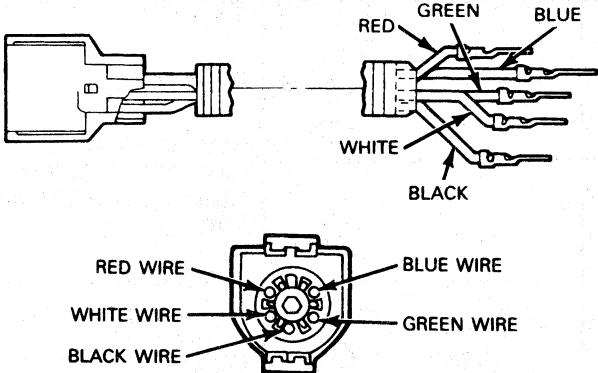
## Transaxle Converter Bypass Clutch Not Applying Properly — Code 39 — Pinpoint Test A — Continued

TEST STEP	RESULT	ACTION TO TAKE
<p><b>A3</b> CHECK BYPASS CLUTCH APPLICATION</p> <ul style="list-style-type: none"> <li>Connect service tool jumper harness red wire to battery + power supply.</li> <li>With engine running and transmission in 3rd gear, connect the service tool harness black wire to ground to energize bypass clutch solenoid.</li> </ul>  <p><b>SERVICE TOOL JUMPER</b></p> <p><b>CAUTION:</b> Do not connect a power supply with reversed polarity to these wires or solenoid diode will be damaged.</p>	<p>Clutch applies — engine speed drops slightly</p> <p>Clutch does not apply — engine speed does not drop slightly</p>	<p>No electrical component failure.</p> <p>Bypass clutch solenoid operating properly.</p> <p>Error code may be indicating a slipping bypass clutch.</p> <p>Refer to torque converter service or transaxle diagnosis. "No Converter Clutch Apply."</p> <p>If transaxle service is required, REPEAT Self-Test after service.</p> <p>GO to A4.</p>
<p><b>A4</b> CHECK BYPASS SOLENOID VALVE</p> <ul style="list-style-type: none"> <li>Check main control bypass clutch control valve for sticking condition.</li> </ul>	<p>OK</p> <p>OK</p>	<p>GO to A5.</p> <p>SERVICE spool valve as necessary.</p>
<p><b>A5</b> CHECK BYPASS SOLENOID (Continued)</p> <ul style="list-style-type: none"> <li>Remove bypass solenoid.</li> <li>Check condition of O-ring.</li> <li>Shake solenoid to check for free armature and internal valve.</li> <li>Check for contamination in/on solenoid (NOTE: Small hole in valve)</li> </ul>	<p>OK</p> <p>OK</p>	<p>REFER to Torque Converter Service or Transaxle Diagnosis "No Converter Clutch Apply." If transaxle requires service, REPEAT Self-Test after service.</p> <p>REPLACE bypass clutch solenoid. REPEAT Self-Test.</p>

CD5993-B

## DIAGNOSIS (Continued)

## THS 4/3 Switch Circuit Failed To Open — Code 59 — Pinpoint Test B

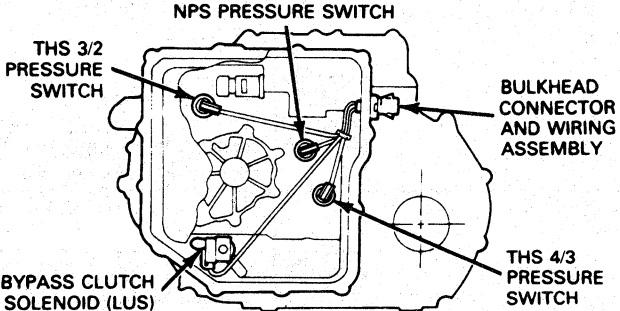
TEST STEP	RESULT	ACTION TO TAKE
<p><b>NOTE:</b> THS 4/3, 3/2 pressure switches are normally open switches that close with hydraulic pressure. Failure of transaxle to engage in DRIVE would result in service code 59; failure of transaxle to shift to 3rd gear would result in service code 69. Check for these proper hydraulic functions before testing electrical parts.</p>		
<b>B1</b> CHECK WIRING		
<ul style="list-style-type: none"> <li>Check that vehicle harness connector is fully engaged on the transmission bulkhead connector and that the vehicle harness terminals are fully engaged in connector.</li> </ul>	<p>OK ► GO to B2.</p> <p>OK/NO ► SERVICE as required. REPEAT Self-Test.</p>	
<b>B2</b> CHECK SWITCH FOR CONTINUITY		
<ul style="list-style-type: none"> <li>Install service jumper harness on transmission bulkhead connector.</li> </ul>  <ul style="list-style-type: none"> <li>Check for continuity between engine ground and blue wire with an ohmmeter or other low current tester (less than 200 milliamps).</li> <li>With engine running and transaxle in NEUTRAL, ohmmeter should show NO continuity (infinite resistance).</li> <li>Shift transaxle into DRIVE. Switch should close and resistance should be less than 10 ohms.</li> <li>Switch should stay closed in 1st, 2nd, and 3rd gears, then open in 4th gear.</li> </ul>	<p>Circuit</p> <p>OK ► REFER to Engine/Emissions Diagnosis* manual, Volume H Self-Test Section and PERFORM service on codes as required.</p> <p>Circuit</p> <p>OK/NO ► GO to B3.</p>	

\*Can be purchased as a separate item.

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## DIAGNOSIS (Continued)

## THS 4/3 Switch Circuit Failed To Open — Code 59 — Pinpoint Test B — Continued

TEST STEP	RESULT	ACTION TO TAKE
<b>B3</b> CHECK INTERNAL CONNECTIONS <ul style="list-style-type: none"> <li>Remove transaxle side oil pan and check that internal connector with blue wire is firmly connected to THS 4/3 pressure switch. Connector should not pull off easily or fit loosely.</li> </ul> 	<p> <input checked="" type="radio"/> OK → GO to B4.  <input type="radio"/> <del>OK</del> → REPLACE bulkhead connector and wiring assembly. REPEAT Self-Test.         </p>	
<b>B4</b> CHECK INTERNAL WIRING <ul style="list-style-type: none"> <li>Remove connector from pressure switch by pushing on end of connector, while pulling on wire end of connector.</li> <li>Check for continuity in the bulkhead connector by measuring resistance between service tool blue wire and terminal inside connector just removed.</li> <li>Resistance should be less than 2.0 ohms.</li> </ul>	<p> <input checked="" type="radio"/> OK → GO to B5.  <input type="radio"/> <del>OK</del> → REPLACE bulkhead connector and wiring assembly. REPEAT Self-Test.         </p>	
<b>B5</b> CHECK THS 4/3 SWITCH <ul style="list-style-type: none"> <li>Remove THS 4/3 pressure switch and install in a 1/8-27 pipe fitting that can be connected to a low pressure air supply for pressure leak testing and switch closure.</li> </ul> <p><b>CAUTION: Do not test with water since internal switch materials will be damaged.</b></p> <ul style="list-style-type: none"> <li>With 345 kPa (50 psi) air pressure applied, check for ruptured diaphragm.</li> <li>Submerge switch in transmission oil and check for bubbles flowing out of small vent hole near the switch terminal.</li> </ul>	<p>           (No bubbles) <input checked="" type="radio"/> OK → GO to B6.            (Bubbles) <input type="radio"/> <del>OK</del> → Diaphragm has failed. REPLACE THS 4/3 pressure switch. REPEAT Self-Test.         </p>	

## DIAGNOSIS (Continued)

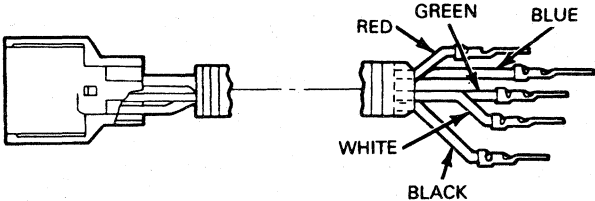
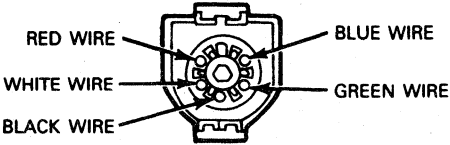
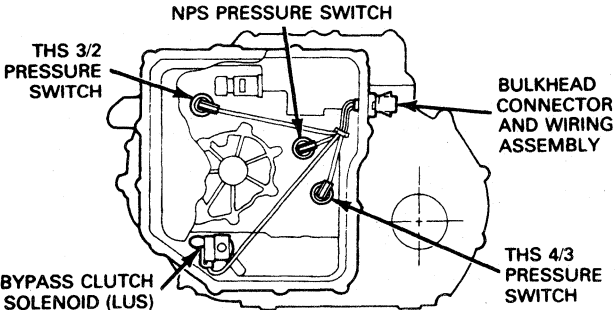
## THS 4/3 Switch Circuit Failed to Open — Code 59 — Pinpoint Test B — Continued

TEST STEP		RESULT	ACTION TO TAKE
<b>B6</b>	<b>CHECK SWITCH RESISTANCE</b>		
<ul style="list-style-type: none"> <li>• With 345 kPa (50 psi) air pressure applied to switch, check resistance between switch terminal and switch case.</li> <li>• Measured resistance should be less than 8.0 ohms.</li> </ul>			Hydraulic circuit supplying pressure to switch may have excessive leakage. REFER to Main Control Assembly Service Section.
			REPLACE switch. REPEAT Step B2. Then, REPEAT Self-Test. Codes 39, 59, 62, 69 and 89 should no longer appear.

CD6264-A

## DIAGNOSIS (Continued)

## THS 3/2 or 4/3 Switch Circuit Failed Closed — Code 62 — Pinpoint Test C

TEST STEP	RESULT	ACTION TO TAKE
<p><b>NOTE:</b> If code 62 occurs <b>ONLY</b> in "Engine Running" Self-Test, then the 4/3 circuit has failed closed to ground.</p> <p>If code 62 occurs in "Key On, Engine Off" Self-Test, then the 3/2 circuit has failed closed to ground.</p> <p>If code 62 occurs in both Sections of Self-Test, follow this entire procedure to determine which circuit has failed.</p>		
<p><b>C1</b> CHECK WIRING</p> <ul style="list-style-type: none"> <li>Remove vehicle harness connector from the transaxle bulkhead connector and install service tool jumper harness.</li> <li>Measure for continuity between engine ground and white wire (THS 3/2 circuit) with an ohmmeter. Infinite resistance should be measured with engine off.</li> <li>Measure resistance between engine ground and the blue wire (THS 4/3 circuit). Infinite resistance should be measured with the engine off and engine running in NEUTRAL.</li> </ul>   	<p>(Infinite resistance readings)</p> <p>OK →</p> <p>⊗ →</p>	<p>REFER to Engine/Emissions Diagnosis* manual, Volume H Self-Test Section. PERFORM service on codes as required.</p> <p>GO to C2.</p>

\*Can be purchased as a separate item.



## DIAGNOSIS (Continued)

## THS 3/2 or 4/3 Switch Circuit Failed Closed — Code 62 — Pinpoint Test C — Continued

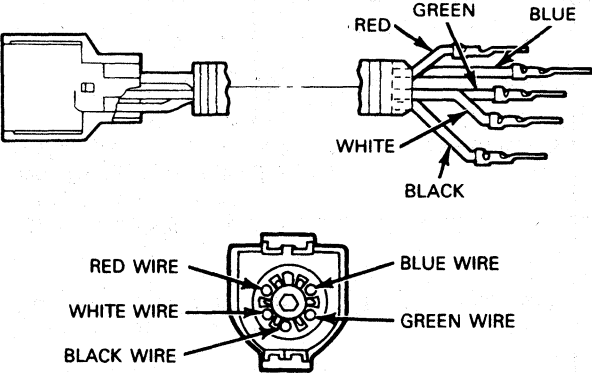
TEST STEP		RESULT	ACTION TO TAKE
<b>C2</b>	<b>CHECK INTERNAL WIRING</b>		
	<ul style="list-style-type: none"> <li>Remove the oil pan and check for pinched, cut or otherwise grounded wiring.</li> </ul>	Wiring OK, for 3/2 switch Wiring OK for 4/3 switch Wiring is pinched, cut or grounded	GO to C3. GO to C4. REPLACE transaxle bulkhead wiring. REPEAT Self-Test.
<b>C3</b>	<b>CHECK 3/2 SWITCH</b>		
	<ul style="list-style-type: none"> <li>Remove wiring connector from 3/2 pressure switch.</li> <li>Measure the pressure switch for continuity to engine ground by connecting one ohmmeter lead to pressure switch terminal and the other ohmmeter lead to the valve body.</li> </ul>	Infinite resistance Continuity to ground	GO to C5. REPLACE 3/2 pressure switch. REPEAT Self-Test.
<b>C4</b>	<b>CHECK 4/3 SWITCH</b>		
	<ul style="list-style-type: none"> <li>Remove wiring connector from 4/3 pressure switch.</li> <li>Measure the pressure switch for continuity to engine ground by connecting one ohmmeter lead to pressure switch terminal and the other ohmmeter lead to the valve body.</li> </ul>	Infinite resistance Continuity to ground	GO to C5. REPLACE 4/3 pressure switch. REPEAT Self-Test.
<b>C5</b>	<b>CHECK INTERNAL WIRES</b>		
	<ul style="list-style-type: none"> <li>With both wires removed from the pressure switches, check for continuity to ground.</li> <li>Connect one ohmmeter lead to white wire and other ohmmeter lead to ground.</li> <li>Then connect one ohmmeter lead to blue wire and other ohmmeter lead to ground.</li> </ul> <p><b>NOTE: Make sure internal terminals are not resting against any metallic parts.</b></p>	Continuity to ground Infinite resistance	REPLACE bulkhead connector. REPEAT Self-Test. REFER to Engine/Emission Diagnosis* manual, Volume H, Self-Test Section and PERFORM service on codes as required.

\*Can be purchased as a separate item.

CD6266-A

## DIAGNOSIS (Continued)

## THS 3/2 Switch Circuit Failed To Open — Code 69 — Pinpoint Test D

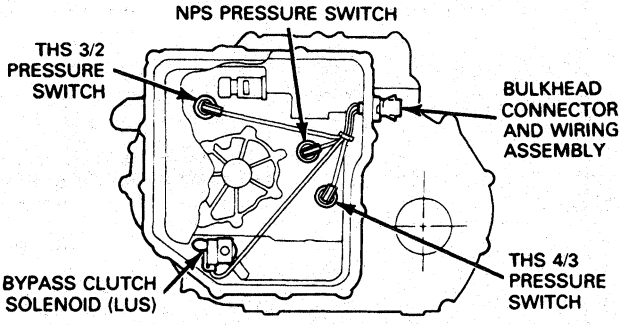
TEST STEP	RESULT	ACTION TO TAKE
<p><b>NOTE:</b> The 4/3, 3/2 pressure switches are normally open switches that close with hydraulic pressure. Failure of transaxle to engage in DRIVE would result in service code 59; failure of transaxle to shift to 3rd gear would result in service code 69. Check for these proper hydraulic functions before testing electrical parts.</p>		
<p><b>D1</b> CHECK WIRING</p>		
<ul style="list-style-type: none"> <li>Check that vehicle harness connector is fully engaged on the transmission bulkhead connector and that the vehicle harness terminals are fully engaged in connector.</li> </ul>	<p>OK →</p> <p>✗ →</p>	<p>GO to D2.</p> <p>SERVICE as required. REPEAT Self-Test.</p>
<p><b>D2</b> CHECK SWITCH FOR CONTINUITY</p>		
<ul style="list-style-type: none"> <li>Install service tool jumper harness on transmission bulkhead connector.</li> </ul>  <ul style="list-style-type: none"> <li>Check for continuity between engine ground and white wire with an ohmmeter or other low current tester (less than 200 milliamps).</li> <li>With engine running and transaxle in DRIVE, 1st or 2nd gear, ohmmeter should show NO continuity (infinite resistance).</li> <li>When the transaxle shifts to 3rd or 4th gear, the switch should close and resistance should be less than 10 ohms between white wire and engine ground.</li> </ul>	<p>Circuit</p> <p>OK →</p> <p>Circuit</p> <p>✗ →</p>	<p>REFER to Engine/Emissions Diagnosis* manual, Volume H Self-Test Section and PERFORM service on codes as required.</p> <p>GO to D3.</p>

\*Can be purchased as a separate item.

CD6267-B



## DIAGNOSIS (Continued)

## THS 3/2 Switch Circuit Failed To Open — Code 69 — Pinpoint Test D — Continued

TEST STEP	RESULT	ACTION TO TAKE
<b>D3</b> CHECK INTERNAL CONNECTIONS <ul style="list-style-type: none"> <li>Remove transaxle side oil pan and check that internal connector with white wire is firmly connected to THS 3/2 pressure switch. Connector should not pull off easily or fit loosely.</li> </ul> 	<p>(OK) → GO to D4.</p> <p>(X) → REPLACE bulkhead connector and wiring assembly. REPEAT Self-Test.</p>	
<b>D4</b> CHECK INTERNAL WIRING <ul style="list-style-type: none"> <li>Remove connector from pressure switch by pushing on end of connector, while pulling on wire end of connector.</li> <li>Check for continuity in the bulkhead connector by measuring resistance between service tool white wire and terminal inside connector just removed.</li> <li>Resistance should be less than 2.0 ohms.</li> </ul>	<p>(OK) → GO to D5.</p> <p>(X) → REPLACE bulkhead connector and wiring assembly. REPEAT Self-Test.</p>	
<b>D5</b> CHECK THS 3/2 SWITCH <ul style="list-style-type: none"> <li>Remove THS 3/2 pressure switch and install in a 1/8-27 pipe fitting that can be connected to a low pressure air supply for pressure leak testing and switch closure.</li> </ul> <p><b>CAUTION: Do not test with water since internal switch materials will be damaged.</b></p> <ul style="list-style-type: none"> <li>With 345 kPa (50 psi) air pressure applied, check for ruptured diaphragm.</li> <li>Submerge switch in transmission oil and check for bubbles flowing out of small vent hole near the switch terminal.</li> </ul>	<p>(No bubbles) (OK) → GO to D6.</p> <p>(Bubbles) (X) → Diaphragm has failed. REPLACE THS 3/2 pressure switch. REPEAT Self-Test.</p>	

## DIAGNOSIS (Continued)

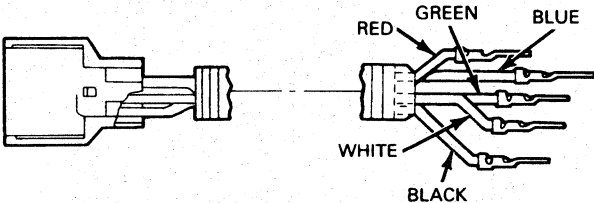
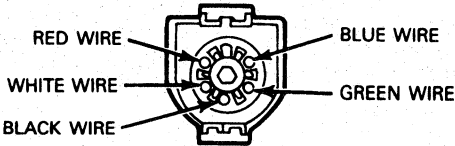
## THS 3/2 Switch Circuit Failed To Open — Code 69 — Pinpoint Test D — Continued

TEST STEP		RESULT	ACTION TO TAKE
<b>D6</b>	<b>CHECK SWITCH RESISTANCE</b>		
<ul style="list-style-type: none"> <li>With 345 kPa (50 psi) air pressure applied to switch, check resistance between switch terminal and switch case.</li> <li>Measured resistance should be less than 8.0 ohms.</li> </ul>		(Less than 8.0 ohms) 	The hydraulic circuit supplying pressure to the switch may have excessive leakage. REFER to Main Control Assembly Service Section.
		(More than 8.0 ohms) 	REPLACE switch. REPEAT D2. Then, REPEAT Self-Test. Codes 39, 59, 62, 69 and 89 should no longer appear.

CD6269-A

## DIAGNOSIS (Continued)

**Bypass Clutch Solenoid (LUS) Circuit Failed — Always Open or Always Closed (Either to Ground or to Power) — Code 89 — Pinpoint Test E**

TEST STEP	RESULT	ACTION TO TAKE
<b>NOTE: Code 39 may also be present. If so, refer to Pinpoint Test for Code 39.</b>		
<b>E1</b> CHECK HARNESS CONNECTIONS <ul style="list-style-type: none"> <li>• Check that vehicle harness connector is fully engaged on the transaxle connector.</li> <li>• Check that vehicle harness connector terminals are fully engaged in the connector.</li> </ul>	(OK) → (X) →	GO to E2. SERVICE or REPLACE as required. REPEAT Self-Test.
<b>E2</b> CHECK RESISTANCE OF SOLENOID <ul style="list-style-type: none"> <li>• Install service jumper harness to transaxle bulkhead connector.</li> <li>• Connect ohmmeter positive lead to red wire and negative lead to black wire.</li> <li>• Check resistance.</li> <li>• Resistance should be between 20-40 ohms.</li> </ul>   <p><b>CAUTION: Do not connect a power supply with reversed polarity to these wires or solenoid diode will be damaged.</b></p>	(OK) → (X) →	REFER to Engine/Emissions Diagnosis* manual, Volume H Self-Test Section and PERFORM service on codes as required. GO to E3.
<b>E3</b> CHECK INTERNAL CONNECTIONS <ul style="list-style-type: none"> <li>• Remove transaxle side oil pan and check that internal connector is fully engaged in solenoid.</li> </ul>	(OK) → (X) →	GO to E4. Fully ENGAGE connector and CHECK continuity. If resistance still is not 20-40 ohms, GO to E4. If resistance OK, REPEAT Self-Test.

\*Can be purchased as a separate item.

CD6270-B

**DIAGNOSIS (Continued)**

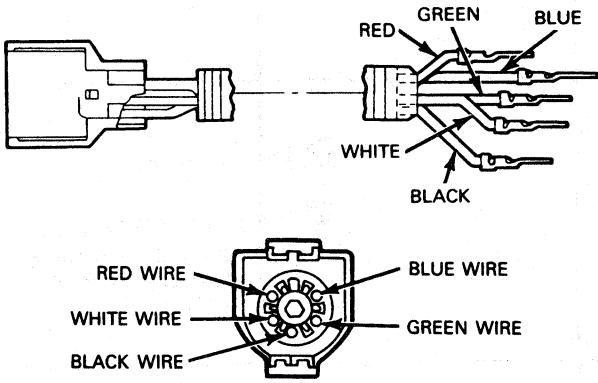
**Bypass Clutch Solenoid (LUS) Circuit Failed — Always Open or Always Closed (Either to Ground or to Power) —  
Code 89 — Pinpoint Test E — Continued**

TEST STEP		RESULT	ACTION TO TAKE
<b>E4</b>	<b>CHECK SOLENOID CONTINUITY</b>		
<ul style="list-style-type: none"> <li>Remove connector from solenoid by pulling on wires at two-way connector.</li> <li>Check solenoid continuity by connecting an ohmmeter positive lead to the positive terminal and the negative lead to the negative terminal of the solenoid. (Polarity symbols + and – are stamped on the solenoid frame.)</li> </ul>		Open circuit (infinite resistance)	REPLACE solenoid. REPEAT Self-Test.
		Solenoid OK (20-40 ohms resistance)	REPLACE bulkhead connector and wiring assembly. RECONNECT all internal connectors and REPEAT E2. REPLACE oil pan, if OK. REPEAT Self-Test procedure, Key On, Engine Off On Demand Test. Code 89 should no longer appear.

CD6271-A

## DIAGNOSIS (Continued)

## Neutral Park Switch (NPS) Failed in Neutral (Open) — Code 57 — Pinpoint Test F

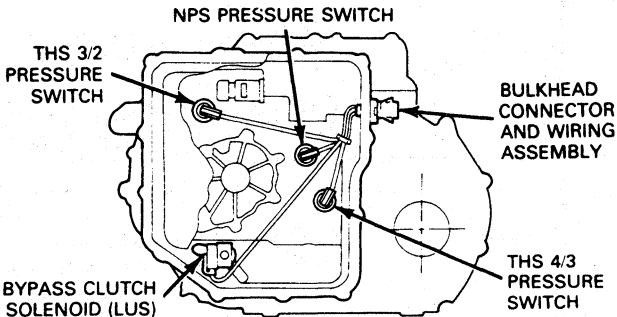
TEST STEP	RESULT	ACTION TO TAKE
<p><b>NOTE:</b> The NPS is a normally open switch that closes with hydraulic pressure. Failure of transaxle to engage in DRIVE or REVERSE would result in service code 57. Check for proper hydraulic functions before testing electrical components.</p>		
<p><b>F1</b> CHECK WIRING</p>		
<ul style="list-style-type: none"> <li>Check that vehicle harness connector is fully engaged on the transmission bulkhead connector and that the vehicle harness terminals are fully engaged in connector.</li> </ul>	<p>OK ►</p> <p>OK/NO ►</p>	<p>GO to F2.</p> <p>SERVICE as required. REPEAT Self-Test.</p>
<p><b>F2</b> CHECK SWITCH FOR CONTINUITY</p>		
<ul style="list-style-type: none"> <li>Install service jumper harness on transmission bulkhead connector.</li> </ul>  <ul style="list-style-type: none"> <li>Check for continuity between engine ground and green wire with an ohmmeter or other low current tester (less than 200 milliamps).</li> <li>With engine running and transaxle in NEUTRAL or PARK, ohmmeter should show NO continuity (infinite resistance).</li> <li>Shift transaxle into REVERSE and DRIVE. Switch should close and resistance should be less than 10 ohms in both ranges.</li> </ul>	<p>Circuit</p> <p>Circuit</p> <p>OK ►</p> <p>OK/NO ►</p>	<p>REFER to Engine/Emissions Diagnosis* manual, Volume H Self-Test Section and PERFORM service on codes as required.</p> <p>GO to F3.</p>

\*Can be purchased as a separate item.

CD6272-B

## DIAGNOSIS (Continued)



## Neutral Park Switch (NPS) Failed in Neutral (Open) — Code 57 — Pinpoint Test F — Continued

TEST STEP	RESULT	ACTION TO TAKE
<b>F3</b> CHECK INTERNAL CONNECTIONS <ul style="list-style-type: none"> <li>Remove transaxle side oil pan and check that internal connector with green wire is firmly connected to neutral pressure switch. Connector should not pull off easily or fit loosely.</li> </ul> 	<div> <div>OK</div> <div>➤</div> </div> <div> <div>✗</div> <div>➤</div> </div>	<div>GO to F4.</div> <div>REPLACE bulkhead connector and wiring assembly. REPEAT Self-Test.</div>
<b>F4</b> CHECK INTERNAL WIRING <ul style="list-style-type: none"> <li>Remove connector from pressure switch by pushing on end of connector, while pulling on wire end of connector.</li> <li>Check for continuity in the bulkhead connector by measuring resistance between service tool green wire and terminal inside connector just removed.</li> <li>Resistance should be less than 2.0 ohms.</li> </ul>	<div> <div>OK</div> <div>➤</div> </div> <div> <div>✗</div> <div>➤</div> </div>	<div>GO to F5.</div> <div>REPLACE bulkhead connector and wiring assembly. REPEAT Self-Test.</div>
<b>F5</b> CHECK THS NPS SWITCH <ul style="list-style-type: none"> <li>Remove neutral pressure switch and install in a 1/8-27 pipe fitting that can be connected to a low pressure air supply for pressure leak testing and switch closure.</li> </ul> <p><b>CAUTION: Do not test with water since internal switch materials will be damaged.</b></p> <ul style="list-style-type: none"> <li>With 345 kPa (50 psi) air pressure applied, check for ruptured diaphragm.</li> <li>Submerge switch in transmission oil and check for bubbles flowing out of small vent hole near the switch terminal.</li> </ul>	<div>           (No bubbles)           <div> <div>OK</div> <div>➤</div> </div> </div> <div>           (Bubbles)           <div> <div>✗</div> <div>➤</div> </div> </div>	<div>GO to F6.</div> <div>Diaphragm has failed. REPLACE THS NPS pressure switch. REPEAT Self-Test.</div>



## DIAGNOSIS (Continued)

## Neutral Park Switch (NPS) Failed in Neutral (Open) — Code 57 — Pinpoint Test F — Continued

TEST STEP		RESULT	ACTION TO TAKE
<b>F6</b>	<b>CHECK SWITCH RESISTANCE</b>		
<ul style="list-style-type: none"> <li>• With 345 kPa (50 psi) air pressure applied to switch, check resistance between switch terminal and switch case.</li> <li>• Measured resistance should be less than 8.0 ohms.</li> </ul>		<p>(Less than 8.0 ohms) </p> <p>(More than 8.0 ohms) </p>	<p>The hydraulic circuit supplying pressure to the switch may have excessive leakage. REFER to Main Control Assembly Service Section.</p> <p>REPLACE switch. REPEAT Step F2. Then, REPEAT Self-Test. Codes 39, 59, 62, 69 and 89 should no longer appear.</p>

CD6274-A

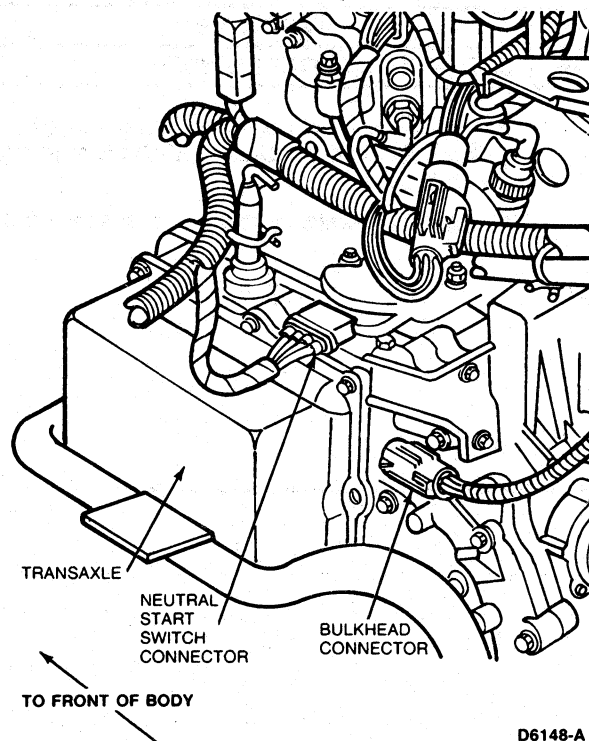
## REMOVAL AND INSTALLATION

### Transaxle

#### Removal and Installation

Before beginning the removal procedure, perform the following preliminary steps:

- Position the vehicle on a hoist. Refer to Pre-Delivery manual, Section 50-04.
  - Raise the hood.
  - Position the fender covers.
  - Disconnect the battery ground cable.
1. Remove air cleaner, hoses and tubes.
  2. Remove 13mm bolt retaining shift cable and bracket assembly to transaxle.  
NOTE: Hold bracket with screwdriver in slot to prevent bracket from moving.
  3. Remove two 10mm shift cable bracket bolts and bracket from the transaxle.
  4. Disconnect electrical connector from neutral safety switch.
  5. Disconnect electrical bulkhead connector from rear of transaxle.

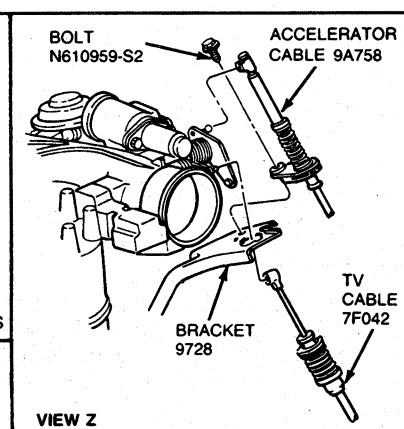
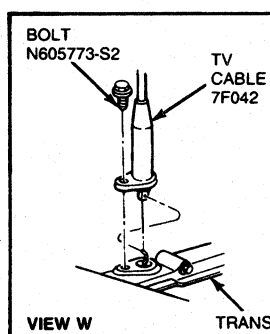
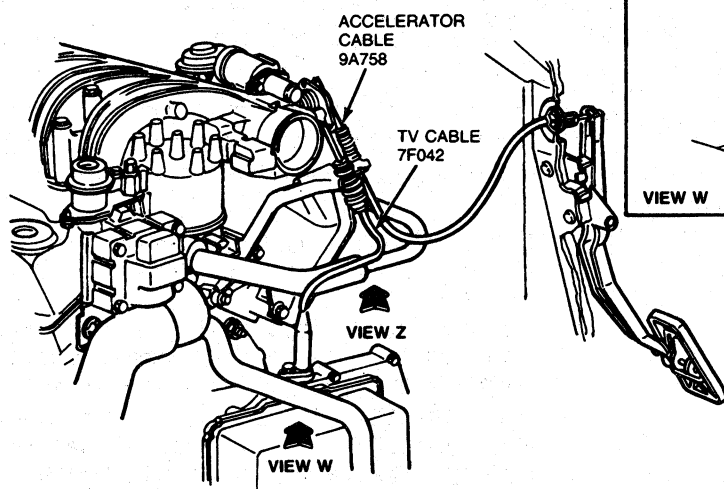


D6148-A

6. To unsnap throttle valve cable from throttle body lever, pull upward to slide cable off throttle body "nail head."
7. Remove one 8mm bolt securing throttle valve cable to transaxle case.

8. Carefully pull up on throttle valve cable and slide throttle valve cable from TV link.

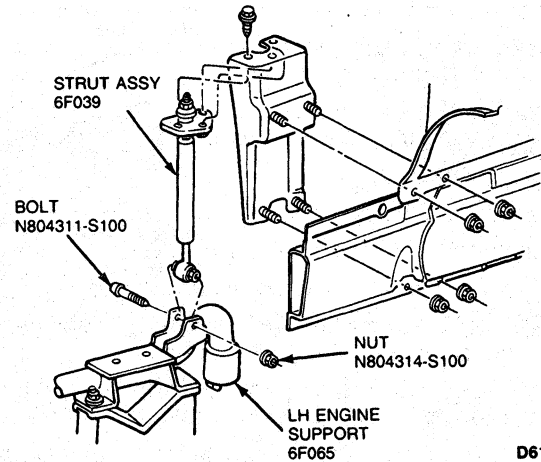
**CAUTION: Pulling too hard may bend internal TV bracket.**



D6149-A

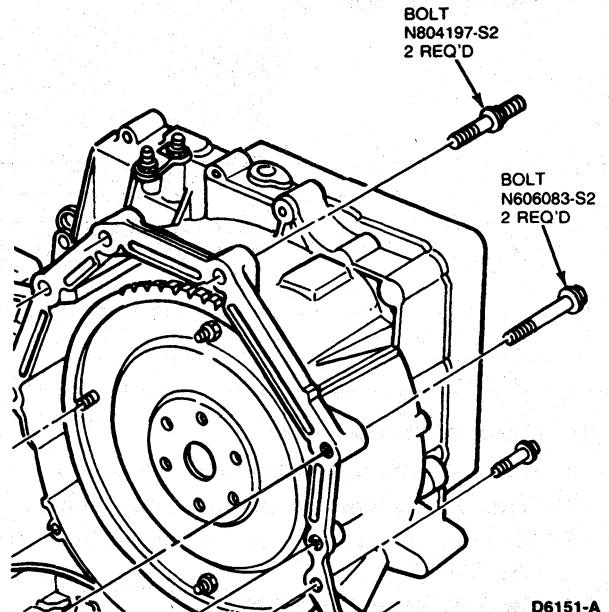
**REMOVAL AND INSTALLATION (Continued)**

9. Remove bolt and nut from LH engine support strut.



D6150-A

10. Remove four 15mm torque converter housing bolts from top of transaxle.



D6151-A

11. To attach the engine support, attach engine lifting bracket to the left rear cylinder with a bolt as shown. The engine plant lifting eye should still be on the right front cylinder head.
12. Place the engine support bars across the engine over each rocker arm cover and attach chains to the bars and lifting brackets.

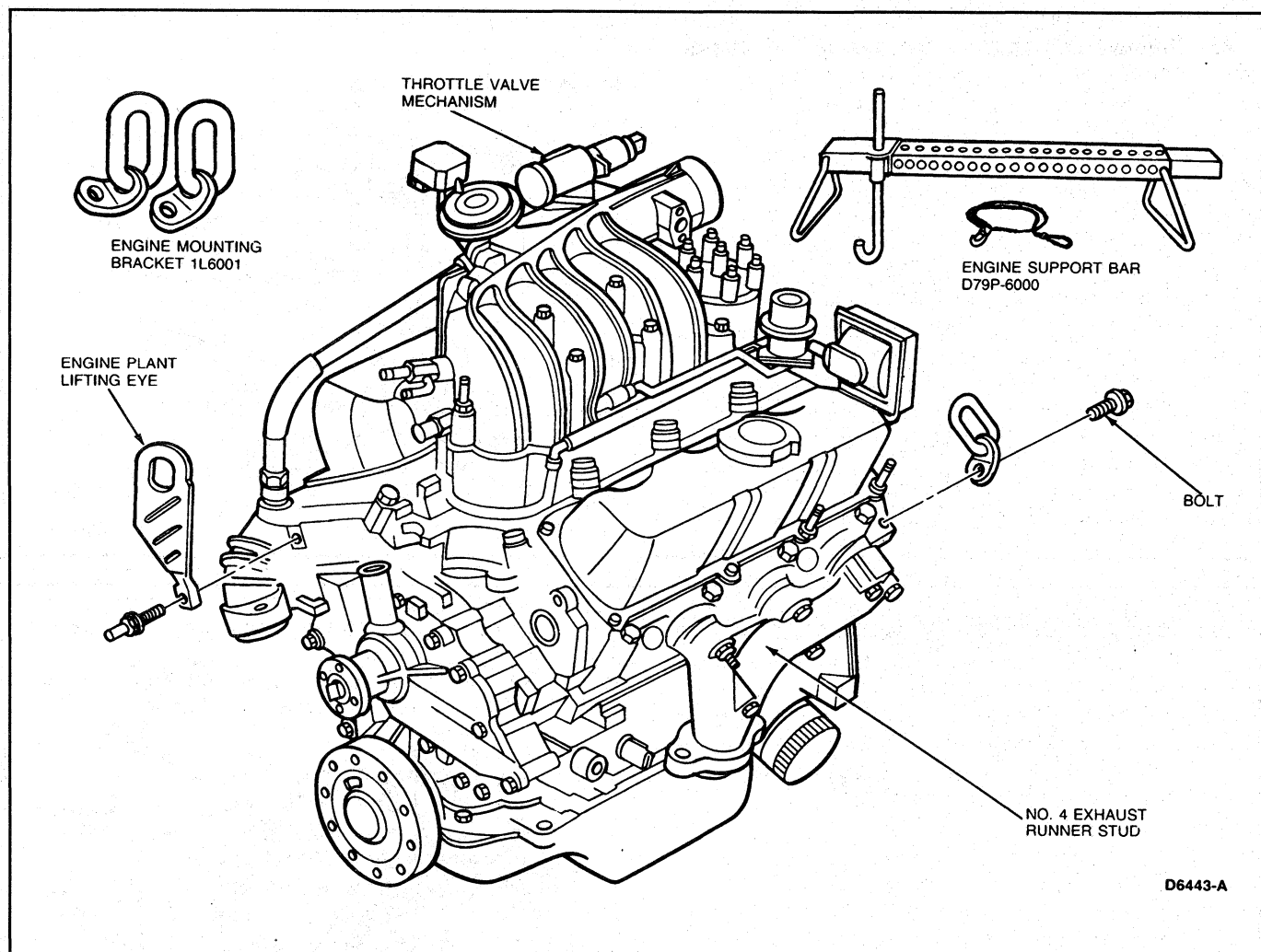
**NOTE:** When only the two support points are used, the engine assembly will hang slightly down at the rear (approximately five degrees) with the AXOD attached. With the AXOD removed, the engine assembly will hang slightly down at the front (about 15 degrees) because of the weight of the accessories. To eliminate

either or both of these tilts, attach supports as follows:

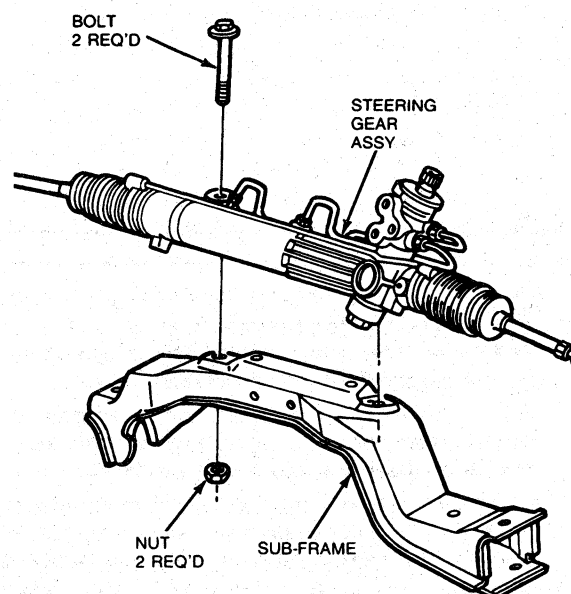
13. For the forward tilt, attach a chain from the left (front) support bar to the stud on the No. 4 exhaust runner.
14. For rearward tilt, attach a chain from the right (rear) support bar to the exhaust manifold between the No. 2 and No. 3 exhaust runner.

**CAUTION:** The support hook or chain must angle forward to the front attaching point. Damage will result if the support hook or chain runs across the throttle cable or throttle valve mechanism.

## REMOVAL AND INSTALLATION (Continued)

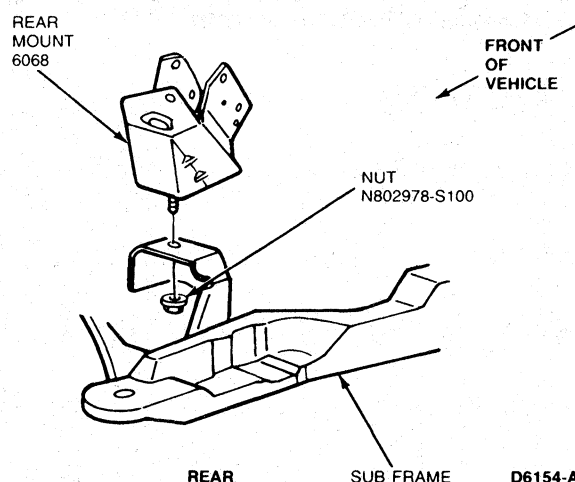
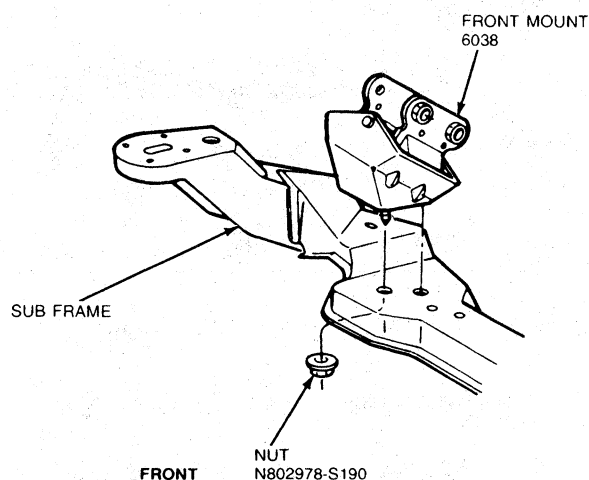


15. Raise vehicle on hoist.
16. Remove both front wheel and tire assemblies.
17. Remove each tie rod end from its spindle.
18. Remove 18mm bolts and nuts attaching lower ball joints.
19. Remove lower ball joints.
20. Remove lower control arms from each spindle.
21. Remove 18mm nuts from stabilizer bar.
22. Remove two 24mm nuts that secure rack-and-pinion to sub-frame.

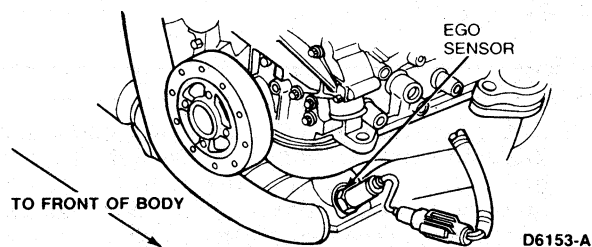


**REMOVAL AND INSTALLATION (Continued)**

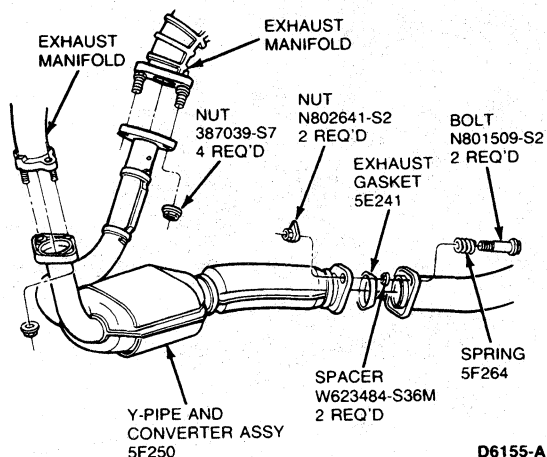
23. Remove two 22mm nuts from engine mounts.



24. Disconnect exhaust gas oxygen (EGO) sensor.



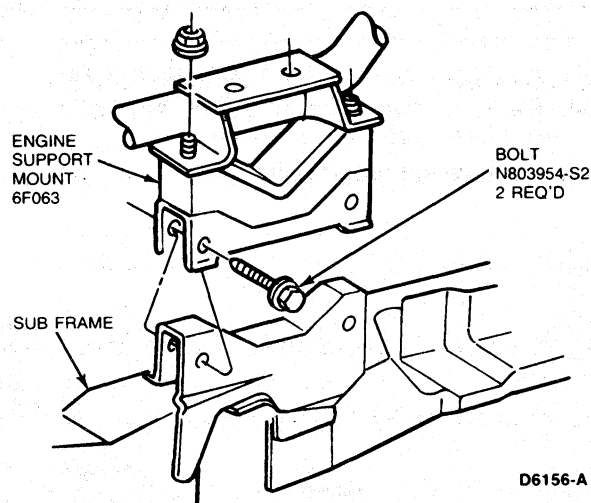
25. Remove exhaust Y-pipe from engine and rear portion of exhaust system.



26. Refer to Section 14-07 for Sub-Frame Removal and Installation.

27. Remove four 18mm bolts from sub-frame attaching points.

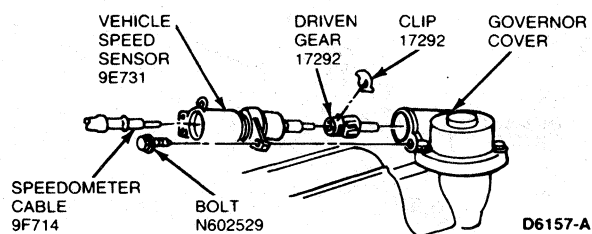
28. Remove two 15mm bolts from LH engine support mount and lower sub-frame.



29. Position transaxle jack under transaxle oil pan.

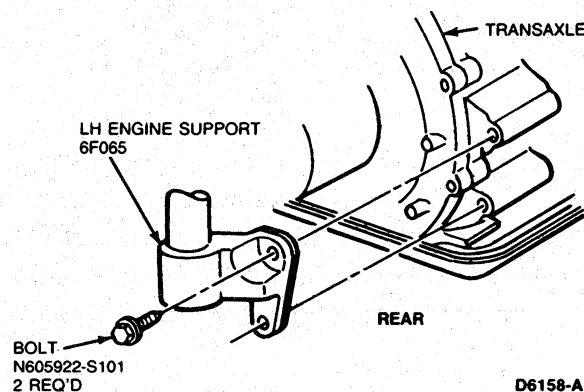
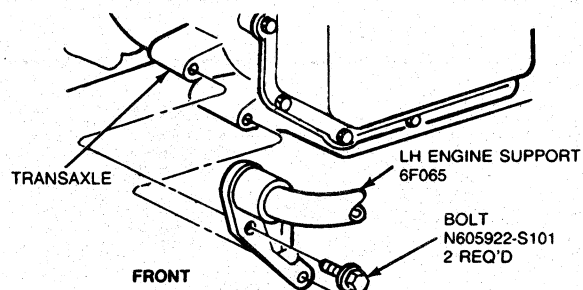
30. Remove vehicle speed sensor from transaxle.

NOTE: Vehicles with electronic instrument clusters do not use a speedometer cable.



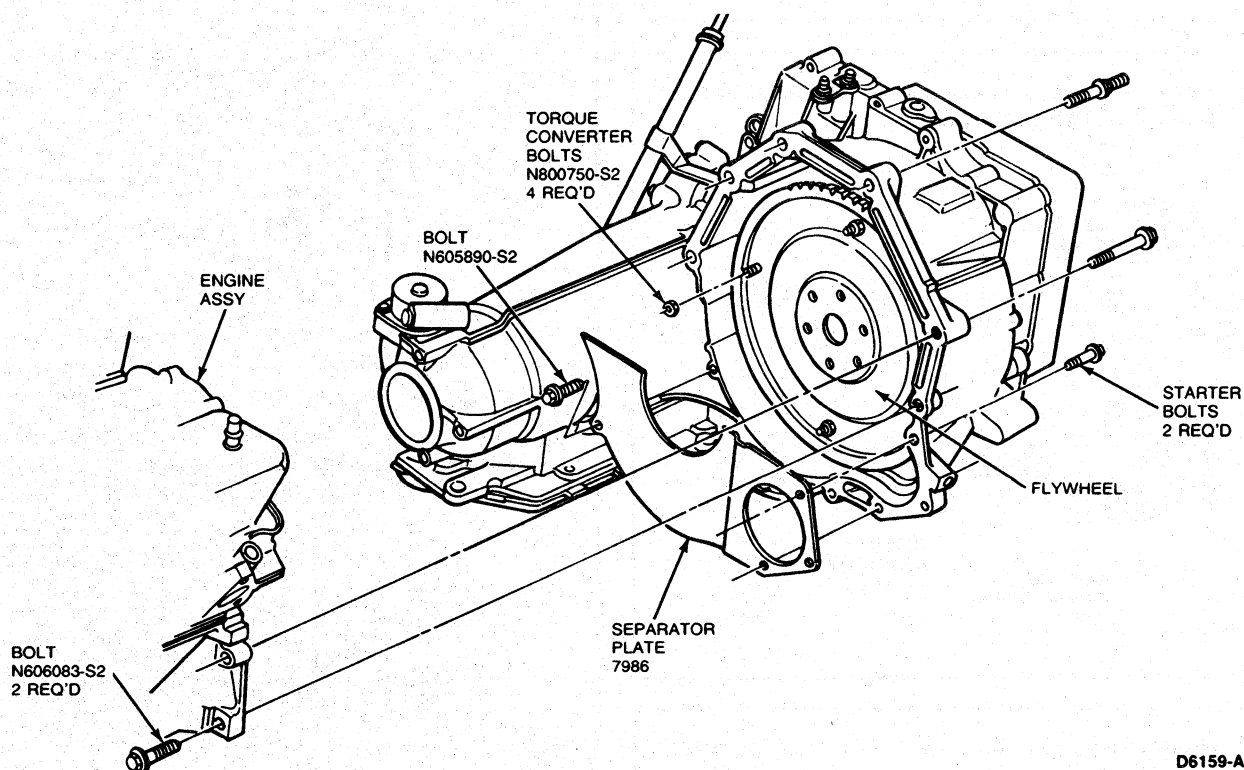
**REMOVAL AND INSTALLATION (Continued)**

31. Remove two 15mm bolts from transaxle mount.
32. Remove four 15mm bolts from LH engine support and remove support.



D6158-A

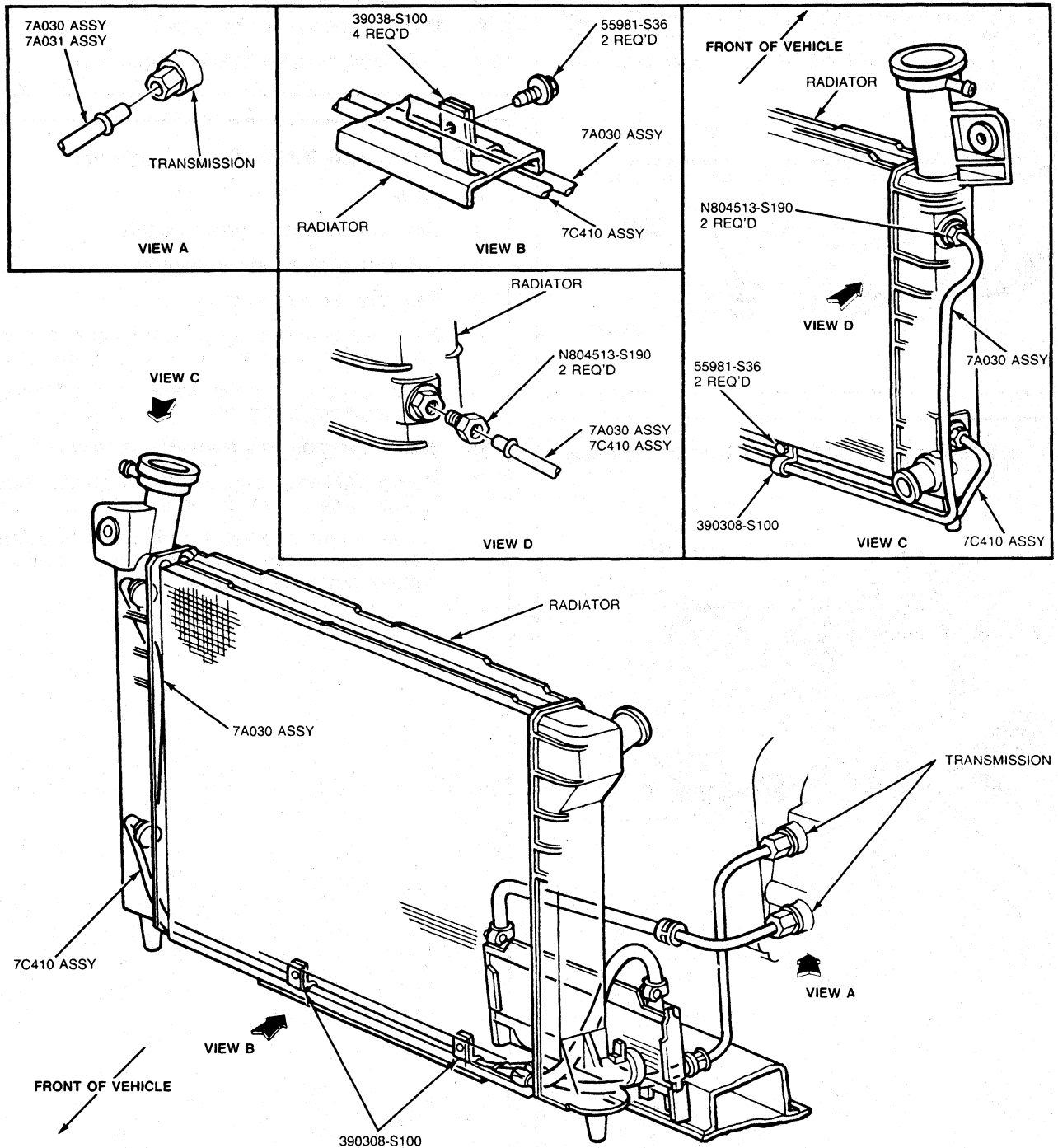
33. Remove 8mm bolt from separator plate.
34. Remove two starter attaching bolts and position starter out of the way.
35. Remove separator plate.
36. Rotate engine with 1/2-inch drive ratchet and 7/8-inch deep well socket on crankshaft pulley bolt to align torque converter bolts with starter drive hole. Then, remove four 15mm torque converter-to-flywheel attaching nuts.



D6159-A

**REMOVAL AND INSTALLATION (Continued)**

37. Disconnect transaxle cooler lines.



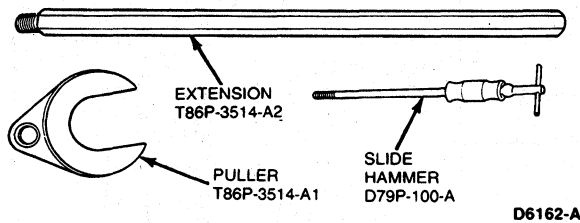
D6444-A

**REMOVAL AND INSTALLATION (Continued)**

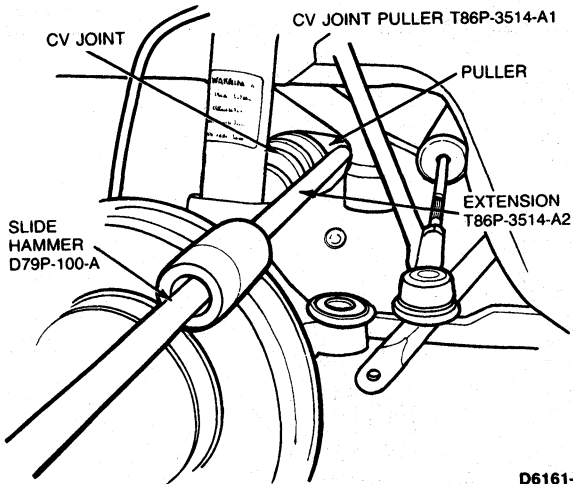
38. Remove halfshafts as follows:

**CAUTION: Do not pry against case.**

- Screw Extension T86P-3514-A2 into CV Joint Puller T86P-3514-A1 and install Slide Hammer D79P-100-A or equivalent into extension.



- Position puller behind CV joint and remove joint.



39. Remove the last two 15mm torque converter housing bolts.
40. Separate transaxle from engine and carefully lower transaxle out of vehicle.
41. To install, reverse Steps 1 through 37.

**Oil Pump and Valve Body Assembly****Removal**

1. Disconnect battery ground cable.
2. Remove battery and battery tray.
3. Remove remote air cleaner.
4. Secure supply hoses, vacuum lines and wiring away from pump and valve body cover.
5. Raise vehicle on hoist. Refer to Pre-Delivery manual, Section 50-04.
6. Support engine and transaxle assembly.
7. Remove LH engine mounts and supports. Refer to Transaxle Removal and Installation.
8. Loosen pump and valve body cover bolts and drain transmission fluid. After fluid has drained, remove cover and gasket.

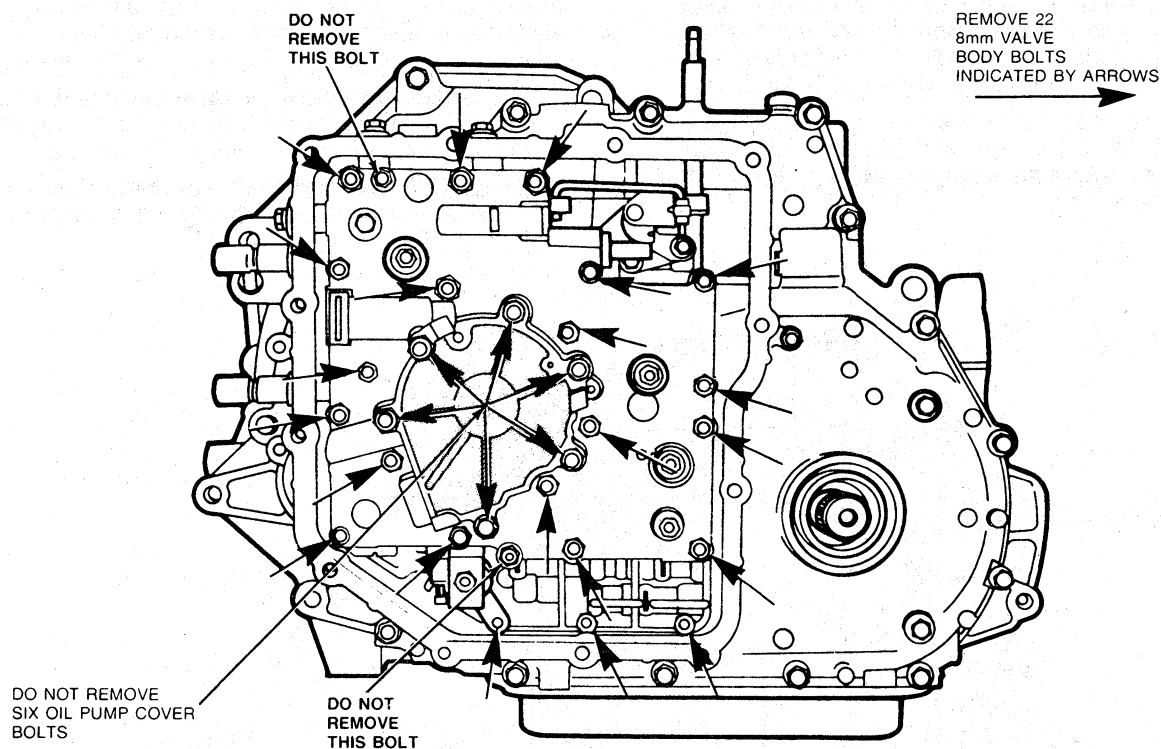


## REMOVAL AND INSTALLATION (Continued)

9. Remove 22 pump and valve body assembly-to-chain cover bolts.

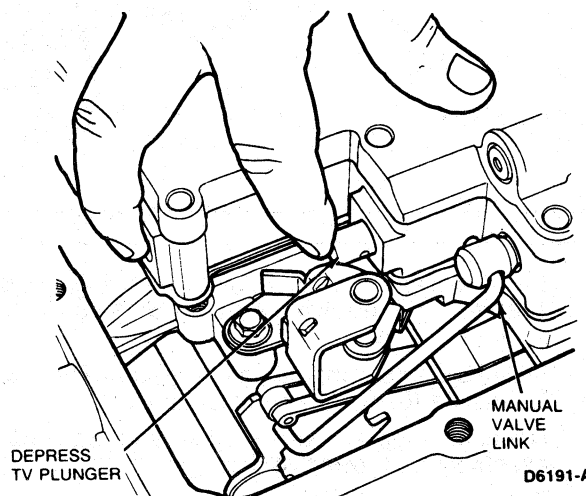
**CAUTION:** Do not remove the two bolts that retain the oil pump and valve body assembly together.

**CAUTION:** Do not remove oil pump cover bolts.



D5915-B

10. Pull pump and valve body assembly out enough to clear throttle valve bracket and rotate valve body toward dash panel and disconnect manual valve link.
11. Remove pump and valve body assembly from vehicle.



D6191-A

## REMOVAL AND INSTALLATION (Continued)

## Installation

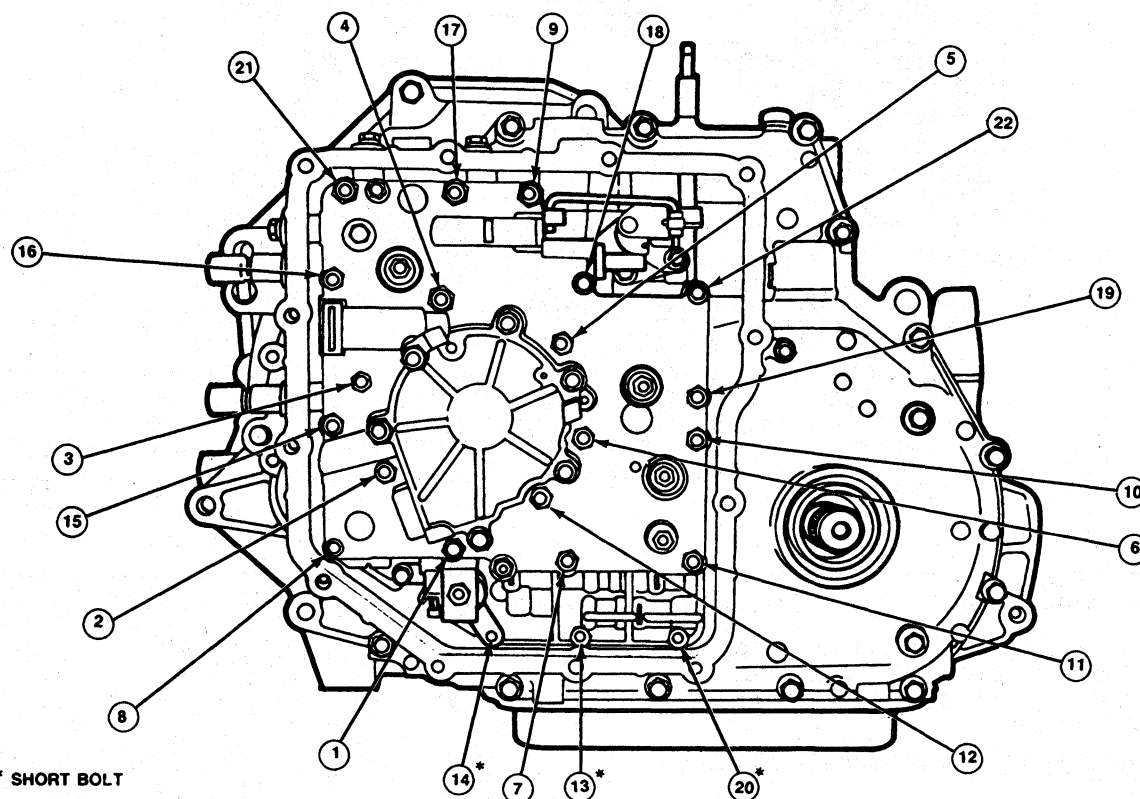
1. Install new pump and valve body-to-chain cover gasket.
2. Slide pump and valve body assembly onto oil pump shaft.
3. Rotate pump and valve body assembly toward dash panel and engage manual valve link with manual valve.
4. Slightly rotate or jiggle pump and valve body assembly to engage splines on oil pump shaft with splines in oil pump rotor. Valve body should slide flush onto chain cover without force.

NOTE: It may be necessary to rotate engine using 7/8 inch deep-well socket on crankshaft pulley to complete engagement of pump shaft to pump.

NOTE: If full engagement of the pump and valve body assembly is not obtained using the above procedure, the following alternate method may be used:

- Remove manual valve from valve body.
  - Rotate assembly as necessary to allow full engagement (360 degree rotation possible).
  - After full engagement, return assembly to installed position and install manual valve.
5. Use Valve Body Alignment Pin T86P-70100-C or equivalent to position valve body and install pump and valve body retaining bolts. Tighten bolts to 9-12 N·m (7-9 lb-ft) in sequence shown.

**CAUTION: Do not use retaining bolts to draw pump and valve body into position.**



\* SHORT BOLT

D6123-A

6. Install pump and valve body cover using a new gasket. Tighten cover retaining bolts to 14-16 N·m (10-12 lb-ft).
7. Install LH engine mounts and supports. Refer to Transaxle Removal and Installation.
8. Remove support from engine and transaxle assembly and lower vehicle.
9. Position supply hoses, vacuum lines and wiring in position.
10. Install remote air cleaner.
11. Install battery tray and battery.
12. Fill transaxle with specified quantity and quality of oil.
13. Start engine, move transaxle selector lever through all ranges. Check pump and valve body cover for leaks.

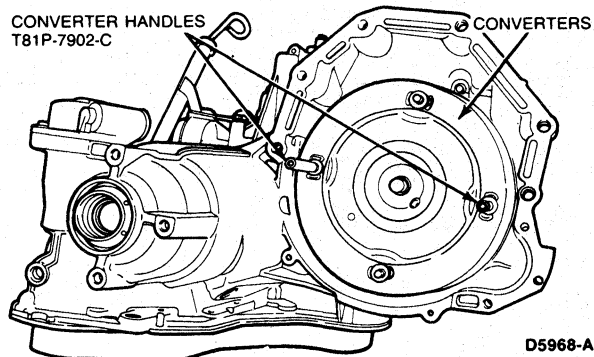
## DISASSEMBLY AND ASSEMBLY

## Transaxle

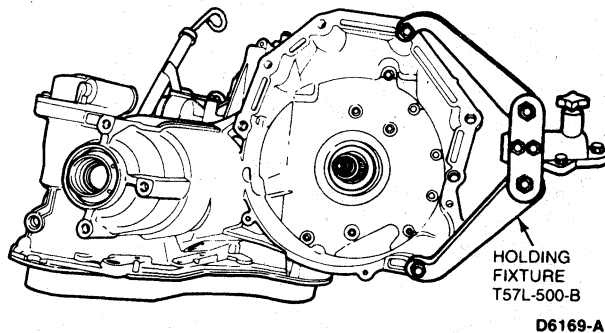
## Disassembly

1. Install Converter Handles T81P-7902-C or equivalent. Remove converter from transaxle.

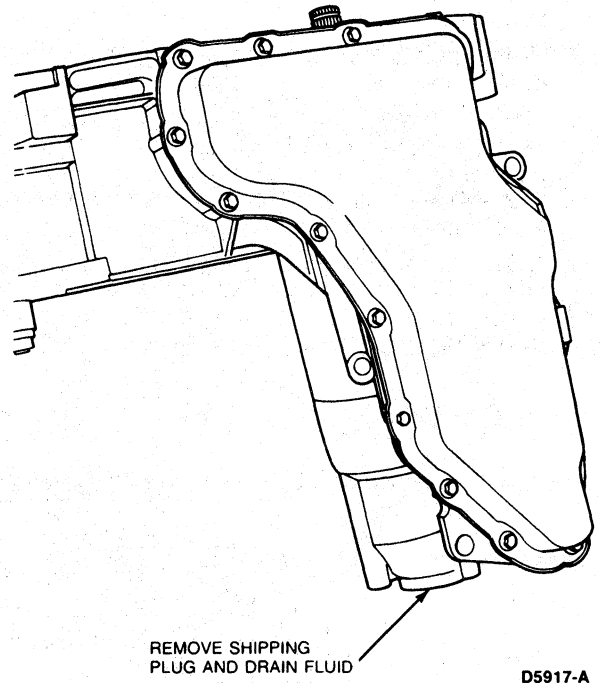
**CAUTION:** The torque converter is heavy. Be careful not to drop it.



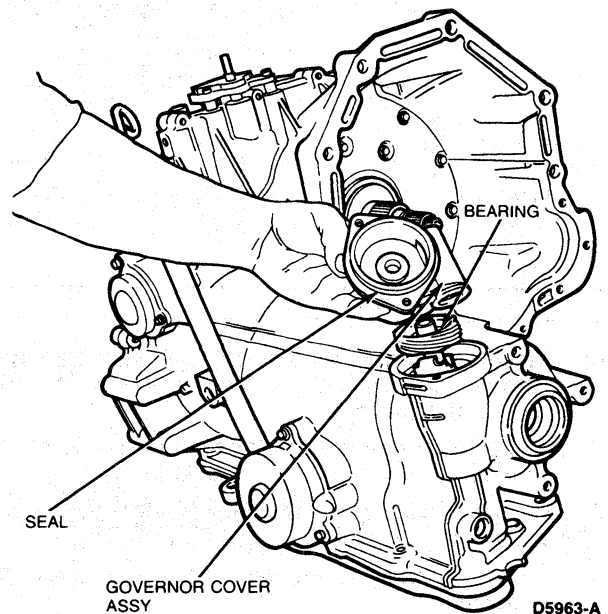
2. Mount transaxle in Holding Fixture T57L-500-B or equivalent.



3. Turn transaxle in vertical position. Remove shipping plugs and drain fluid.



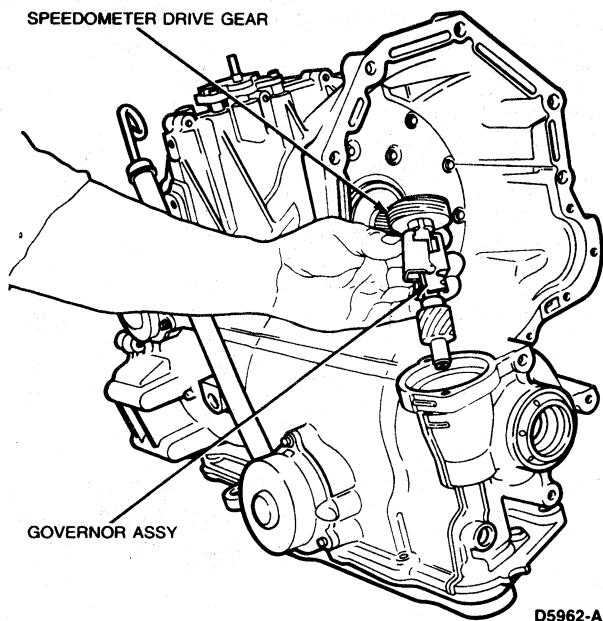
4. Return transaxle to horizontal position.
5. Remove two 8mm governor cover bolts, cover and seal. Discard seal. A new one must be installed during assembly.



**DISASSEMBLY AND ASSEMBLY (Continued)**

6. Lift governor and speedometer drive gear assembly, and bearing out of case.

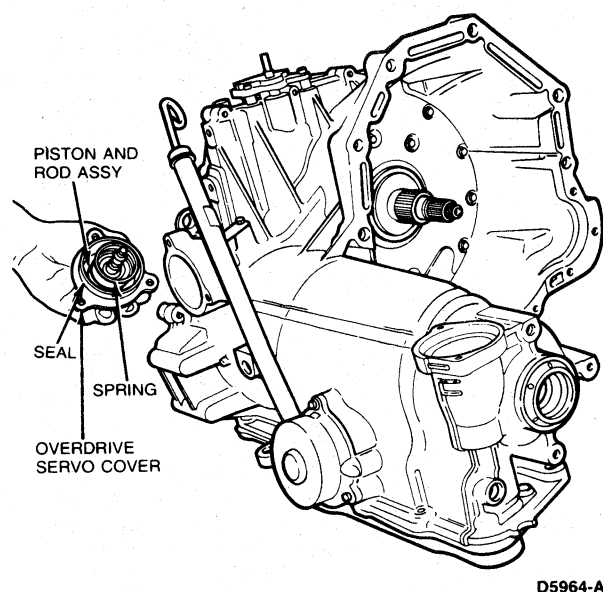
NOTE: Bearing sits on top of speedometer gear.



7. Remove three 8mm overdrive servo cover bolts, cover, piston assembly and spring.

NOTE: Discard O-ring seal on cover.

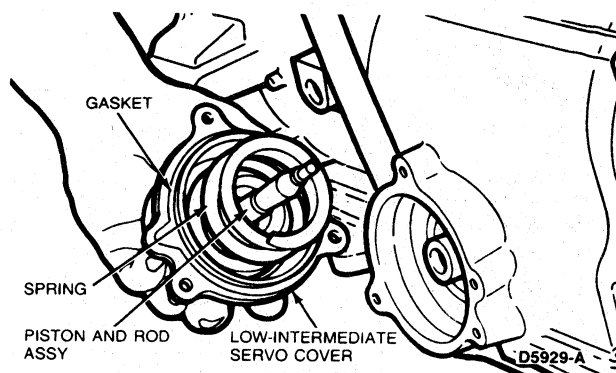
NOTE: Piston assembly and spring may remain in cover.



8. Remove three 8mm low-intermediate servo cover bolts, cover, piston assembly and spring.

9. Remove and discard gasket.

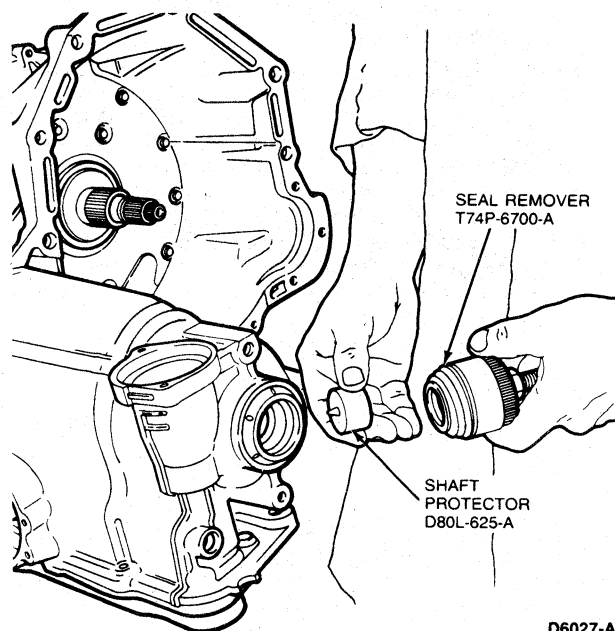
NOTE: Piston assembly and spring may remain in cover.



10. Remove RH output shaft seal as follows:

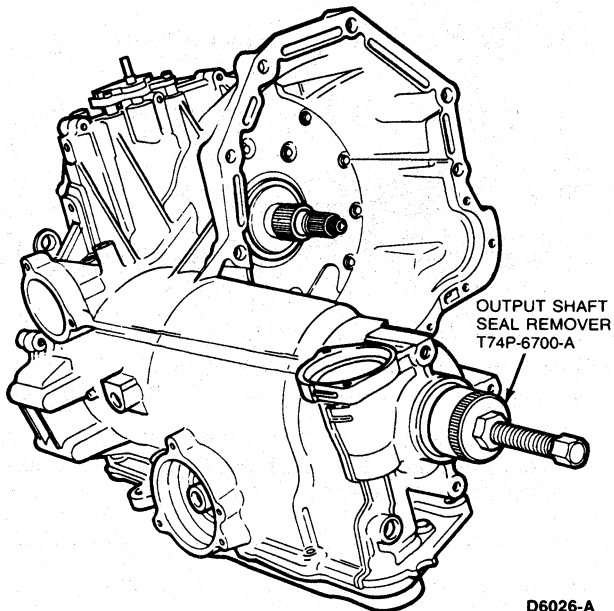
NOTE: Output shaft seal is a two-piece construction; outer metal protector and inner rubber seal.

- a. Install Shaft Protector D80L-625-A or equivalent into output shaft opening.



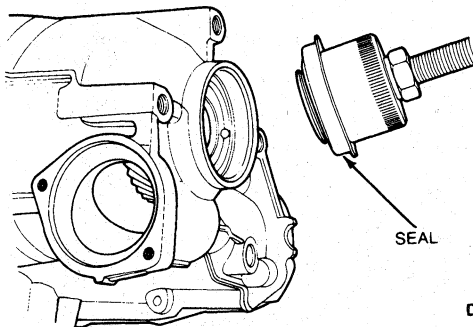
**DISASSEMBLY AND ASSEMBLY (Continued)**

- b. Screw Output Shaft Seal Remover T74P-6700-A or equivalent, into metal seal protector.
- c. Tighten screw on end of tool until the metal seal protector is removed.

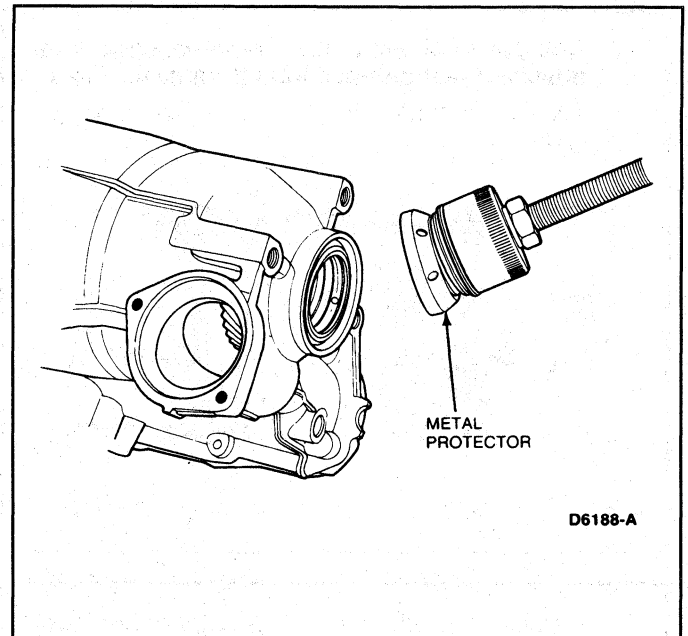


D6026-A

- d. Remove metal seal protector from tool, and install tool into seal.
- e. Tighten screw on the end of tool until seal is removed.

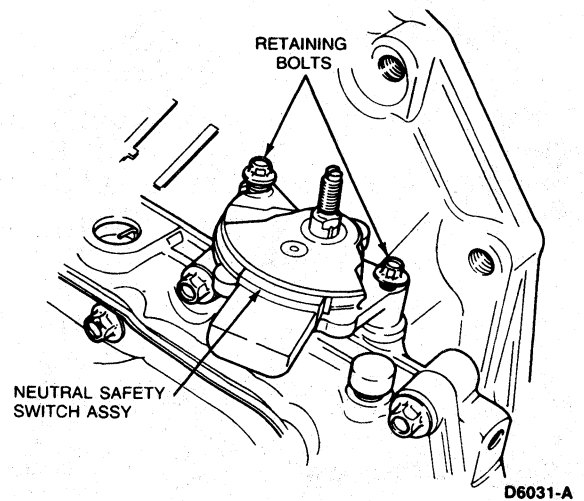


D6187-A



D6188-A

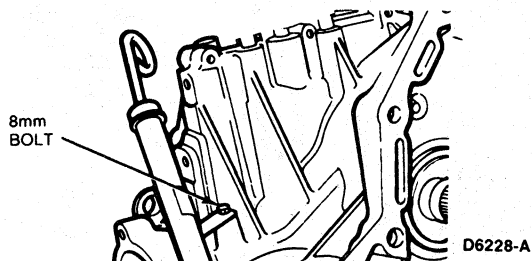
11. Remove two 8mm neutral safety switch retaining bolts and remove switch.



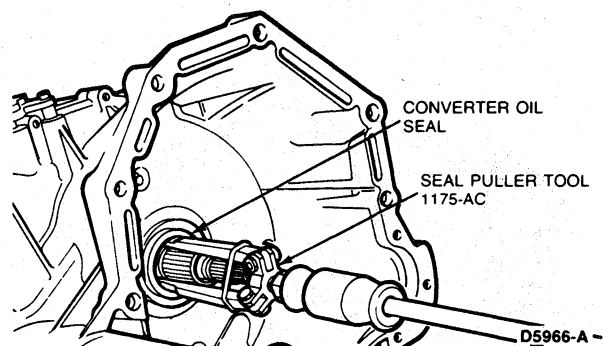
D6031-A

**DISASSEMBLY AND ASSEMBLY (Continued)**

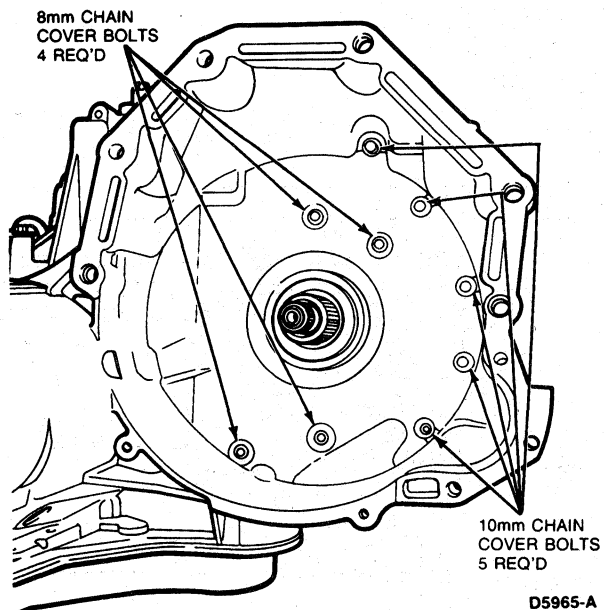
12. Remove one 8mm fluid level dipstick tube attaching bolt and pull tube from case.



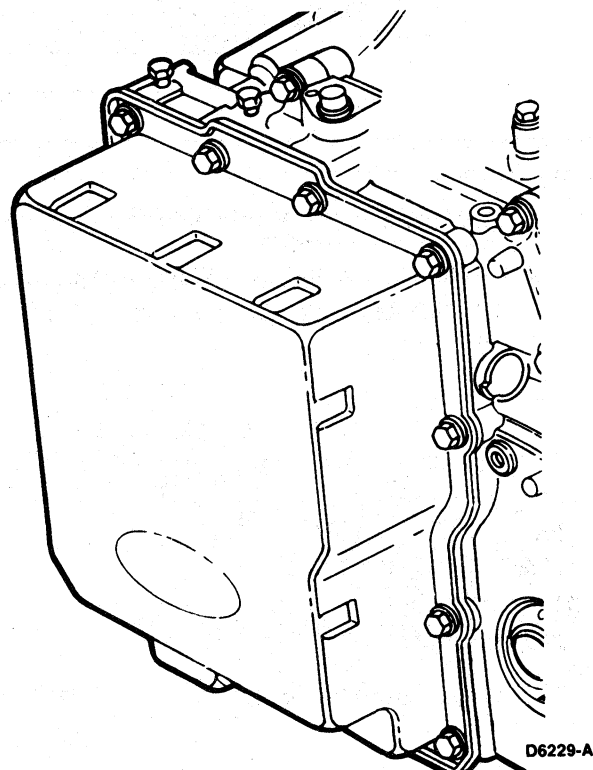
14. Remove converter oil seal using Seal Puller TOOL 1175-AC and Impact Slide Hammer T58L-101-A or equivalent.



13. Remove five 10mm and four 8mm chain cover bolts from inside torque converter housing.



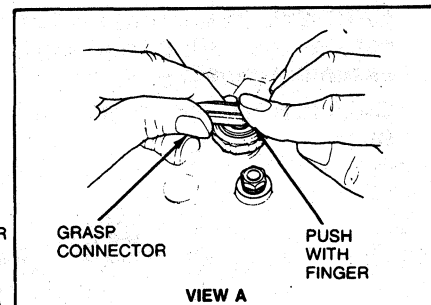
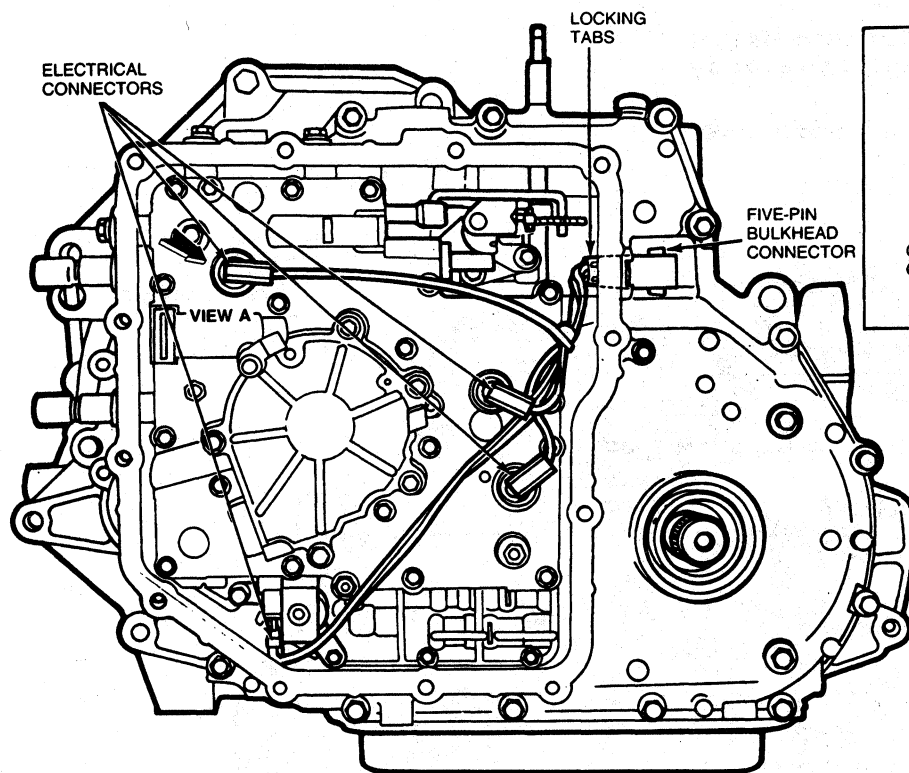
15. Remove twelve 10mm pump and valve body cover (upper reservoir) bolts. Remove cover and discard gasket.



## DISASSEMBLY AND ASSEMBLY (Continued)

16. Disconnect four electrical connectors from pressure switches and solenoid.

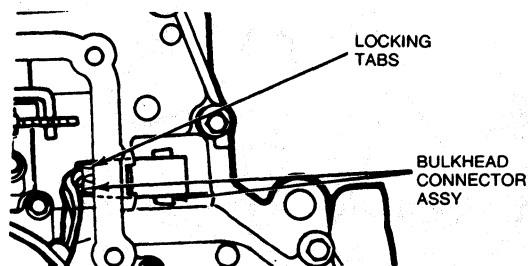
**CAUTION:** Use both hands. Do not pull on wire.



D5913-A

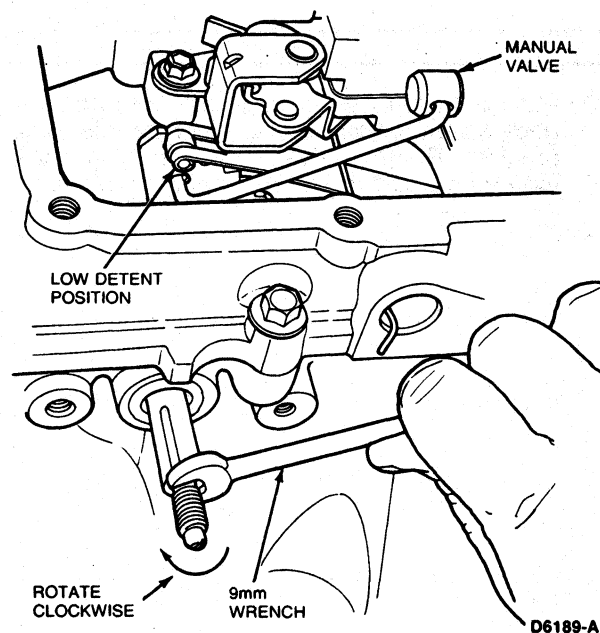
17. Compressing tabs on both sides of bulkhead connector from inside of chain cover, remove connector and wiring from chain cover.

**CAUTION:** Do not pull on wiring. Pull on connector.



D6186-A

18. Using a 9mm wrench on flats on end of manual shaft, rotate shaft clockwise to position manual linkage in LOW detent (valve positioned all the way in).



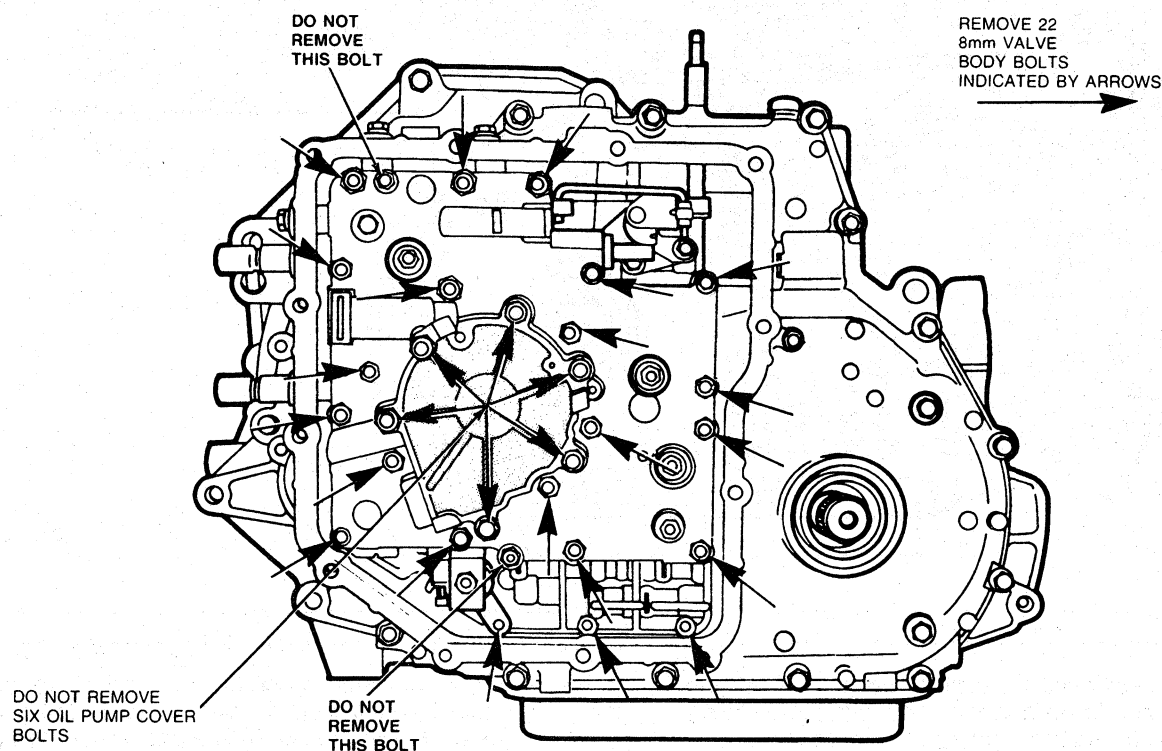
D6189-A

**DISASSEMBLY AND ASSEMBLY (Continued)**

19. Remove 22 8mm oil pump and valve body assembly attaching bolts. Note length and location of bolts.

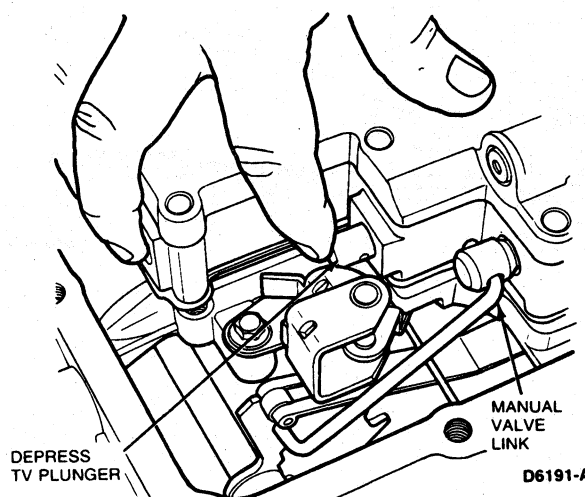
**CAUTION:** Do not remove the two bolts that retain the oil pump and valve body assembly together.

**CAUTION:** Do not remove oil pump cover bolts.



D5915-B

20. Push in TV plunger and pull oil pump and valve body assembly outward to clear throttle valve bracket. Rotate valve body clockwise and remove manual valve link from manual valve.

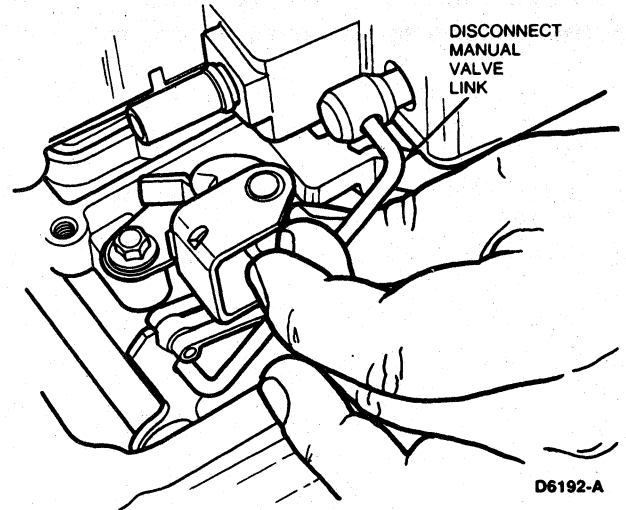


D6191-A

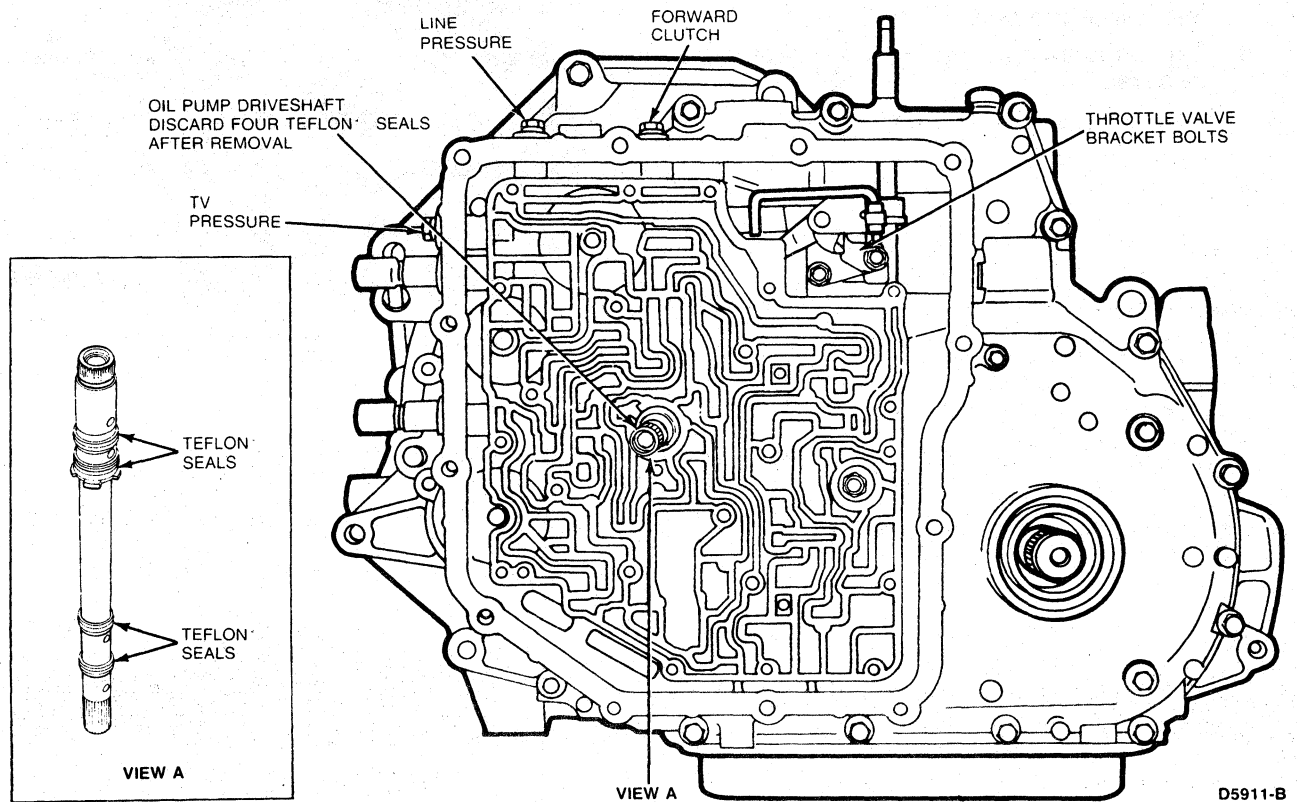


**DISASSEMBLY AND ASSEMBLY (Continued)**

21. Disconnect manual valve link from detent lever and remove pump and valve body assembly.

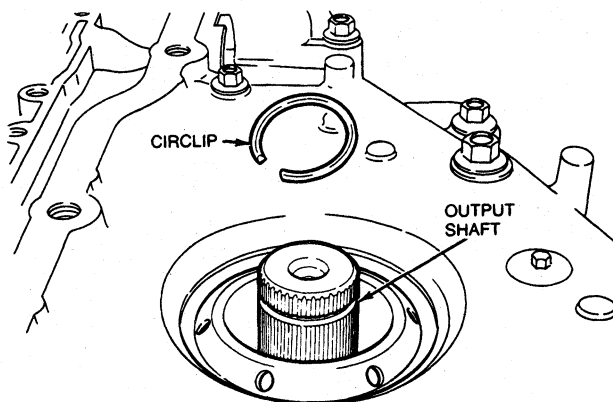


22. Remove two 8mm throttle valve bracket bolts from chain cover and remove bracket.
23. Pull oil pump driveshaft out of case. Remove and discard four Teflon® seals from pump shaft.



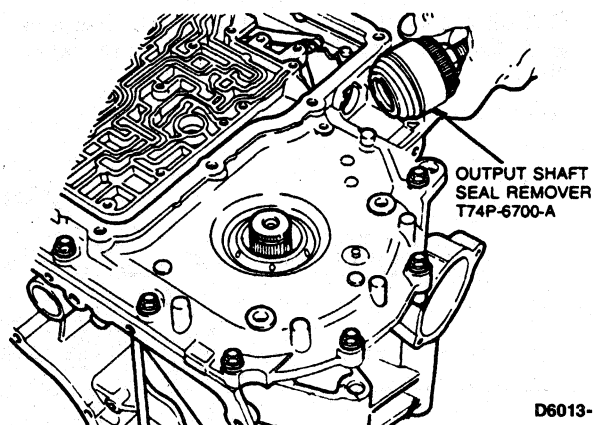
**DISASSEMBLY AND ASSEMBLY (Continued)**

24. Rotate transaxle into vertical position.
25. Remove and discard output shaft circlip.



D5986-A

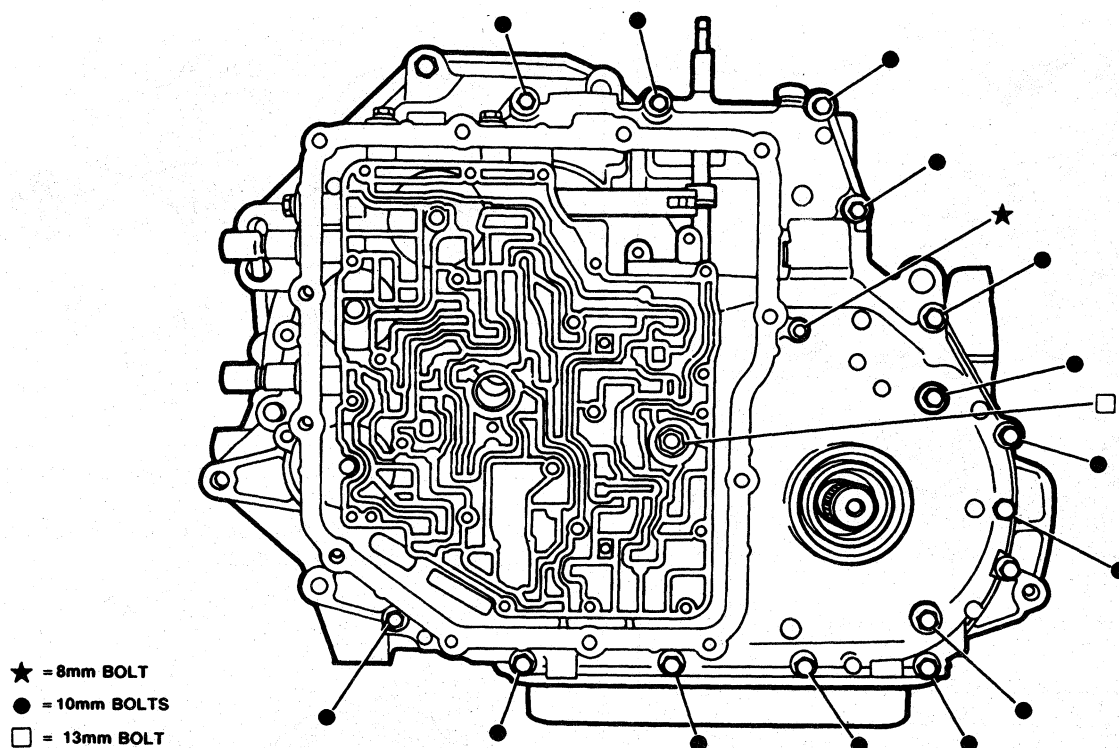
26. Remove LH output shaft seal as follows:
  - a. Screw T74P-6700-A or equivalent into metal seal protector.
  - b. Tighten screw on the end of tool until metal seal protector is removed.
  - c. Remove metal seal protector from tool and install tool into seal.
  - d. Tighten screw on the end of tool until seal is removed.



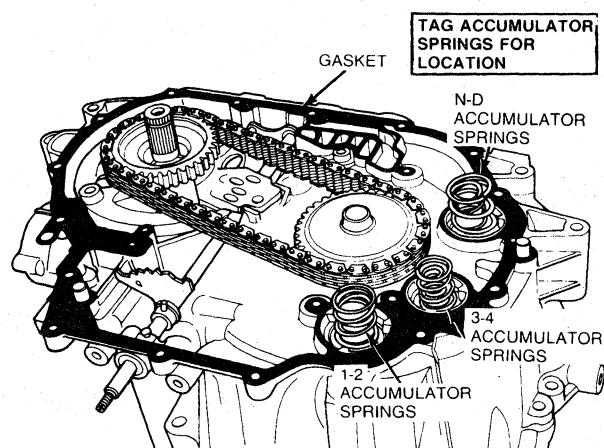
D6013-A

**DISASSEMBLY AND ASSEMBLY (Continued)**

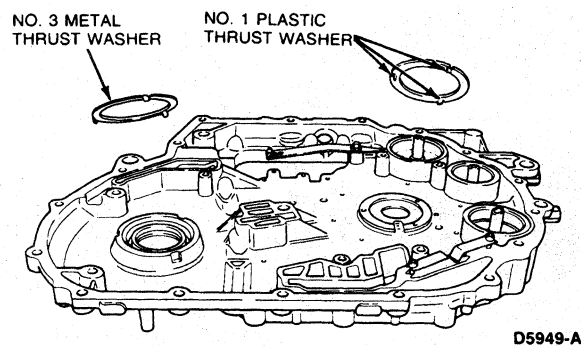
27. Remove fourteen 10mm, one 13mm and one 8mm chain cover bolts. Note length and location of bolts.



28. Remove chain cover and tag accumulator springs to be sure they are installed in their correct positions during assembly.
29. Remove and discard chain cover gasket.

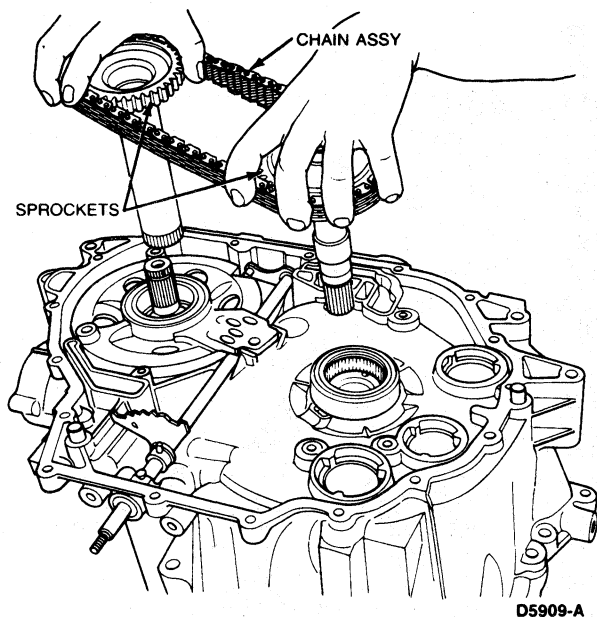


30. Remove No. 1 and No. 3 thrust washers from chain cover.



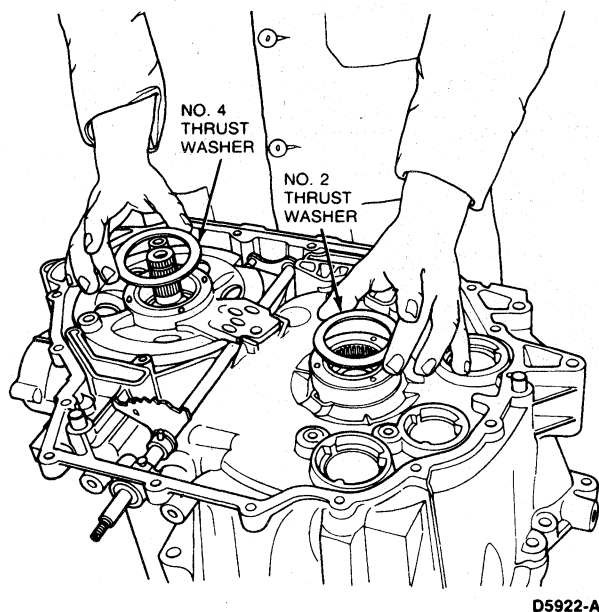
**DISASSEMBLY AND ASSEMBLY (Continued)**

31. Simultaneously, lift out both sprockets with chain assembly.

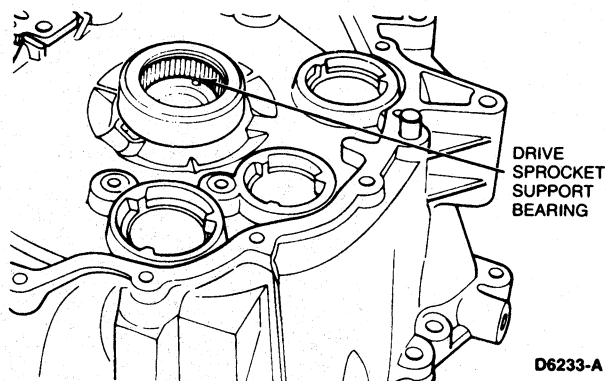


32. Remove No. 2 thrust washer from drive sprocket support and No. 4 thrust washer from driven sprocket support.

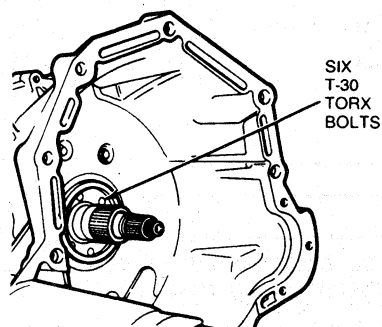
NOTE: No. 4 thrust washer may remain on driven sprocket.



33. Inspect drive sprocket support bearing to determine if it needs to be replaced.

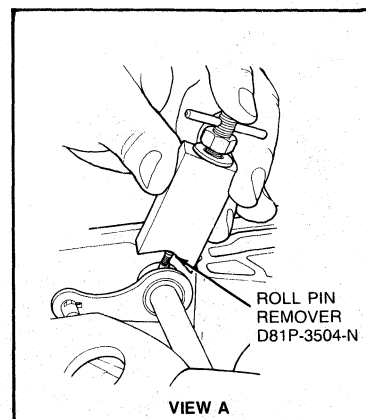
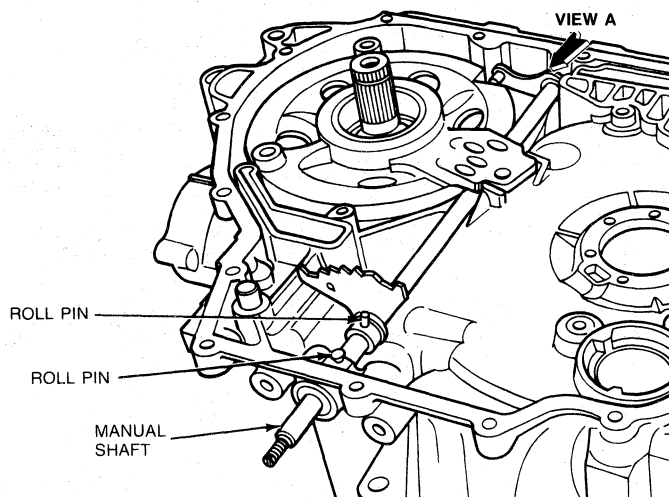


If bearing is OK, remove six T-30 Torx® bolts attaching support to case.



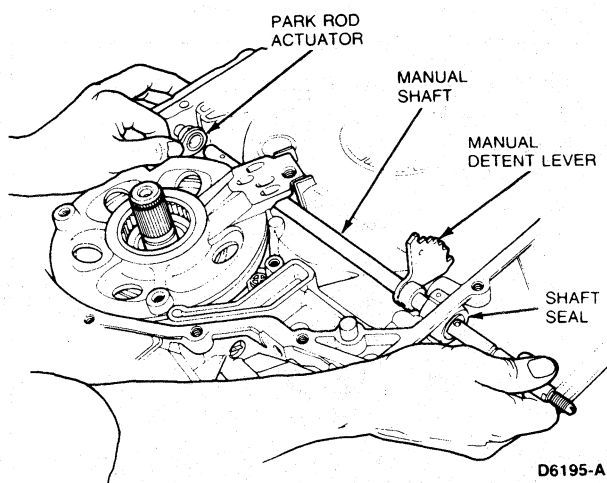
## DISASSEMBLY AND ASSEMBLY (Continued)

34. Remove and discard lockpin and two roll-pins from manual shaft using Lockpin Remover D81P-3504-N or equivalent **being careful not to damage any machined surfaces.**



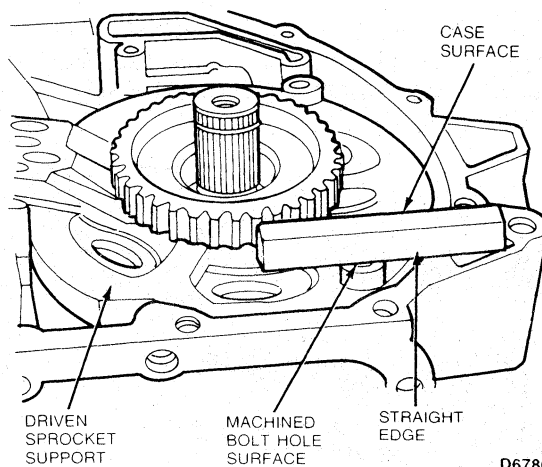
D5921-B

35. Slide manual linkage shaft out of case. Then, pry seal out of case.



D6195-A

- 35A. Determine with a straight edge or a flat block whether the machined bolt hole surfaces on the support are above or below the case machined surface for reassembly.



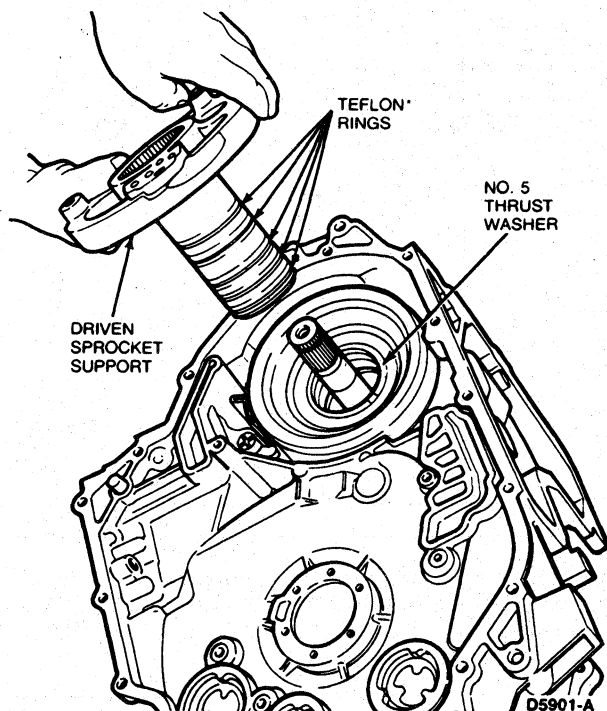
D6780-A

**DISASSEMBLY AND ASSEMBLY (Continued)**

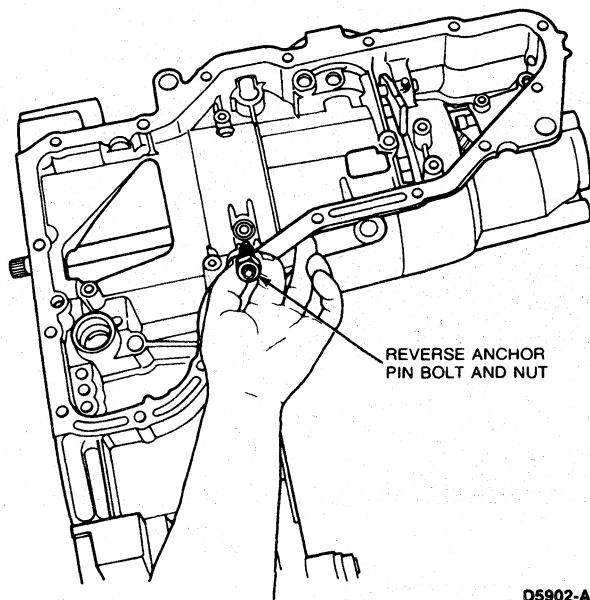
36. Remove driven sprocket support assembly and remove five Teflon® seals from support.

37. Remove No. 5 selective thrust washer.

NOTE: Thrust washer may remain on sprocket support assembly.

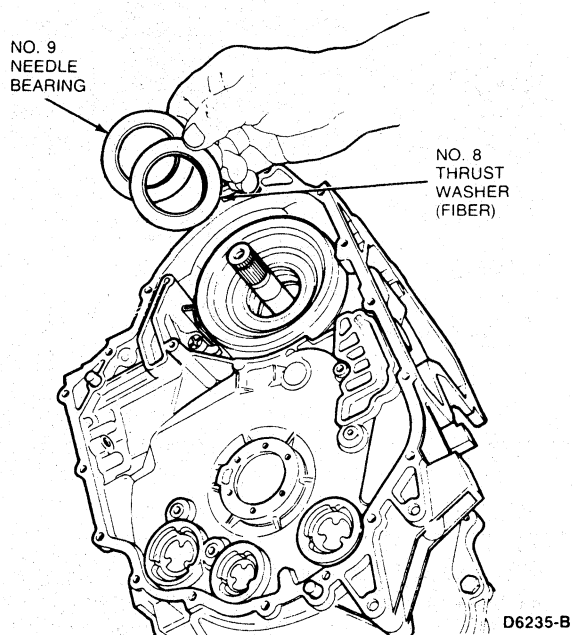


NOTE: If support is binding it may be necessary to back out reverse clutch anchor bolt.



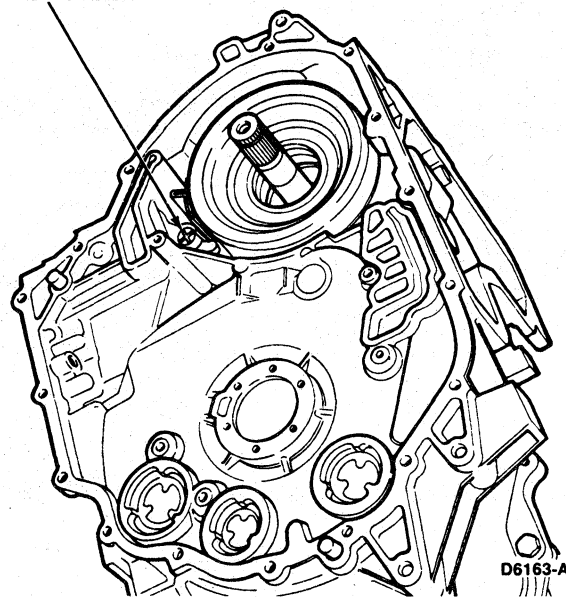
38. Using a wire hook, remove No. 8 selective thrust washer and No. 9 needle bearing from bottom of cylinder.

NOTE: Thrust washer and needle bearing may remain on driven sprocket support assembly when it is removed.



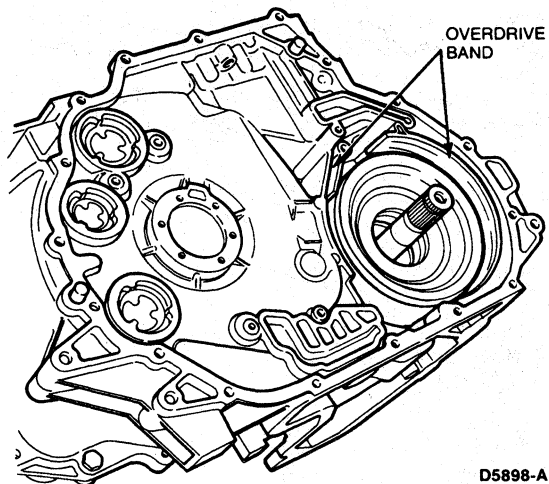
39. Remove plastic overdrive band retainer.

OVERDRIVE  
BAND RETAINER

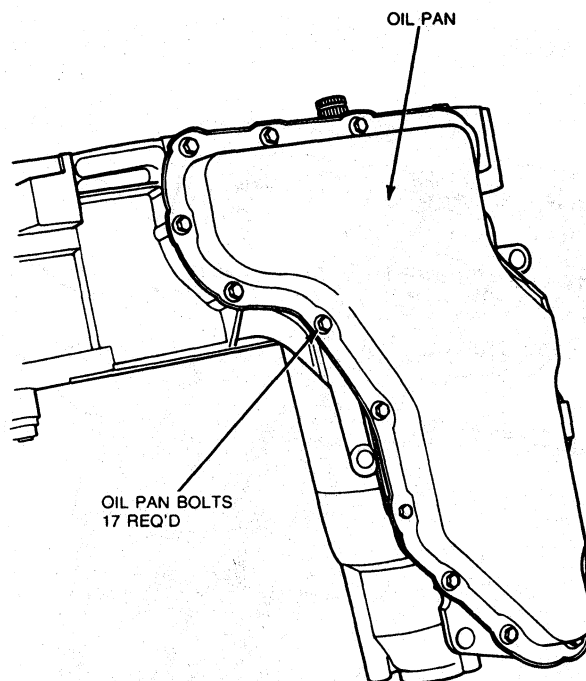


## DISASSEMBLY AND ASSEMBLY (Continued)

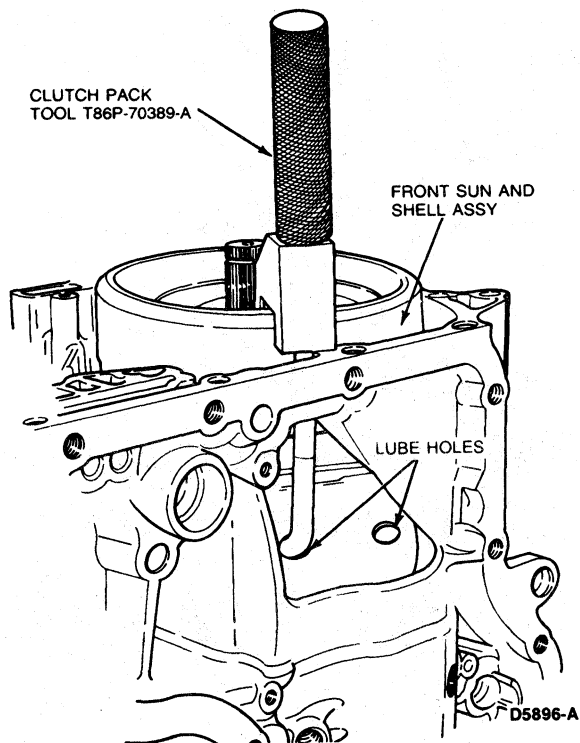
40. Remove overdrive band.



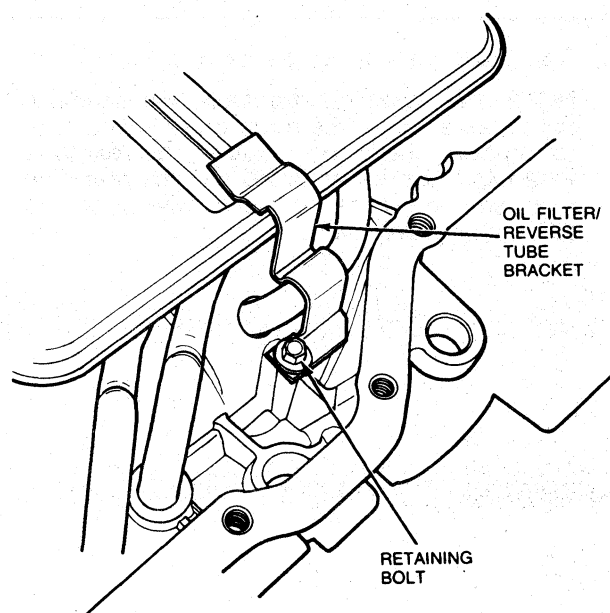
42. Remove seventeen 8mm oil pan cover bolts. Remove cover and discard gasket.



41. Using Clutch Pack Tool T86P-70389-A or equivalent install hook-end of tool into one of the six lube holes in front sun and shell assembly. Position notched block over edge of assembly and tighten handle. **Do not** over-tighten handle. Lift assembly out of case.



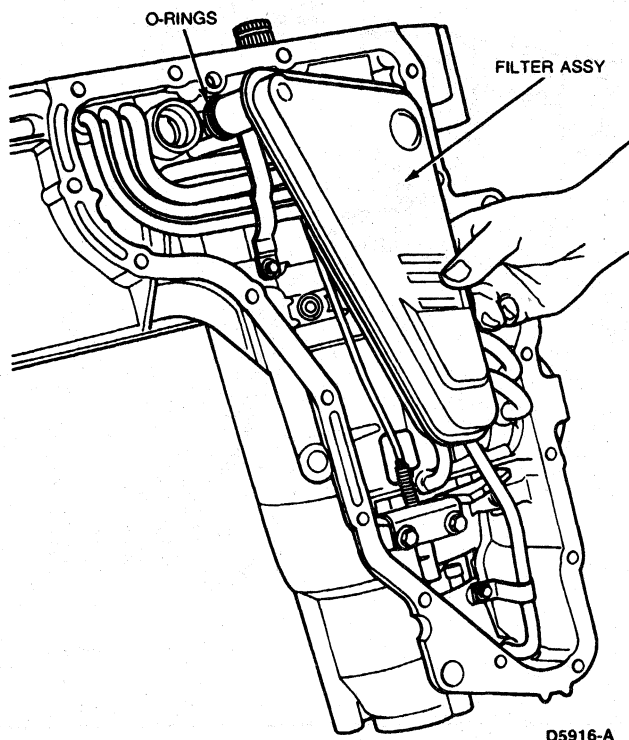
43. Remove 8mm reverse apply tube/oil filter bracket bolt and bracket.



## DISASSEMBLY AND ASSEMBLY (Continued)

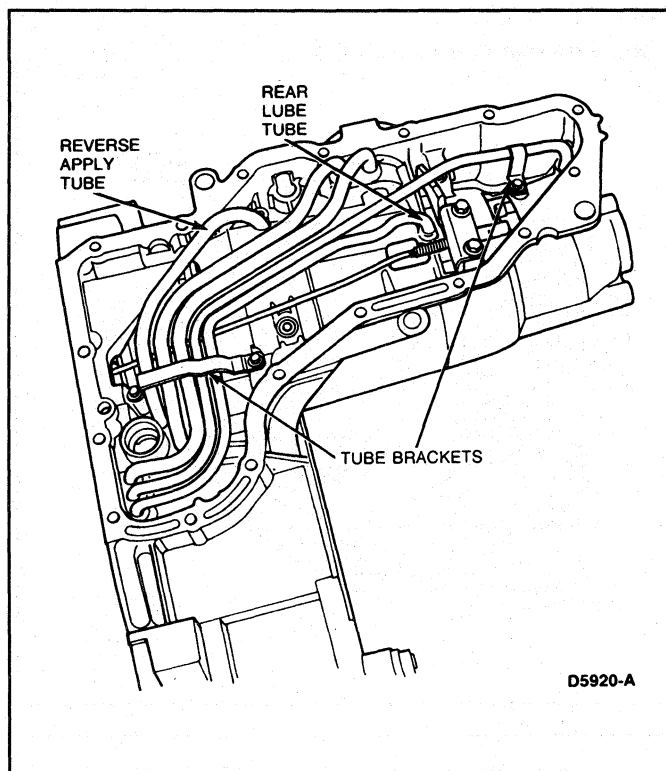
44. Remove oil filter screen and discard two O-rings.

NOTE: O-rings may stick inside case.



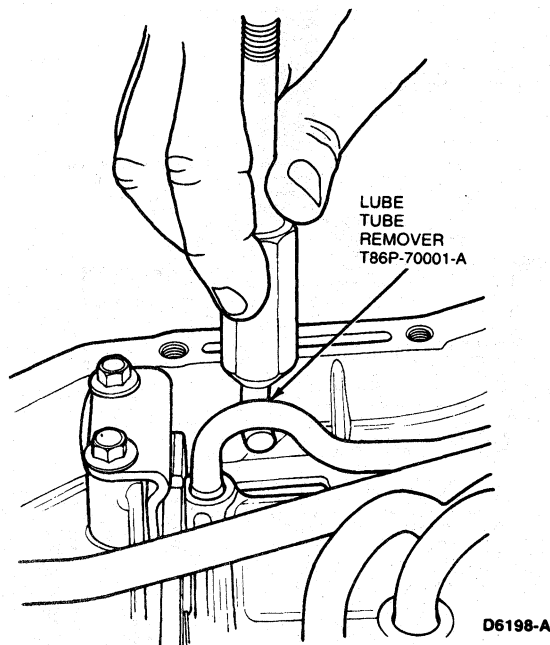
45. Remove 8mm tube bracket bolts and brackets.

NOTE: For complete transaxle disassembly, the reverse apply tube **must** be removed prior to removing the reverse clutch. The rear lube tube must also be removed and the rear lube tube seal must be replaced whenever the differential is removed.



46. If necessary, remove lube tubes using Lube Tube Remover T86P-70001-A and Impact Slide Hammer T59L-100-B or equivalent.

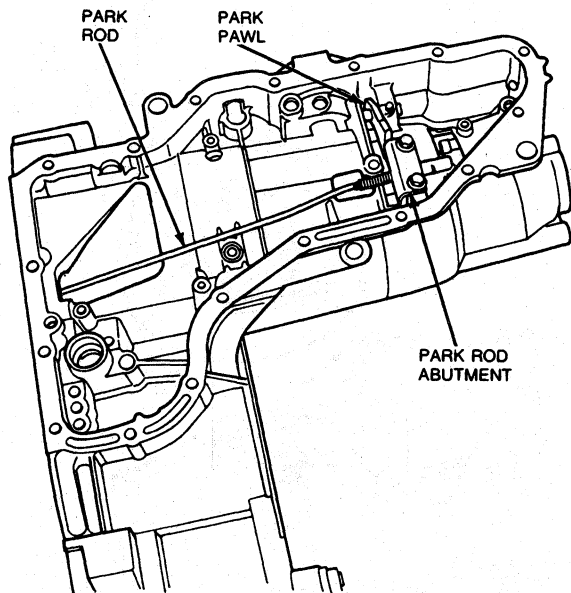
NOTE: Tubes are held in with Loctite.





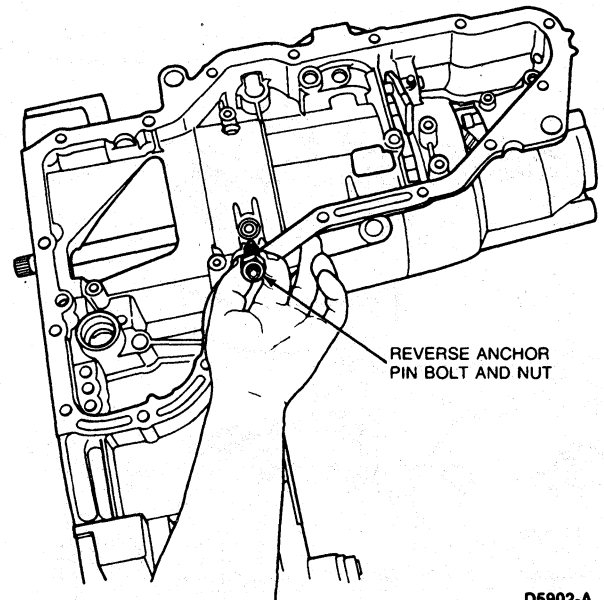
**DISASSEMBLY AND ASSEMBLY (Continued)**

47. Remove two 8mm park rod abutment bolts. Remove park rod by lifting rod to clear abutment and lower from case.



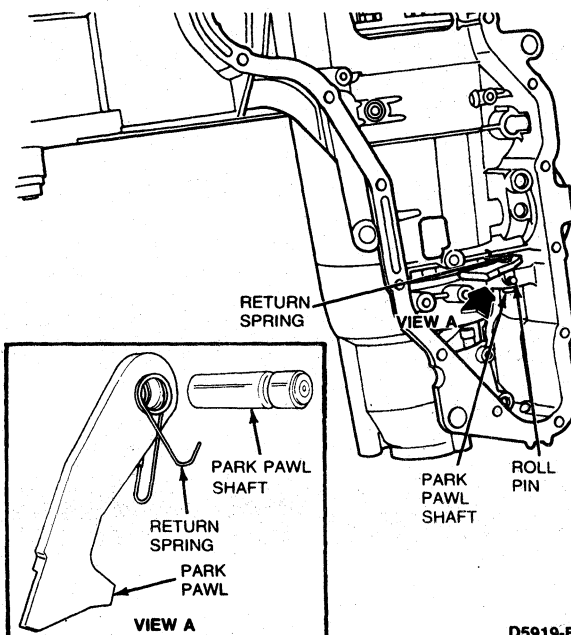
D6117-A

50. Loosen 19mm reverse clutch anchor pin nut and remove 6mm Allen head bolt.



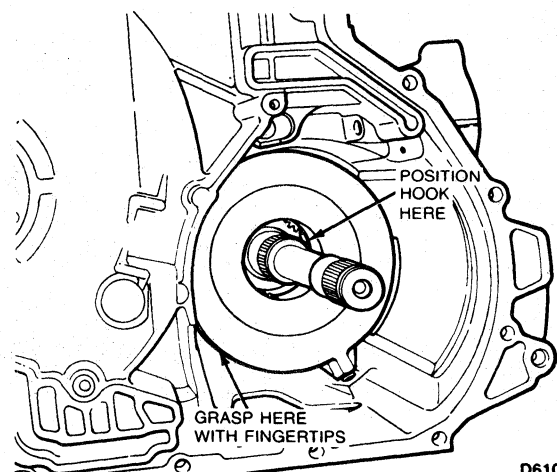
D5902-A

48. Remove park pawl shaft roll pin.  
49. Use magnet to remove park pawl shaft, and remove park pawl and return spring.



D5919-B

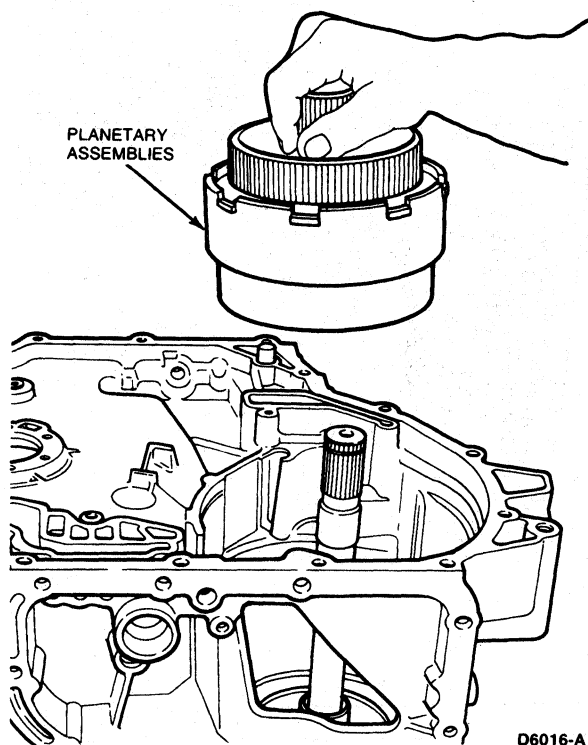
51. Rotate transaxle to the horizontal position.  
52. Locate hook portion of Clutch Pack Tool T86P-70389-A or equivalent on inner diameter of reverse clutch cylinder. Grasp outer diameter of cylinder with fingertips and slide clutch assembly out of case.



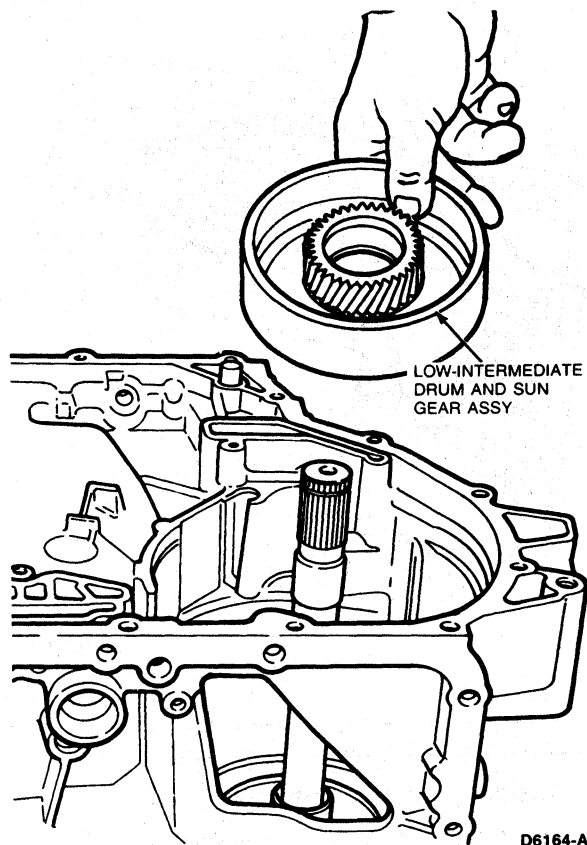
D6107-A

**DISASSEMBLY AND ASSEMBLY (Continued)**

53. Rotate transaxle to vertical position. Holding the front planetary shaft, lift out both front and rear planetary assembly.

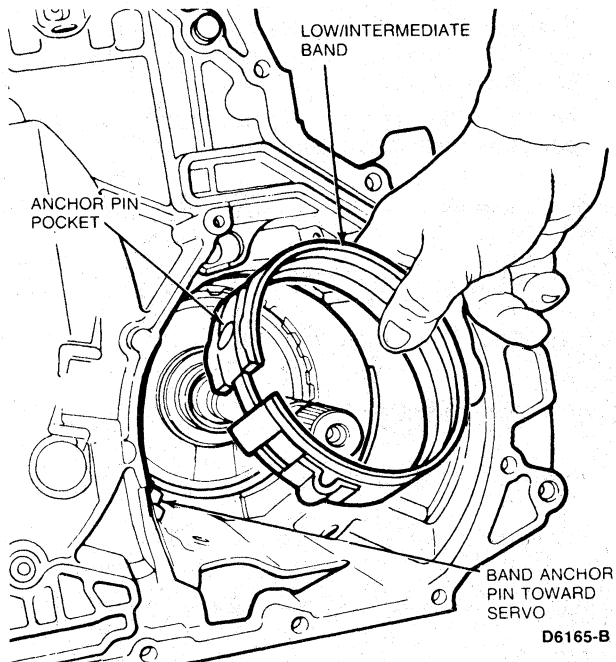


54. Lift out low-intermediate drum and sun gear assembly.

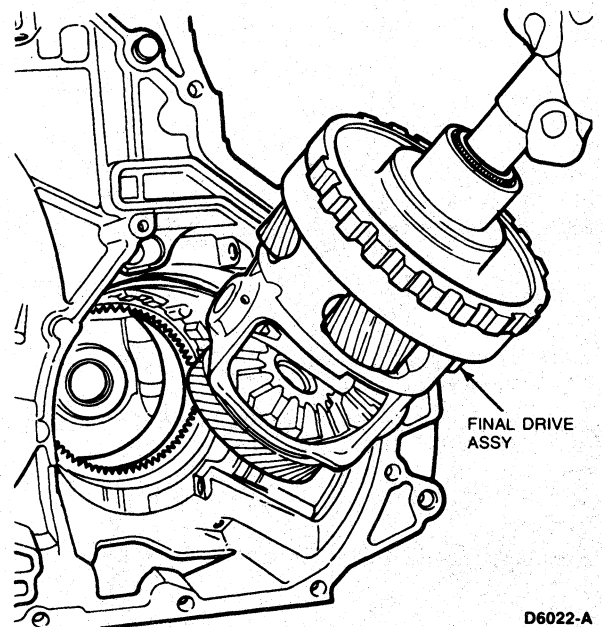


**DISASSEMBLY AND ASSEMBLY (Continued)**

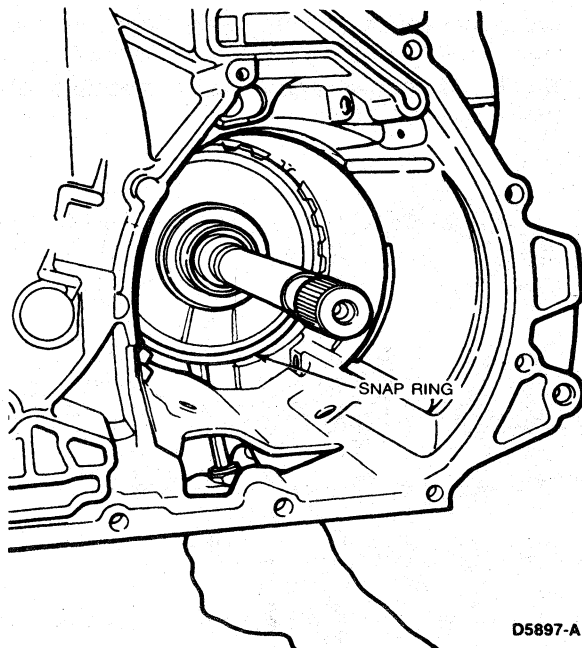
55. Remove low-intermediate band.



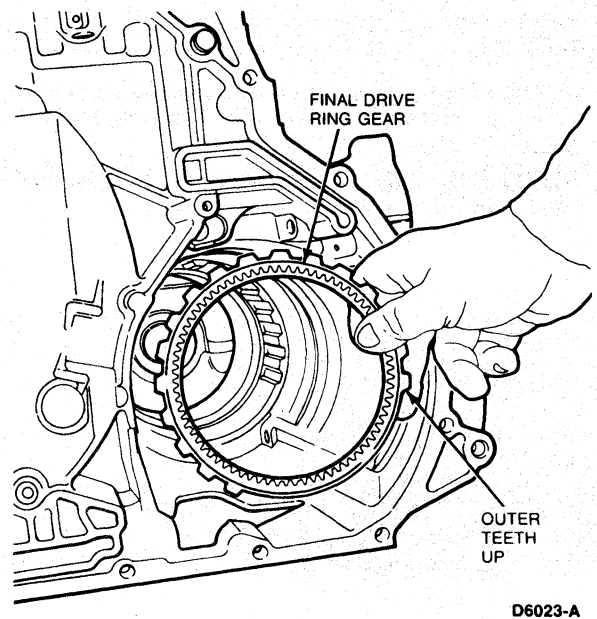
57. Lift out final drive assembly using output shaft.



56. Remove final drive gear assembly snap ring from case using a screwdriver inserted through side of case.



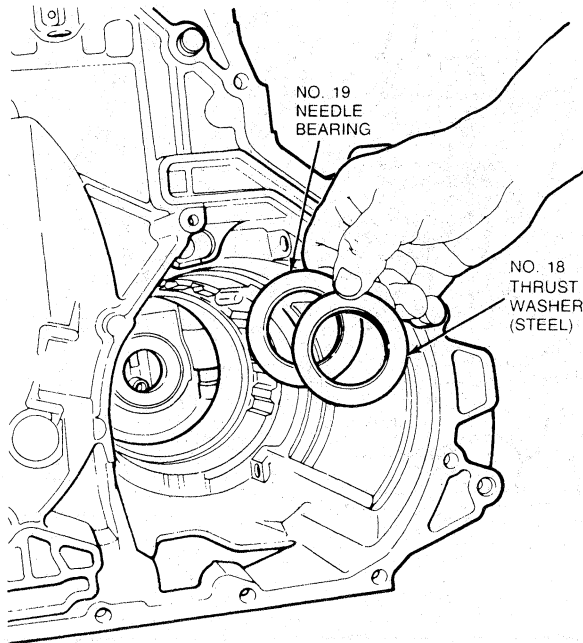
58. Remove final drive ring gear from case.



## DISASSEMBLY AND ASSEMBLY (Continued)

59. Remove No. 18 thrust washer and No. 19 needle bearing.

NOTE: No. 18 thrust washer may remain on the final drive assembly next to governor drive gear.

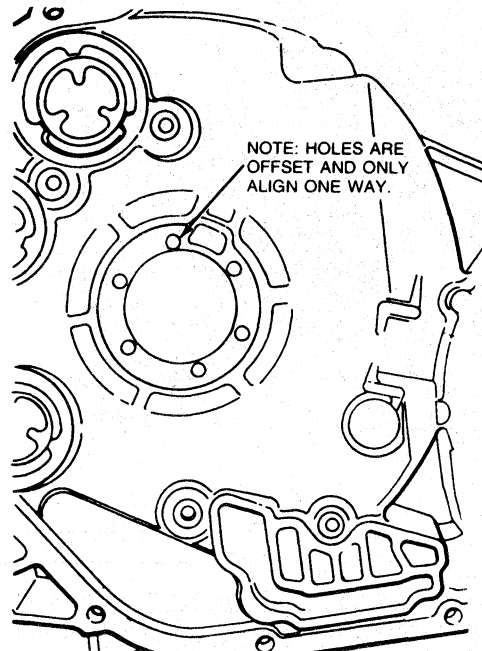


D5899-B

## Assembly

1. Position case in horizontal position.
2. If removed, install drive sprocket support. Install six (T-30) Torx® bolts and tighten to 9-12 N·m (7-9 lb-ft).

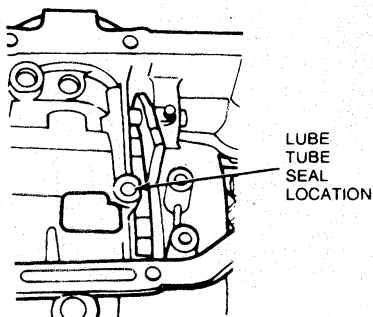
NOTE: Bolt holes are offset. Sprocket support can only be aligned one way.



D6033-A

60. Remove and discard rear lube tube seal using a 3/8-inch diameter rod or drift. Tap seal toward inside of case.

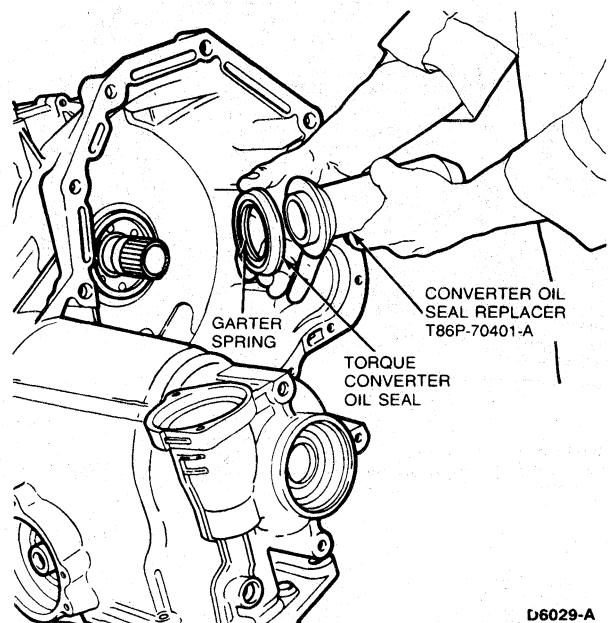
**CAUTION:** This must be done whenever differential is removed from case.



D6236-A

3. Install converter oil seal using Converter Oil Seal Replacer T86P-70401-A or equivalent.

NOTE: After installation, verify presence of garter spring on seal.

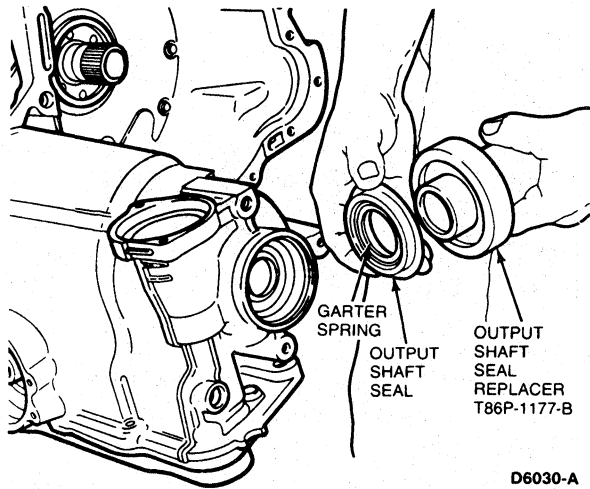


D6029-A

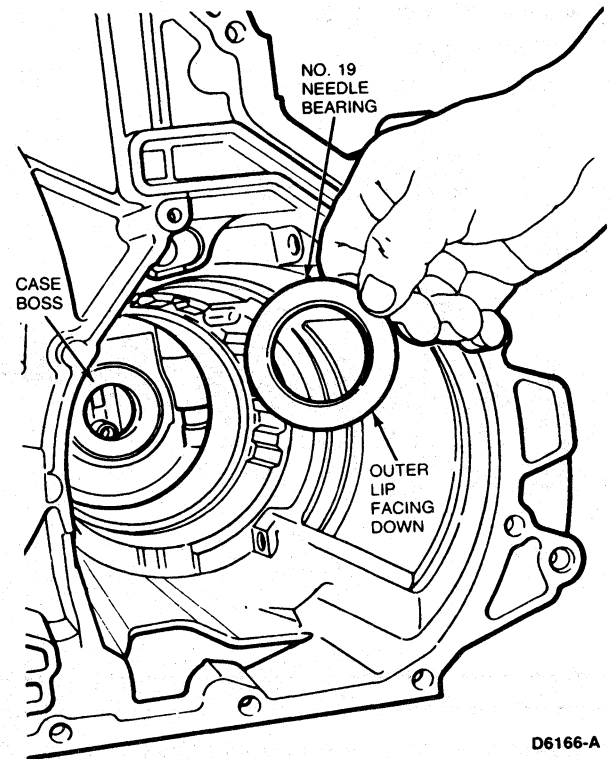
**DISASSEMBLY AND ASSEMBLY (Continued)**

4. Install RH output shaft seal using Output Shaft Seal Replacer T86P-1177-B or equivalent.

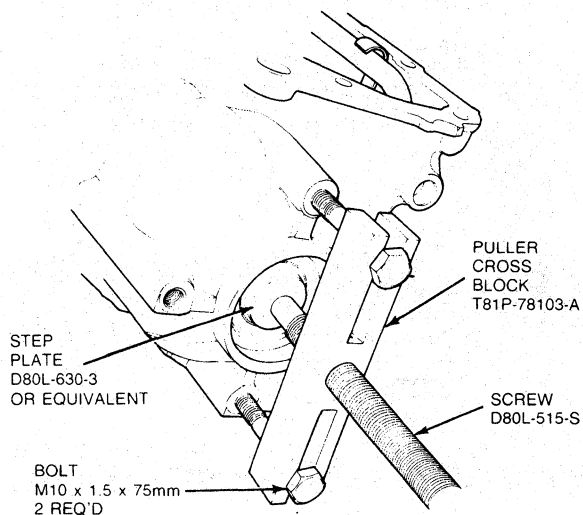
NOTE: After installation, verify presence of garter spring on seal.



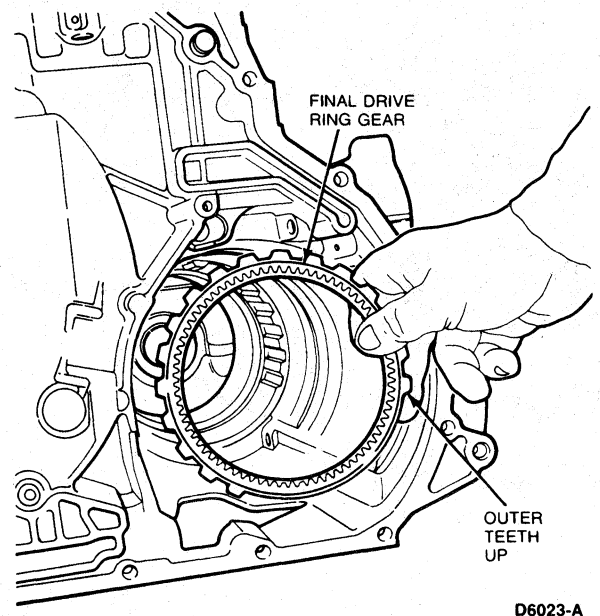
6. Place case in vertical position. Install No. 19 needle bearing over case boss with flat side facing up, outer lip facing down.



5. Install Puller Crossblock T81P-78103-A, Screw D80L-515-S, Step Plate D80L-630-3 and two M10-1.5 x 75mm bolts or equivalent, over RH output shaft opening. Tool will be used later to perform selective thrust washer checks.

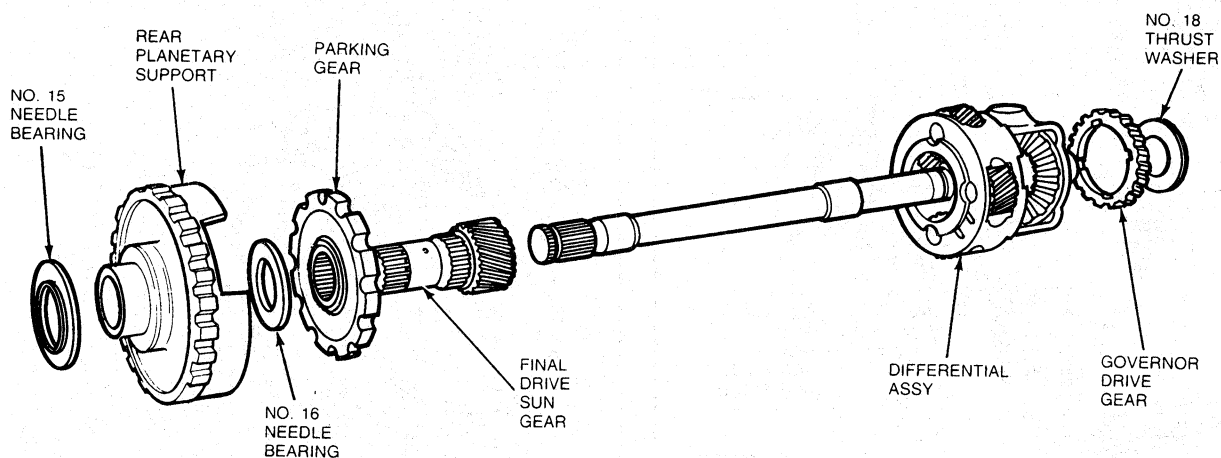


7. Install final drive ring gear with external splines up. Using a hammer handle if necessary, tap gently to fully seat into case splines.

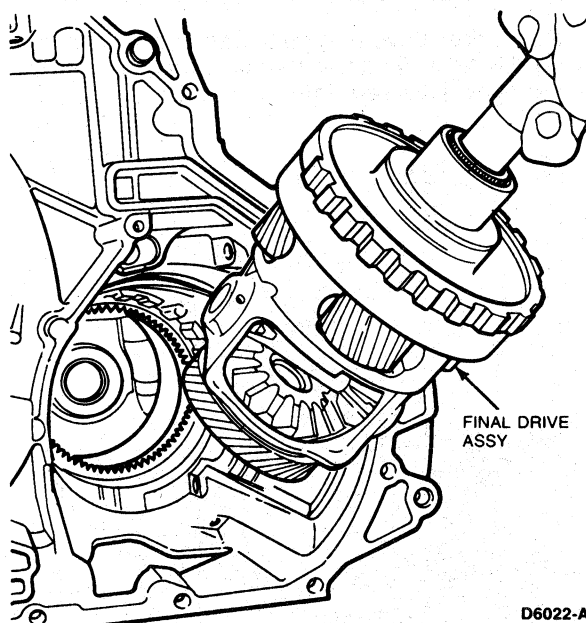


**DISASSEMBLY AND ASSEMBLY (Continued)****8. Assemble the following components:**

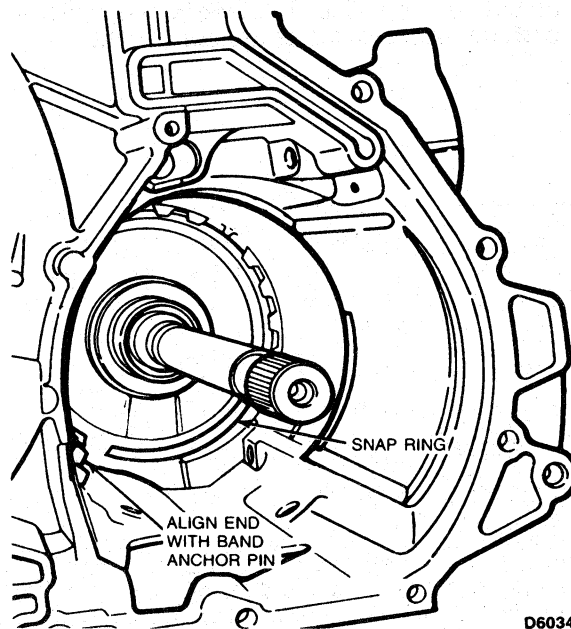
- Governor drive gear.
- Rear planetary support.
- Differential assembly.
- Final drive sun gear.
- Parking gear.
- No. 16 needle bearing.
- Rear planetary support.
- No. 15 needle bearing.
- No. 18 thrust washer.



D6237-B

**9. Lower final drive assembly into case.**

D6022-A

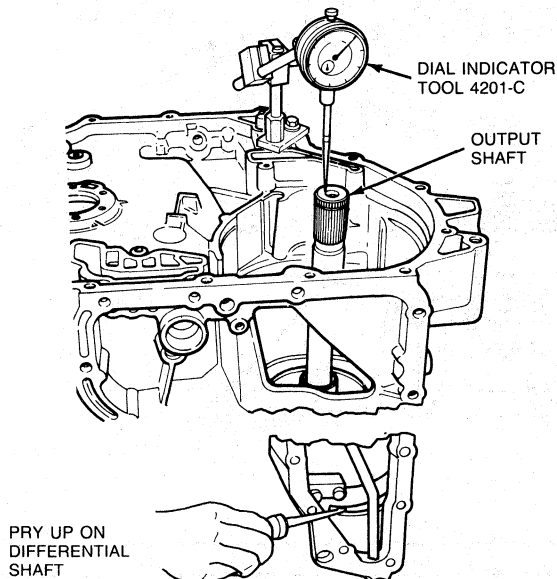
**10. Install snap ring and align end of snap ring with low-intermediate band anchor pin.**

D6034-A

**DISASSEMBLY AND ASSEMBLY (Continued)**

11. Perform end clearance check for No. 18 selective thrust washer as follows:

- Place screwdriver under differential case and pry up.
- Mount Dial Indicator TOOL 4201-C or equivalent with stylus on end of output shaft.
- Back out screw on tool installed in Step 5 until it no longer touches shaft.
- Zero dial indicator.
- Tighten screw to 4-5 N·m (35-44 lb-in).
- Observe reading on dial indicator.



D6008-B

The clearance should be 0.1-0.65mm (.004-.025 inch). If the clearance is not within specification, selective thrust washers are available in the following thicknesses:

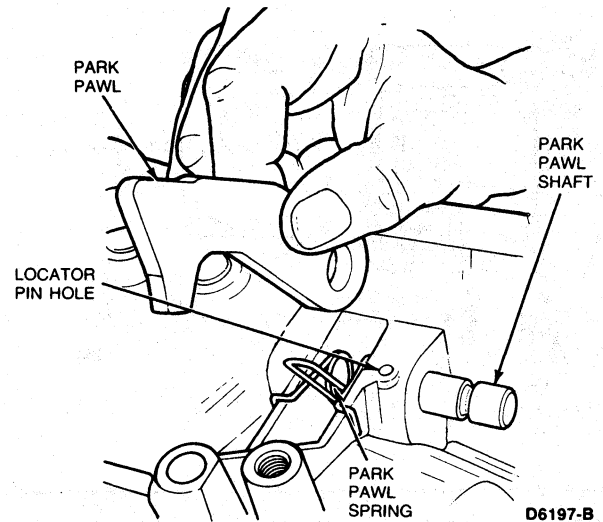
- 1.25-1.15mm (0.049-0.045 in) Orange
- 1.50-1.40mm (0.059-0.055 in) Purple
- 1.75-1.65mm (0.069-0.065 in) Yellow

12. After installing the correct thrust washer, check the clearance.

NOTE: After completing end clearance check, back off screw on tool and leave tool in position for No. 5 and No. 8 selective thrust washer clearance check to be performed later.

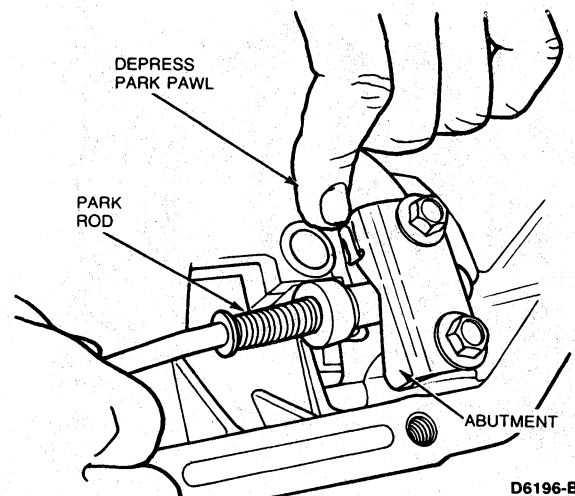
13. Install park pawl, return spring, park pawl shaft and locator pin.

NOTE: Ensure that the park pawl engages the park gear and returns freely.



D6197-B

14. Install park rod actuating lever and park rod in case. Install park rod abutment and start abutment bolts. Push in park pawl and locate rod between pawl and abutment.

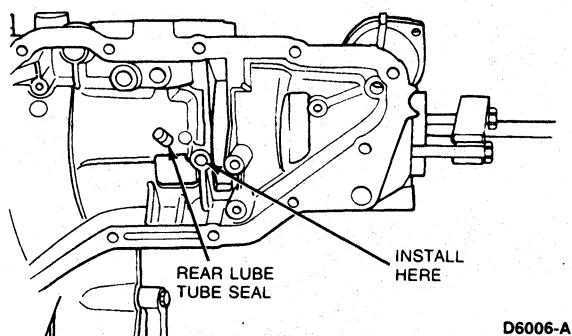


D6196-B

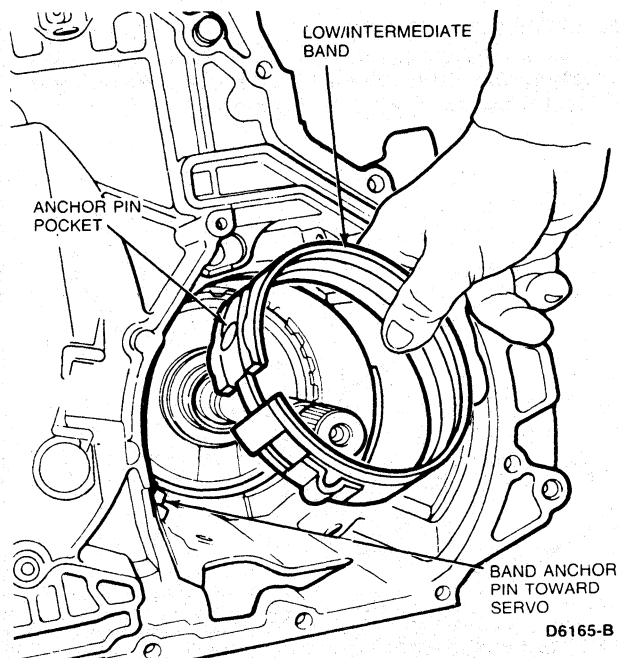
**DISASSEMBLY AND ASSEMBLY (Continued)**

15. Using a 3/8-inch rod or drift, gently install lube tube seal in case. Seal should be flush against rear support.

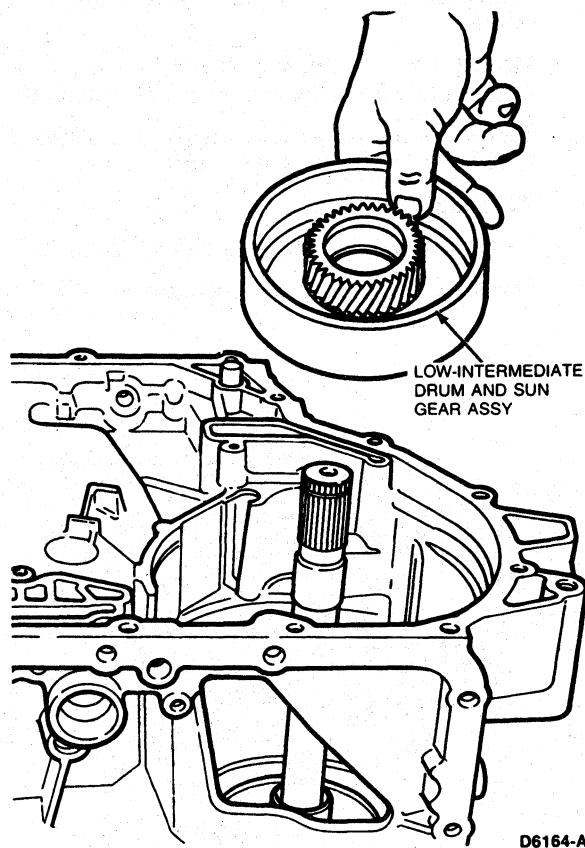
NOTE: Rubber end of seal goes into case first.



16. Install low-intermediate band into case and align anchor pin pocket with anchor pin.

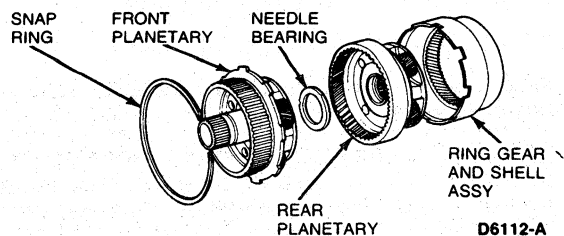


17. Install low-intermediate drum and sun gear.



18. Assemble the following components:

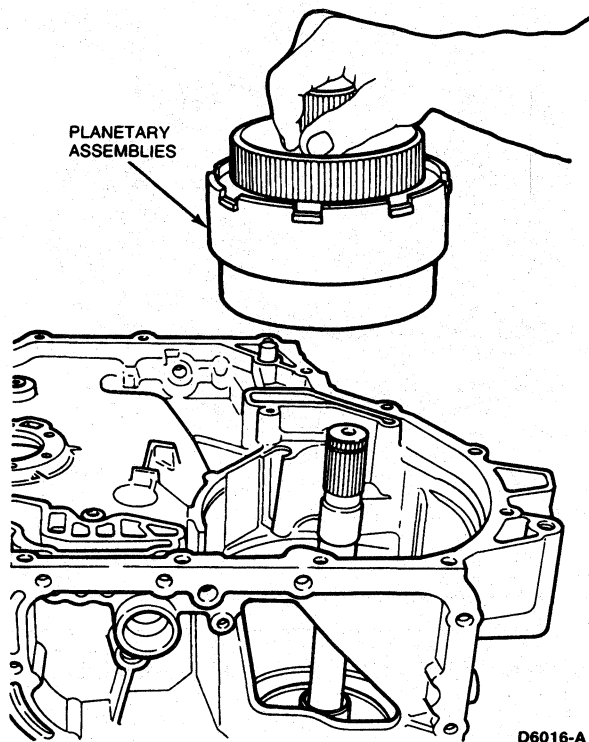
- Ring gear and shell assembly.
- Rear planetary.
- No. 13 needle bearing.
- Front planetary.
- Snap ring.



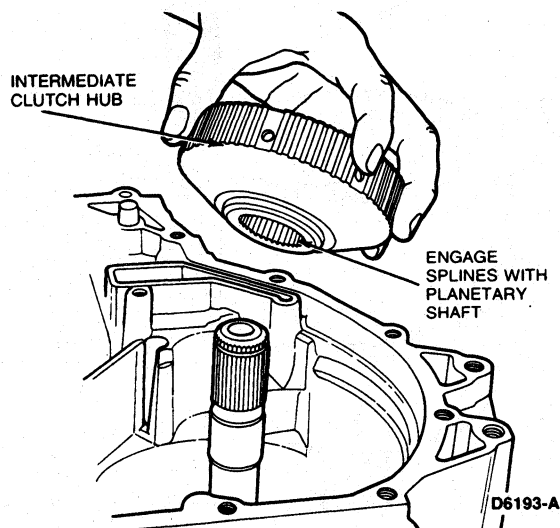


**DISASSEMBLY AND ASSEMBLY (Continued)**

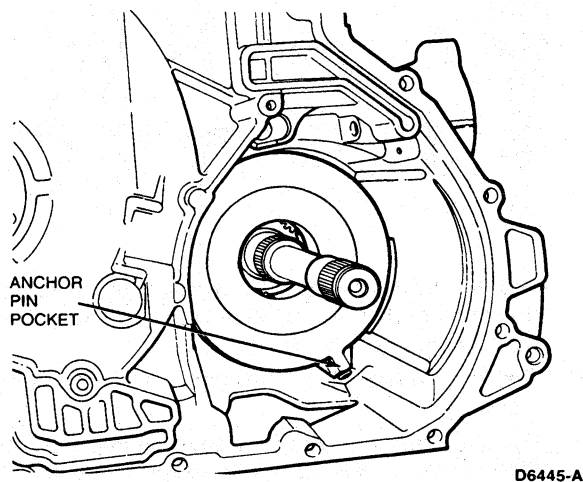
19. After assembling components, carefully slide assembly over output shaft.



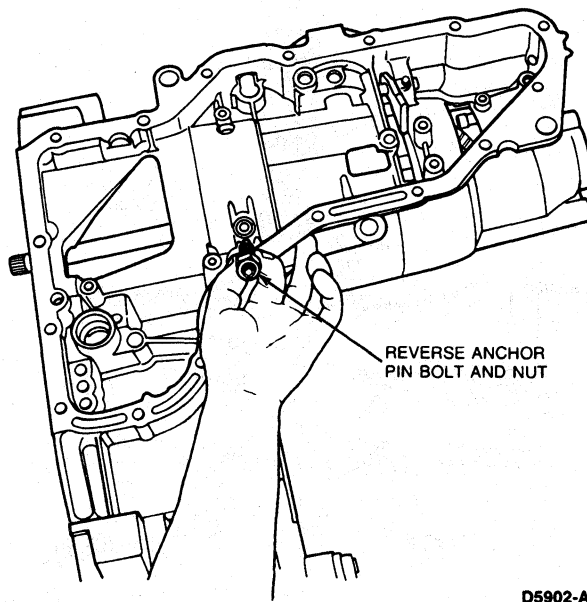
NOTE: To seat reverse clutch, the intermediate clutch hub can be used as a tool to complete clutch plate engagement. Rotating planet with hub will allow clutch splines to engage.



20. Lower reverse clutch into case and start clutch plate engagement.
21. Align clutch cylinder anchor pin pocket with anchor pin case hole.

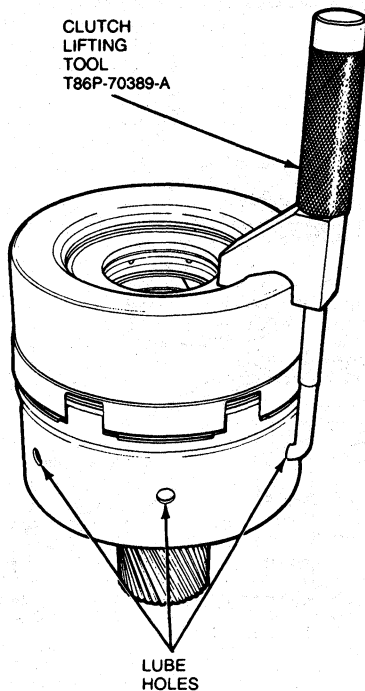


22. Start reverse anchor pin bolt but do not tighten.



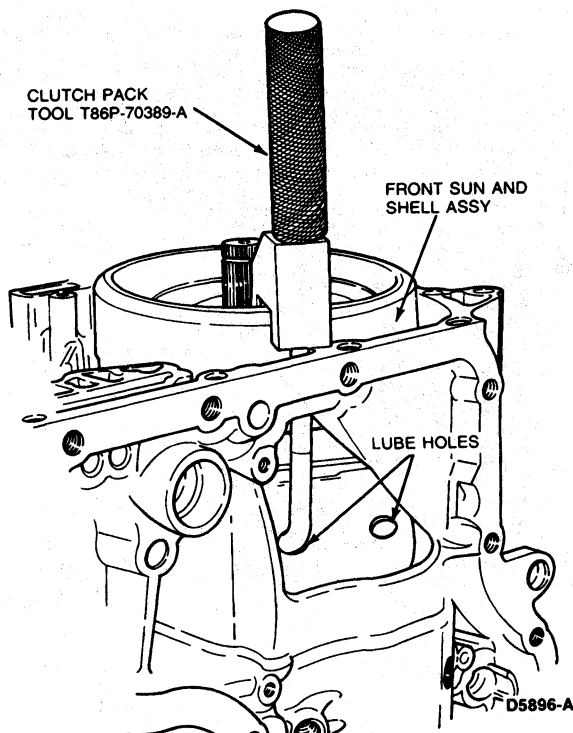
## DISASSEMBLY AND ASSEMBLY (Continued)

23. Assemble forward, direct and intermediate clutch assembly. Attach Clutch Pack Tool T86P-70389-A or equivalent to assembly.



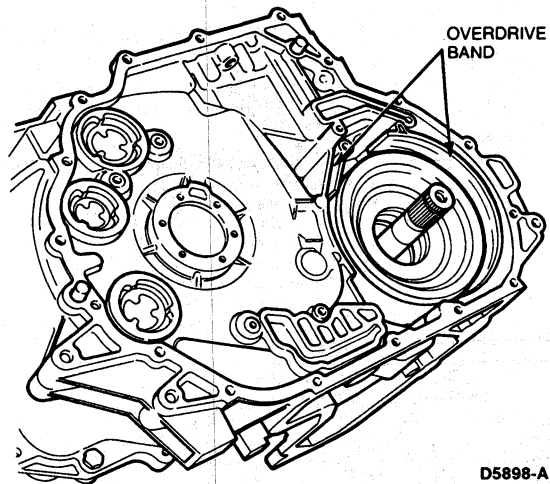
D6199-A

24. Lower assembly into case, aligning shell and sun gear splines into forward planetary. **CAUTION: Ensure the assembly is fully seated before removing tool.**

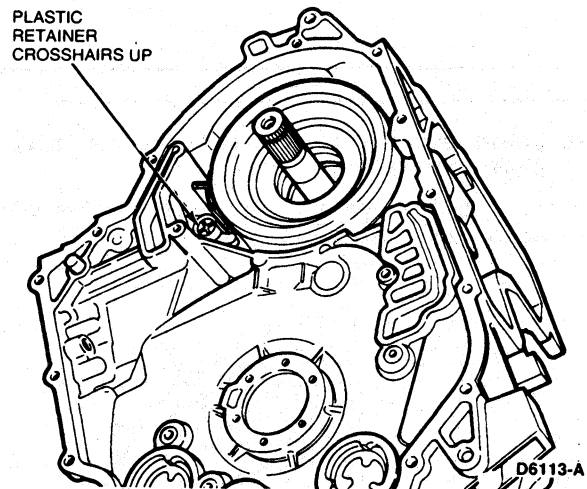


D5896-A

25. Install overdrive band into case.



26. Install plastic retainer with cross hairs facing up.



**NOTE:** Perform Steps 27 through 33 to check the drive sprocket end clearance for No. 5 and No. 8 selective thrust washers.

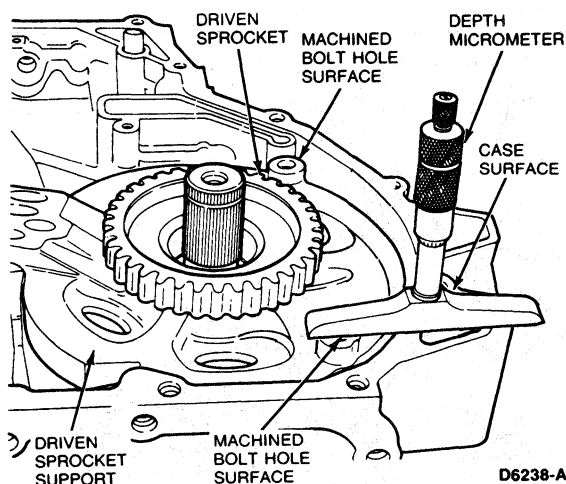
27. Tighten screw on endplay tool previously installed.
28. If not already removed, remove all five Teflon® seals from driven sprocket support assembly.
29. Install No. 9 needle bearing over output shaft, with outer lip facing up. Then install No. 8 selective thrust washer.

## DISASSEMBLY AND ASSEMBLY (Continued)

30. Remove No. 5 thrust washer, if still attached to sprocket support.
31. Install driven sprocket support and driven sprocket.
32. To measure No. 8 thrust washer clearance, it first must be determined if machined bolt hole surfaces on driven sprocket support are above or below case machined surface.

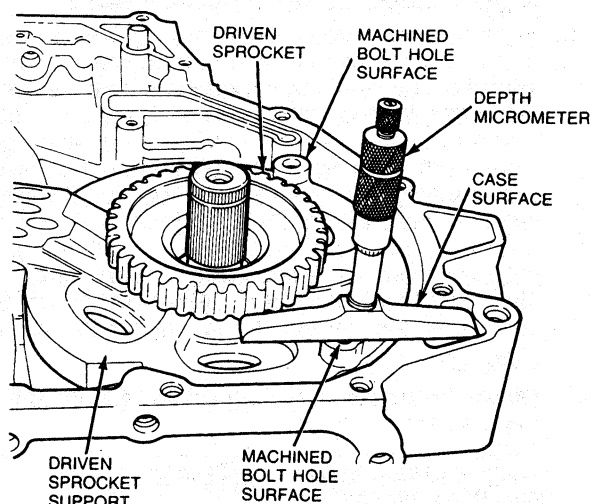
If machined bolt hole surfaces are **above** case machined surface, place depth micrometer on machined bolt hole surface on driven sprocket support. Measure distance to case machined surface. Measure at both support bolt hole machined surfaces and determine average from both readings. If reading exceeds 0.21mm (0.008 inch), refer to No. 8 Thrust Washer.

Use selection chart to determine correct thrust washer to install. Install correct thrust washer, repeat measurement and record reading. Go to Step 33.



D6238-A

If machined bolt hole surfaces are **below** case machined surface, place depth micrometer on case machined surface and measure distance to driven sprocket support machined bolt hole surfaces. Measure at both support bolt hole machined surfaces and determine average from both readings. If reading exceeds 0.46mm (0.018 inch), refer to No. 8 Thrust Washer Selection chart below to determine correct thrust washer to install. Install correct thrust washer, repeat measurement and record reading. Go to Step 33.



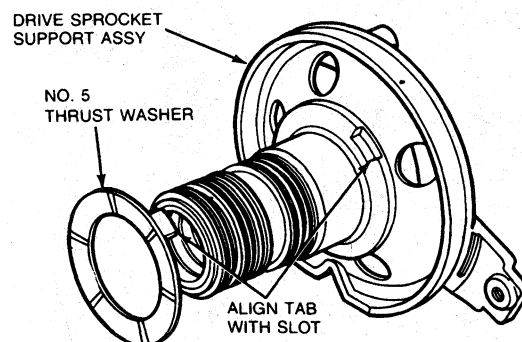
D6015-A

## NO. 8 THRUST WASHER SELECTION

Thrust Washer Thickness		Color
mm	Inches	
1.53-1.43	0.060-0.056	Natural
1.78-1.68	0.070-0.066	Dark Green
2.02-1.92	0.079-0.075	Light Blue
2.27-2.17	0.089-0.085	Red

CD6116-A

33. Remove driven sprocket, driven sprocket support, No. 8 selective thrust washer and No. 9 needle bearing.
34. Install No. 5 thrust washer on driven sprocket support, aligning tab on washer with slot in driven sprocket support. Apply grease to thrust washer to help hold it in position.



D5941-A

**DISASSEMBLY AND ASSEMBLY (Continued)**

35. Install driven sprocket support without No. 8 thrust washer and No. 9 needle bearing.
36. Position depth micrometer on machined case surface and measure distance between driven sprocket support machined bolt hole surface and case surface. Measure at both bolt hole machined surfaces and determine average from both readings. The difference between this reading and the reading for No. 8 thrust washer recorded in Step 32 must be greater than zero but less than 0.85mm (0.033 inch). If measurement exceeds specification, refer to No. 5 Thrust Washer Selection chart to determine the correct thrust washer to install.

**Example:**

When driven sprocket support surface is above case surface.

Average reading for No. 8 thrust washer measurement. .006 inch

Average reading for No. 5 thrust washer measurement. .018 inch

**Difference** .024 inch

NOTE: Reading from No. 8 thrust washer would be added to determine total.

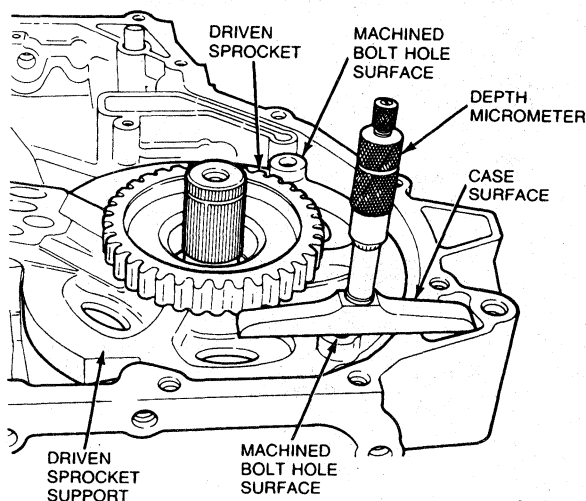
When driven sprocket support surface is below case surface.

Average reading for No. 8 thrust washer measurement. .015 inch

Average reading for No. 5 thrust washer measurement. .045 inch

**Difference** .030 inch

NOTE: Reading from No. 8 thrust washer would be subtracted to determine total.



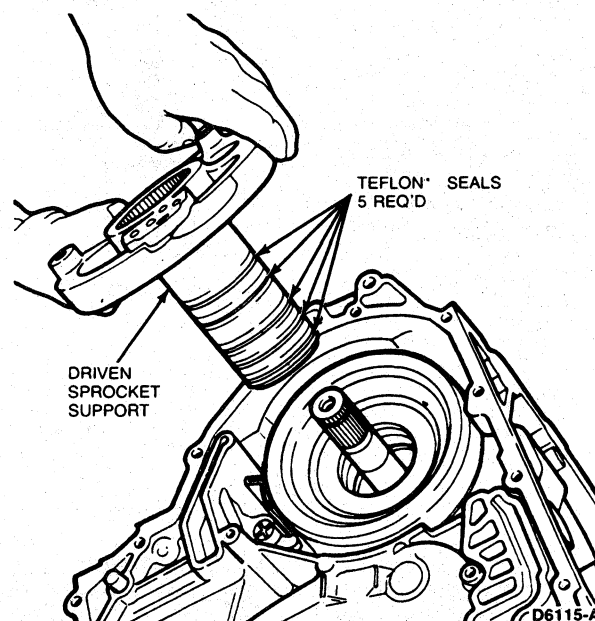
D6015-A

**NO. 5 THRUST WASHER SELECTION**

Thrust Washer Thickness		Color
mm	Inches	
2.28-2.18	0.090-0.086	Green
2.53-2.43	0.099-0.095	Black
2.77-2.67	0.109-0.105	Natural
3.02-2.92	0.118-0.115	Red

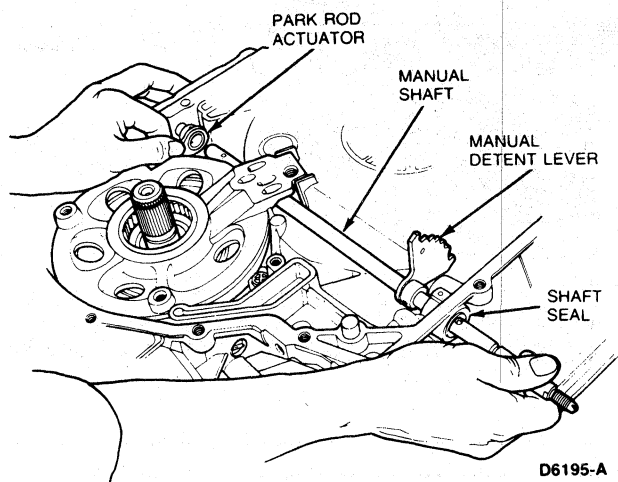
CD6239-A

37. Remove driven sprocket support and install No. 9 needle bearing and correct No. 8 thrust washer.
38. Install Teflon® seals on driven sprocket support.
39. Install correct No. 5 thrust washer on driven sprocket support and install driven sprocket support. Apply grease to thrust washer to help hold it in position.

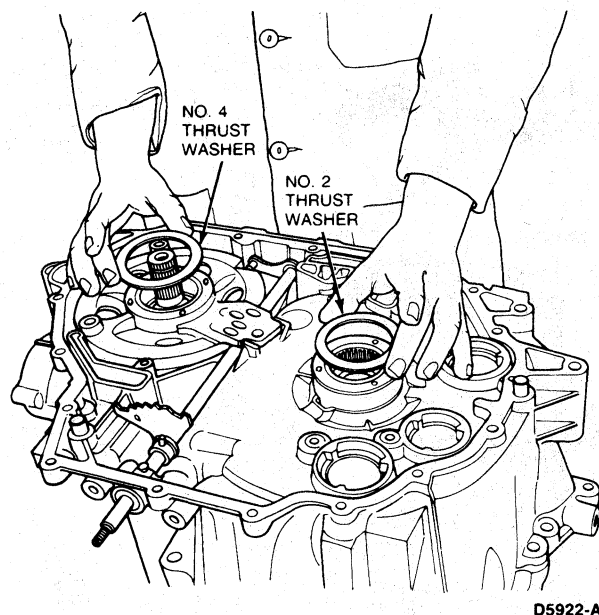


**DISASSEMBLY AND ASSEMBLY (Continued)**

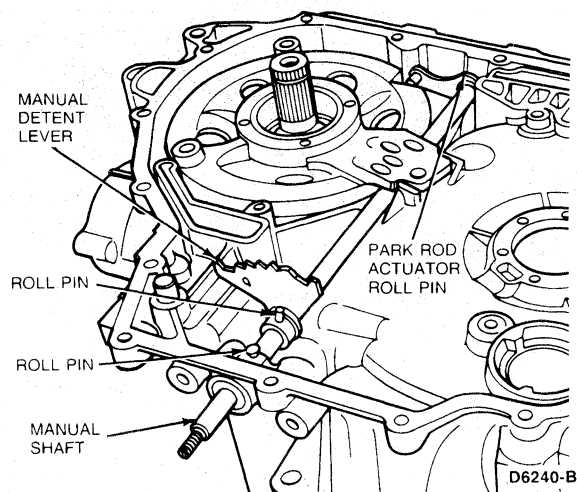
40. Install manual shaft seal by tapping into case.
41. Start manual shaft through seal and slide manual detent lever onto shaft.
42. Slide manual shaft through park rod actuating lever, and tap into case hole.



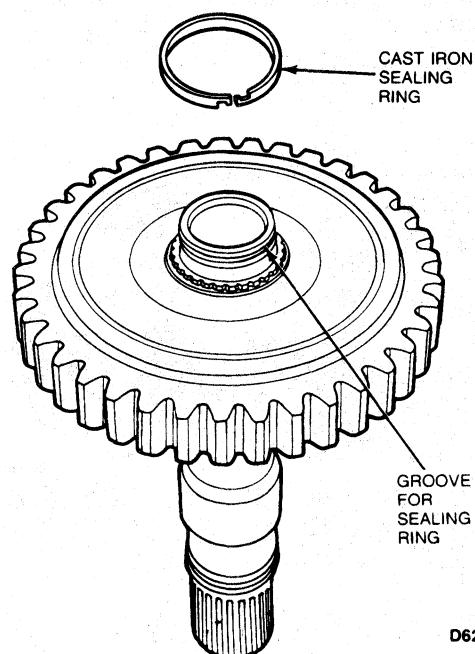
45. Install No. 2 and No. 4 tabbed thrust washers onto drive and driven sprocket supports. Align tabs on thrust washers with holes in sprocket supports. Apply grease to washers to help hold in position.



43. Install new manual shaft lock pin through case hole, aligning with groove in shaft.
44. Install new roll pins in detent lever and park rod actuating lever.

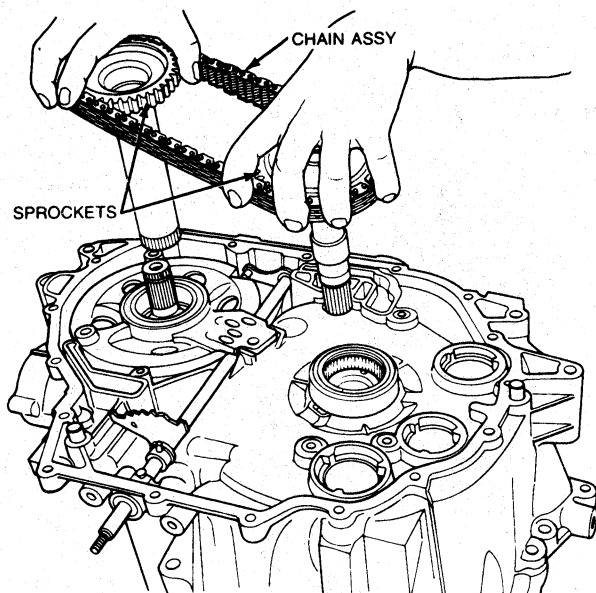


46. Lubricate and install input shaft cast iron sealing ring onto input shaft.



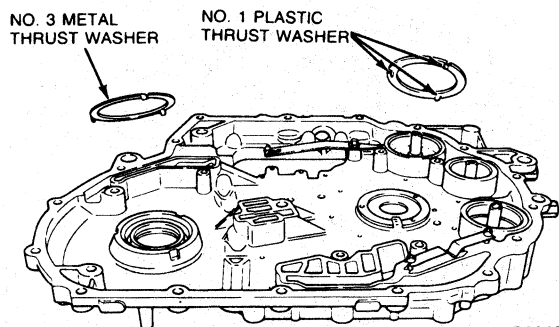
## DISASSEMBLY AND ASSEMBLY (Continued)

47. Install chain on drive and driven sprockets. Lower assembly into sprocket supports, rotating sprockets to ensure that they are fully seated.



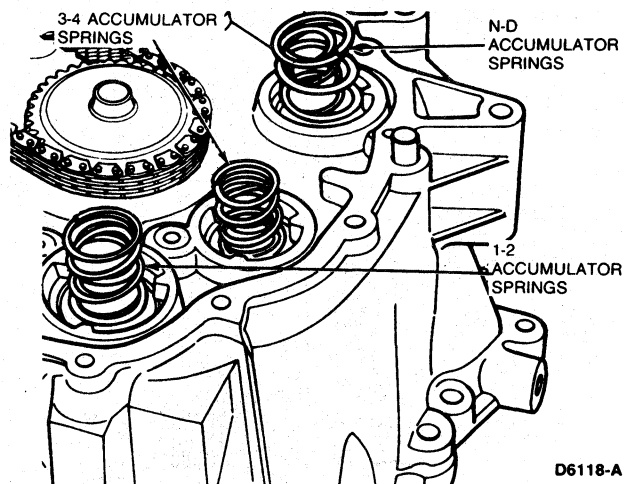
D5909-A

48. Install No. 1 and No. 3 thrust washers on chain cover being sure tabs align with slots in chain cover.



D5949-A

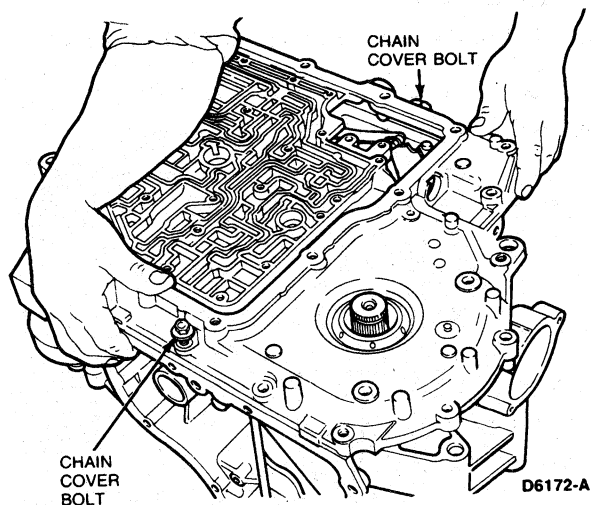
49. Install new chain cover gasket.  
50. Install accumulator springs in correct position.



D6118-A

51. Inspect chain cover alignment pins on case.  
52. Carefully align chain cover input shaft bore with input shaft. Apply gentle downward pressure on chain cover to overcome accumulator spring pressure and start two chain cover bolts.

**CAUTION:** Be extremely careful to prevent damage to the input shaft cast iron sealing ring.

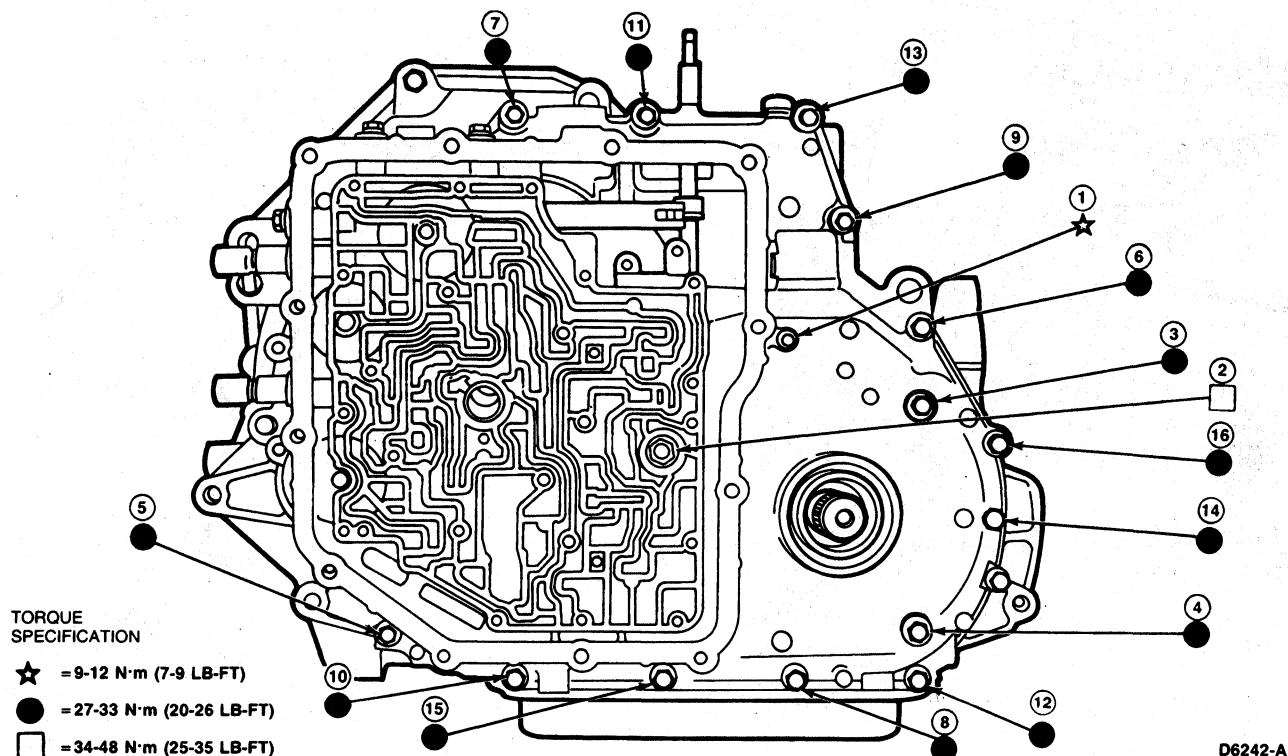


D6172-A

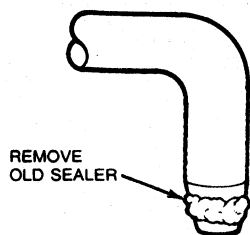
**DISASSEMBLY AND ASSEMBLY (Continued)**

53. Start remaining chain cover bolts and tighten 10mm bolts to 27-33 N·m (20-26 lb-ft). Tighten 8mm bolt to 9-12 N·m (7-9 lb-ft). Tighten 13mm bolt to 34-48 N·m (25-35 lb-ft). Tighten bolts in sequence shown.

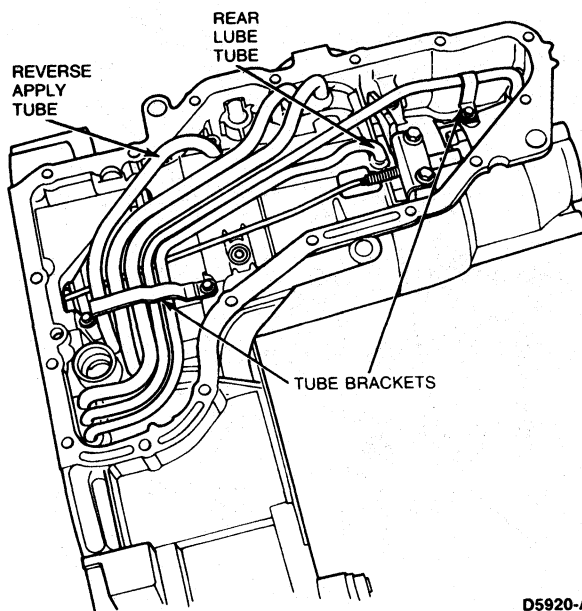
NOTE: After installing chain cover, input shaft should have some end play and should rotate freely. If it will not rotate freely, remove chain cover and inspect cast iron seal for damage.



54. Tighten park rod abutment bolts to 27-30 N·m (20-22 lb-ft).
55. Tighten reverse drum 6mm Allen head anchor bolt to 10-12 N·m (7.5-9 lb-ft) and 19mm locknut to 34-47 N·m (25-35 lb-ft).
56. Remove old sealer from lube tubes.

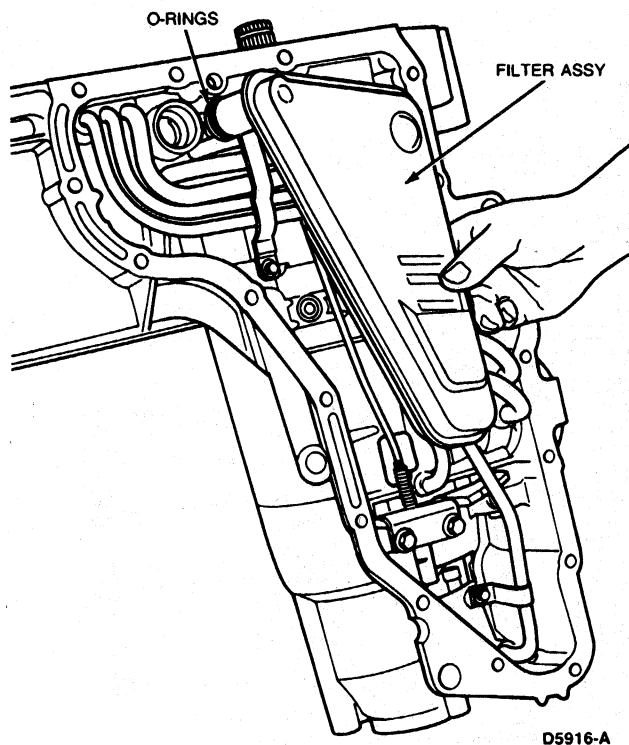


57. Install tubes in position and tap lightly until fully seated. Apply Threadlock 262, E2FZ-19554-B or equivalent around tube-to-case surface.
58. Install tube retaining brackets.

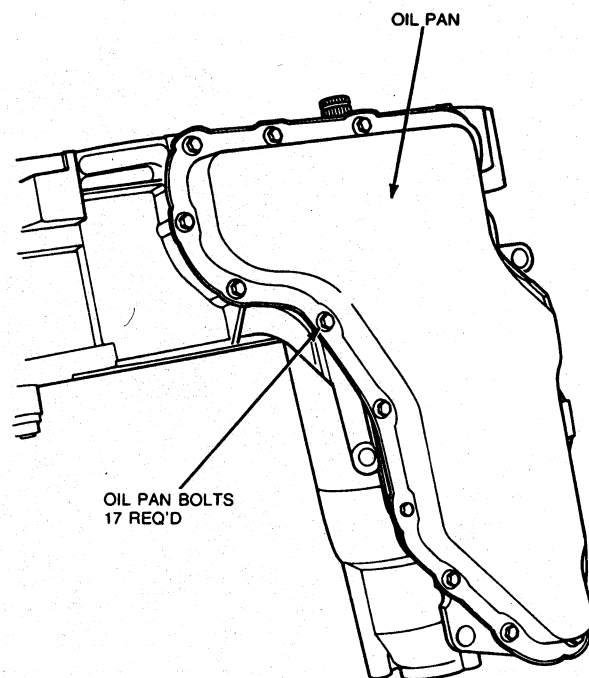


**DISASSEMBLY AND ASSEMBLY (Continued)**

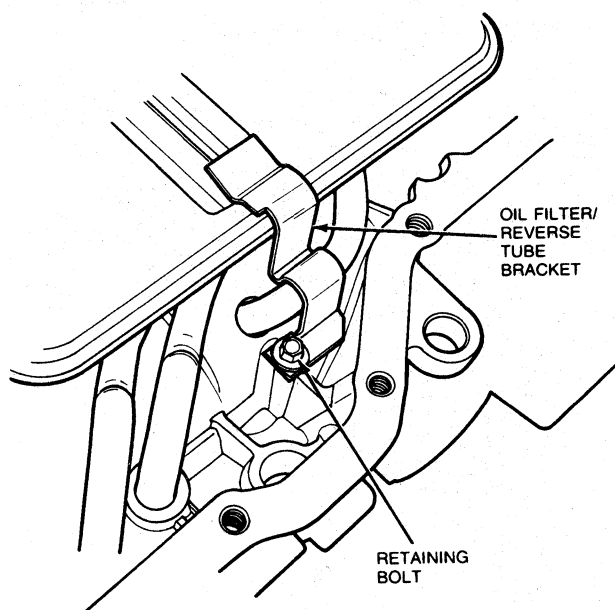
59. Install two O-rings onto oil filter and press oil filter into case.



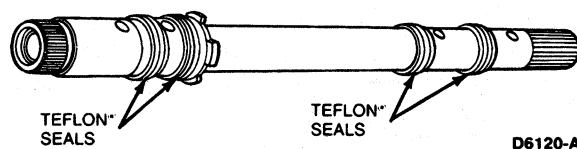
61. Install new oil pan gasket on case and install oil pan. Tighten bolts to 14-16 N·m (10-12 lb-ft).



60. Install reverse apply tube/oil filter bracket.



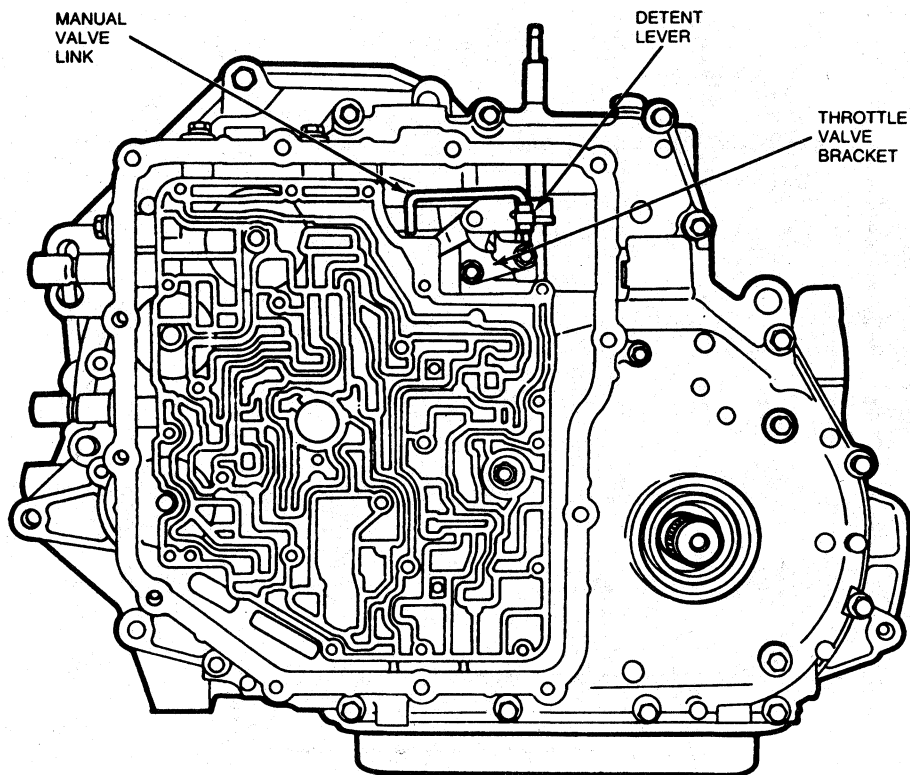
62. Install four new Teflon® seals on pump driveshaft and install shaft.





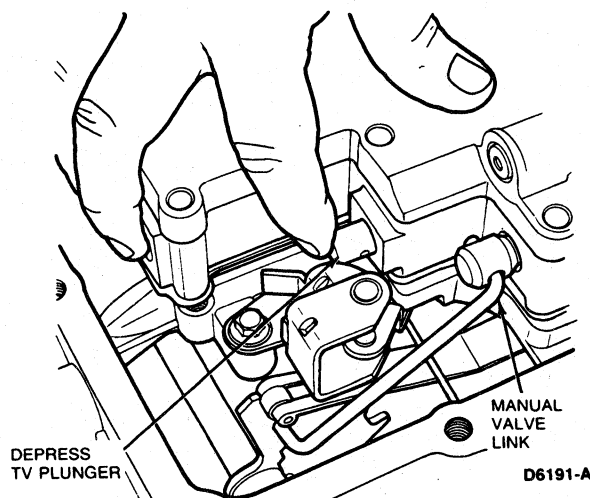
**DISASSEMBLY AND ASSEMBLY (Continued)**

63. Install TV bracket with TV link through hole in case. Tighten bolts to 9-12 N·m (7-9 lb-ft). Connect manual valve link to detent lever.



D6167-A

64. Start oil pump and valve body over pump shaft and connect manual valve link to manual valve. Hold TV plunger in, to clear TV bracket, and install oil pump and valve body into position.

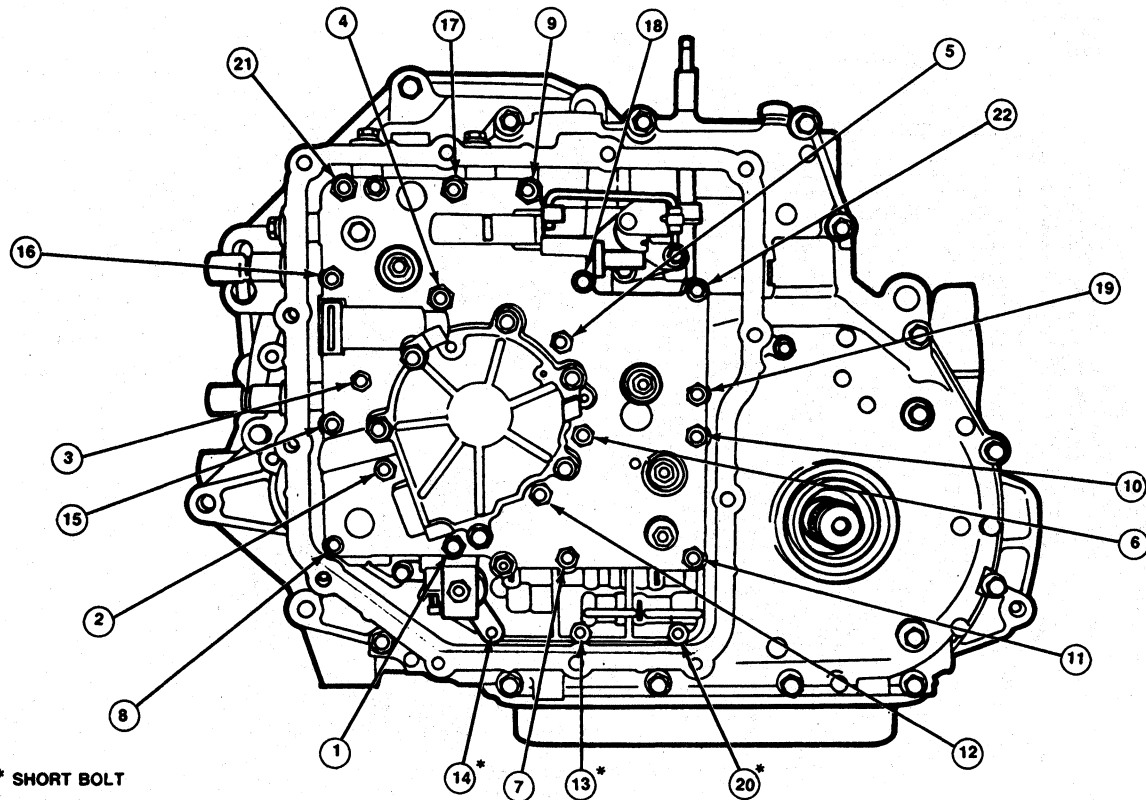


D6191-A

**DISASSEMBLY AND ASSEMBLY (Continued)**

65. Install 22 valve body bolts and tighten in sequence to 9-12 N·m (7-9 lb-ft).

NOTE: Install three short bolts where indicated.

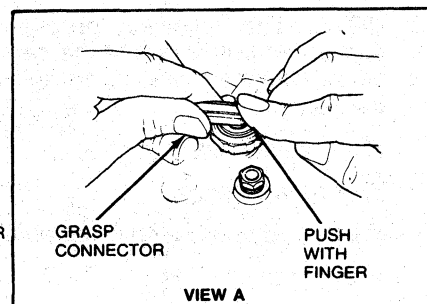
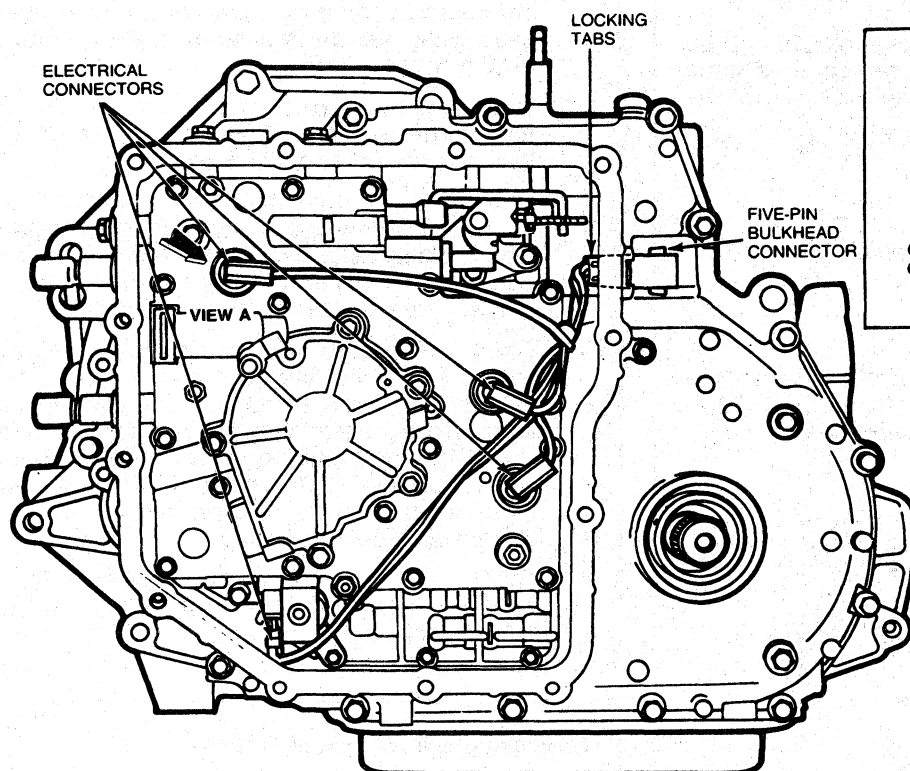


\* SHORT BOLT

D6123-A

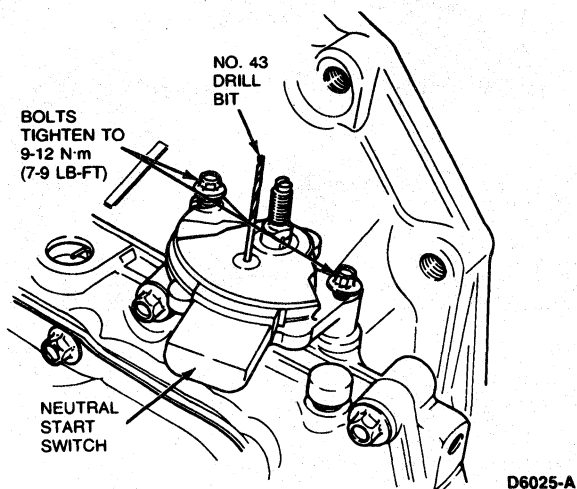
## DISASSEMBLY AND ASSEMBLY (Continued)

66. Install bulkhead connector into case, making sure locking tabs on bulkhead assembly are secure. Install four electrical connectors on proper switches and solenoids until a slight "click" is felt.

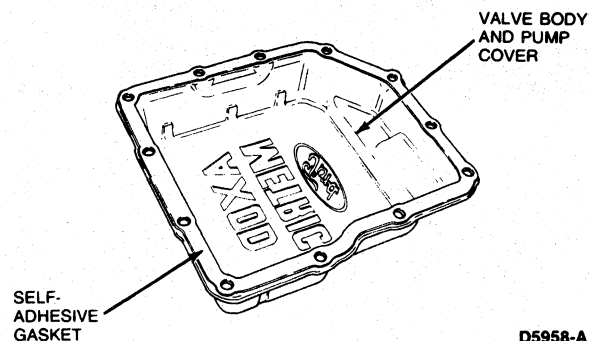


D5913-A

67. Install neutral start switch. With manual shaft in neutral detent, align switch using a No. 43 (.089 inch) drill bit or equivalent. Tighten to 9-12 N·m (7-9 lb-ft).



68. Install new self-adhesive oil pump and valve body cover gasket onto cover.



## DISASSEMBLY AND ASSEMBLY (Continued)

69. Install cover and tighten to 9-12 N·m (7-9 lb-ft).
70. Rotate transaxle to horizontal position.
71. Perform servo travel check as follows:

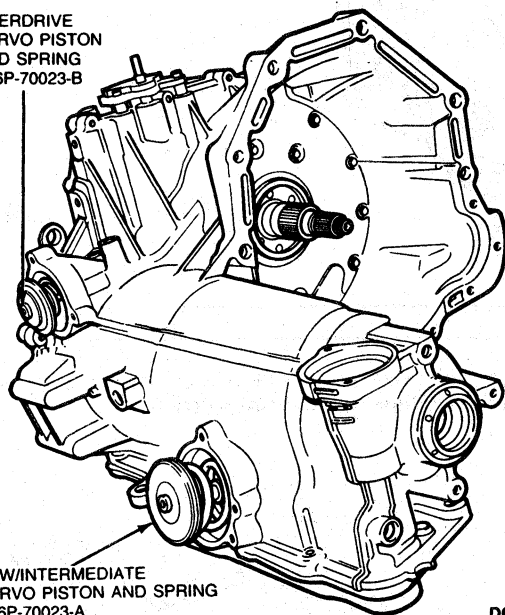
NOTE: This procedure applies to both the overdrive servo and the low-intermediate servo.

NOTE: The following procedure should be performed only if one of the components listed below is being replaced during assembly of the transaxle:

- Transaxle case.
- Band assembly.
- Drum and sun gear assembly.
- Servo piston rod.
- Servo piston.

72. Install spring in case from Overdrive Servo Rod Tool T86P-70023-B or Low/Intermediate Servo Rod Tool T86P-70023-A or equivalent.

OVERDRIVE  
SERVO PISTON  
AND SPRING  
T86P-70023-B



LOW/INTERMEDIATE  
SERVO PISTON AND SPRING  
T86P-70023-A

D6244-B

73. Install servo piston and rod in case.

NOTE: On low/intermediate servo, install without piston seal.

74. Install Servo Rod Tool T86P-70023-B (overdrive servo) or T86P-70023-A (low-intermediate servo) or equivalent, and secure in case using servo cover bolts. Tighten bolts to 9-12 N·m (7-9 lb-ft).

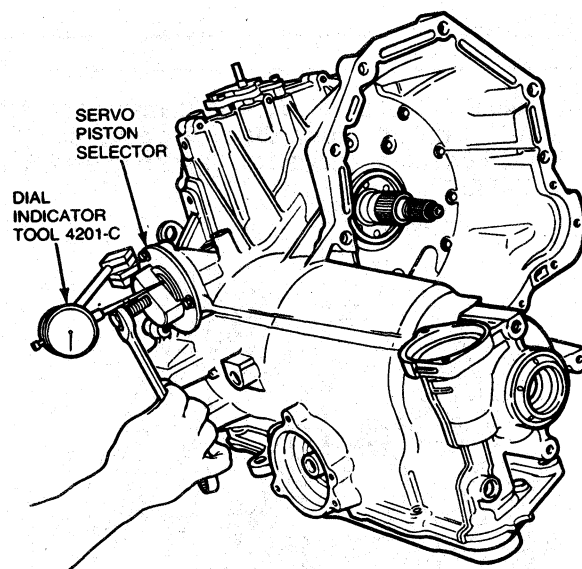
75. Tighten gauge disc screw to 1.13 N·m (10 lb-in) for overdrive servo. Tighten to 3.4 N·m (30 lb-in) for low/intermediate servo.

76. Mount Dial Indicator TOOL-4201-C or equivalent and position stylus through hole in gauge disc. Make certain indicator stylus has contacted servo piston on a flat surface. **Do not** contact step on piston. Zero dial indicator.

77. Back off gauge disc screw until piston movement stops and read dial indicator. The amount of piston travel as indicated on dial indicator will determine the rod length to be installed. For overdrive servo, reading should be 1.8-3.8mm (0.070-0.149 inch). For low/intermediate servo, reading should be 5.5-6.5mm (0.216-0.255 inch).

NOTE: If a new low/intermediate band is installed, reading should be 5-6mm (0.196-0.236 inch).

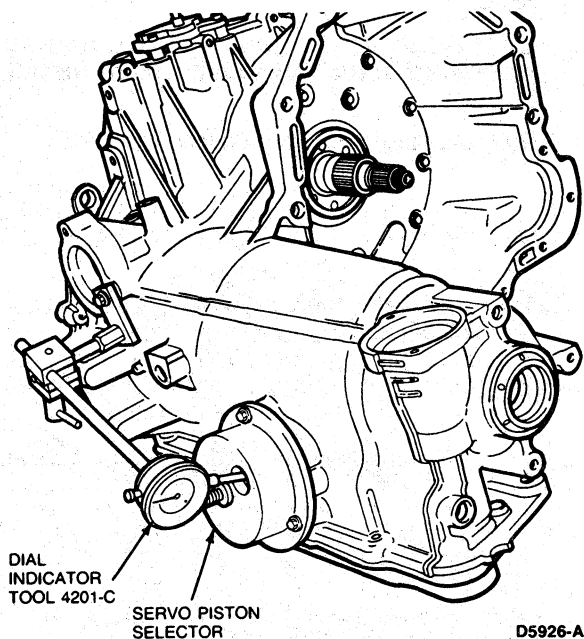
## Overdrive Servo Travel Check



D5927-A

## DISASSEMBLY AND ASSEMBLY (Continued)

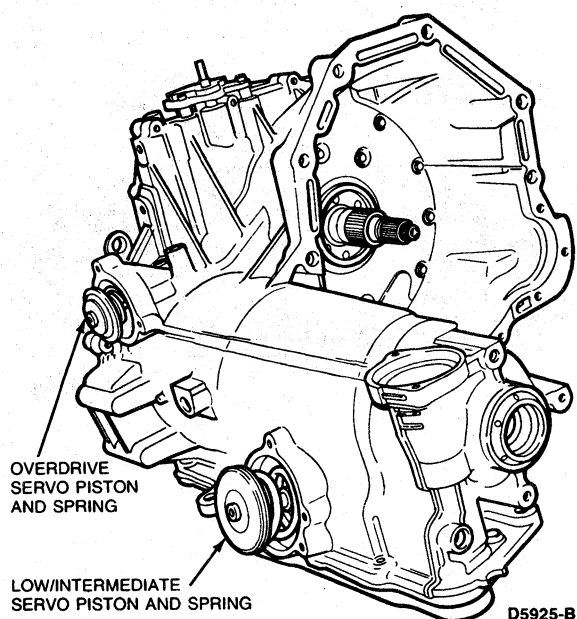
## Low-Intermediate Servo Travel Check



78. Select a new piston rod using the measurement obtained in Step 77. Install new piston rod and repeat Steps 73 through 77 to verify amount of piston travel.

79. Install seals on low/intermediate servo piston.

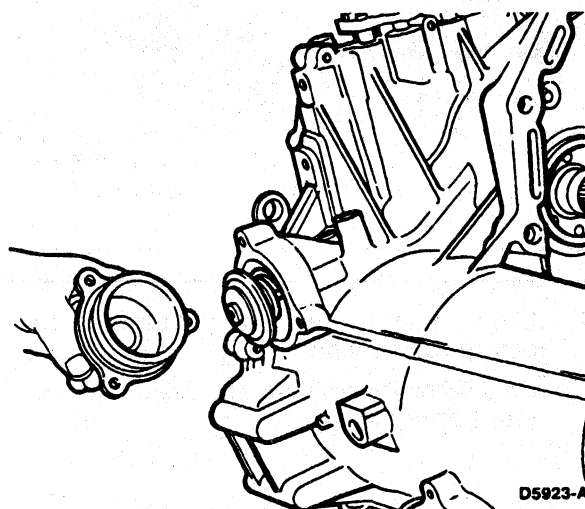
80. Install servo pistons and springs being sure they are fully seated.



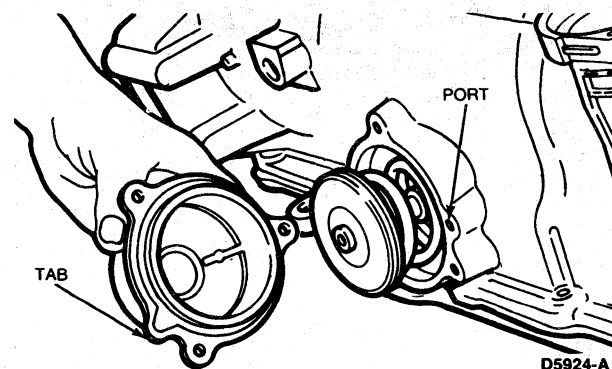
81. Install servo covers for overdrive and low/intermediate servo using new seals for overdrive servo or gasket for low/intermediate servo. Tighten cover bolts to 9-12 N·m (7-9 lb-ft).

**CAUTION:** Be sure to align tab on low/intermediate servo cover with port on case. Tighten bolts two to three turns at a time to prevent cocking servo cover.

## Overdrive Servo Cover



## Low-Intermediate Servo Cover



82. Install dipstick tube grommet and dipstick tube in case. Tighten attaching bolt to 9-12 N·m (7-9 lb-ft).

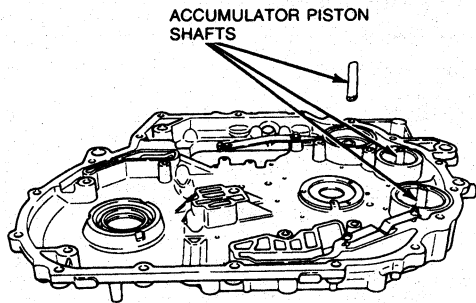
## DISASSEMBLY AND ASSEMBLY (Continued)

## Subassemblies

## Chain Cover

## Disassembly

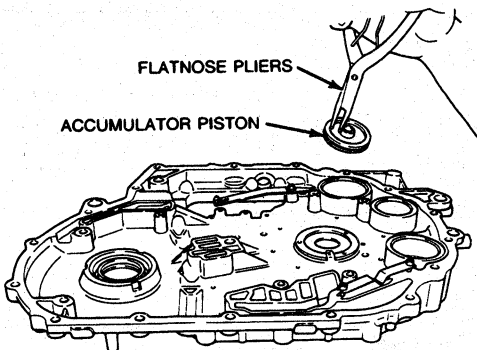
1. Remove three accumulator piston shafts.



D5950-A

2. Using flat nose pliers, remove three accumulator pistons.

**CAUTION: Do not use any objects in piston shaft bore for removal.**

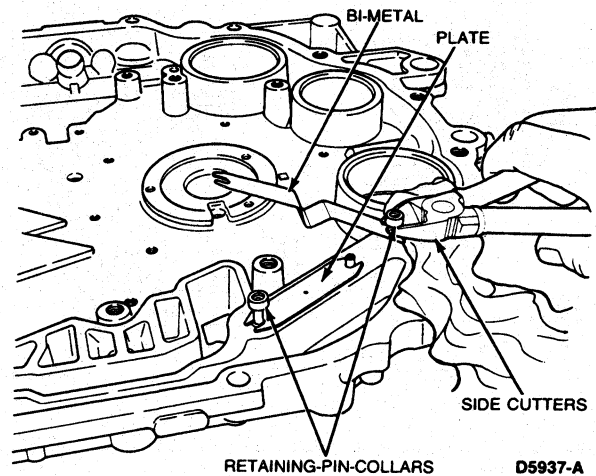


D5939-A

3. Using side cutters, carefully remove bimetal retaining pin collars and remove bimetal and plate.

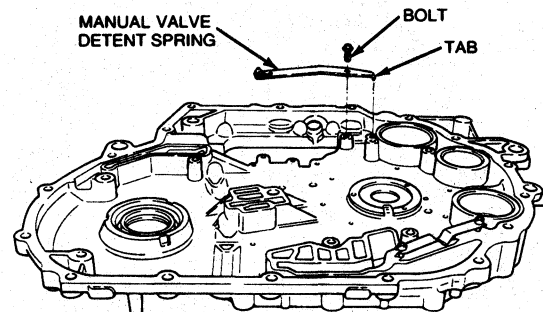
**CAUTION: Use care not to damage machined case surfaces or bi-metallic strips.**

4. Pull retaining pins from cover.



D5937-A

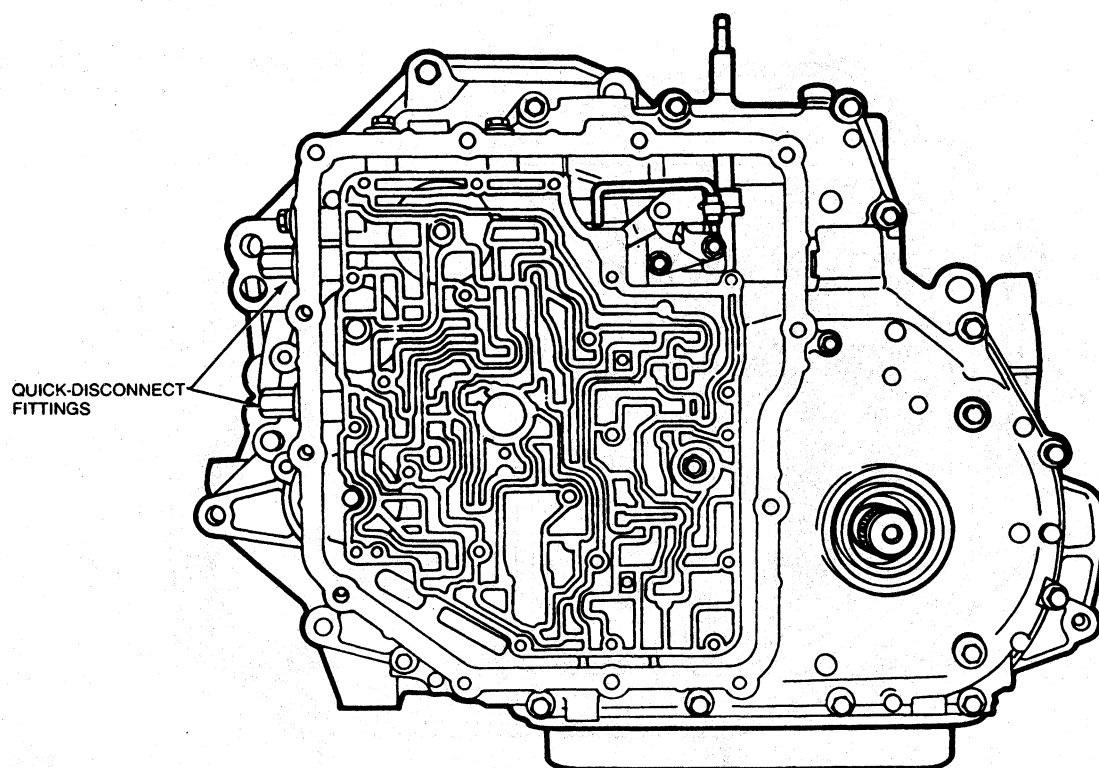
5. Remove 8mm manual valve detent spring bolt and spring.



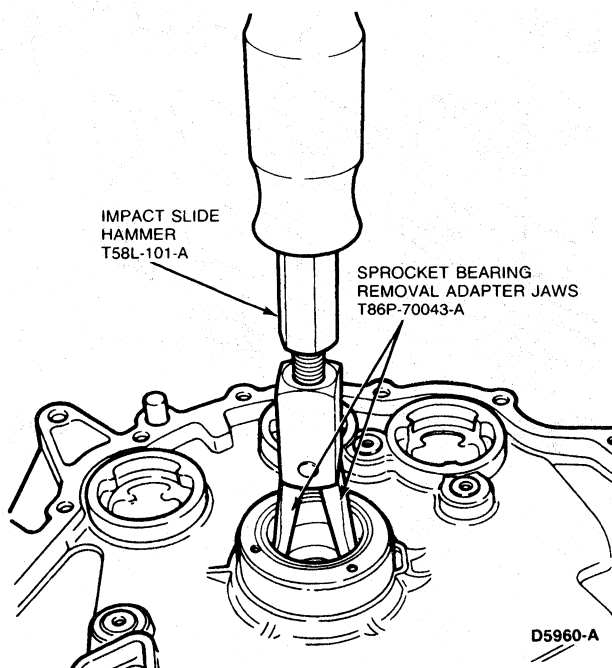
D5938-A

**DISASSEMBLY AND ASSEMBLY (Continued)**

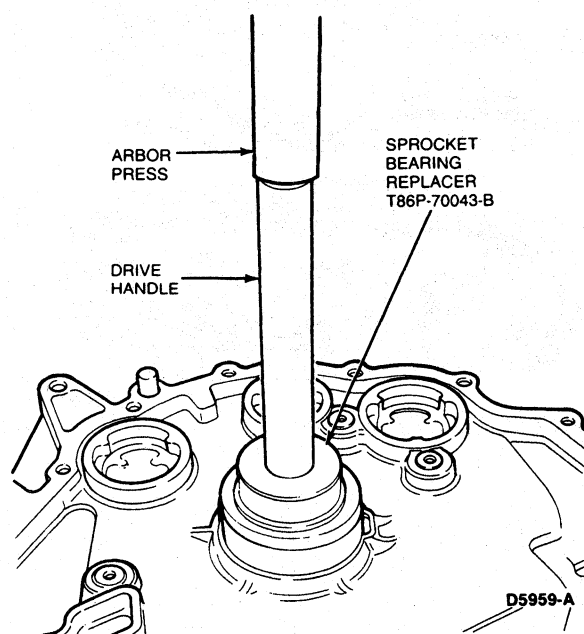
6. Remove quick-connect oil cooler fittings.



7. Remove drive sprocket support needle bearing using Sprocket Bearing Removal Adapter Jaws T86P-70043-A and Impact Slide Hammer T58L-101-A or equivalent.

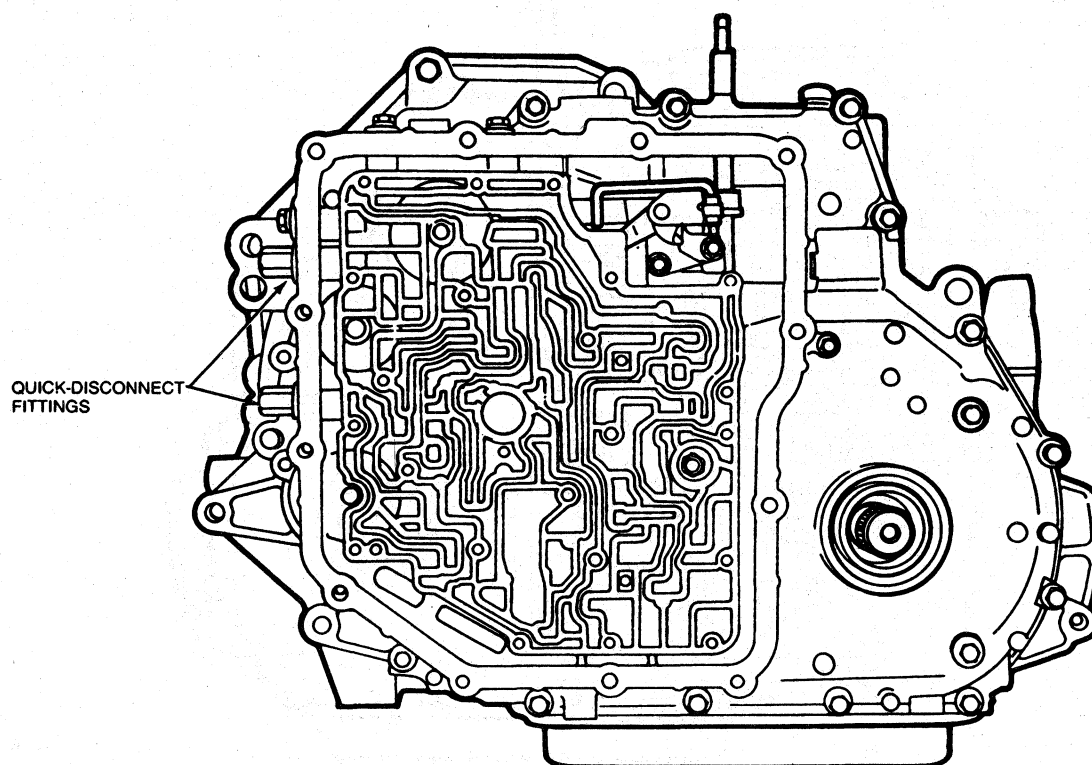
**Assembly**

1. Using an arbor press, install drive sprocket support needle bearing using Sprocket Bearing Replacer T86P-70043-B or equivalent.



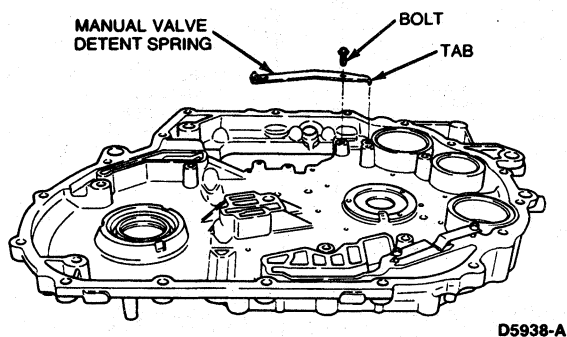
**DISASSEMBLY AND ASSEMBLY (Continued)**

2. Install quick-connect oil cooler fittings.



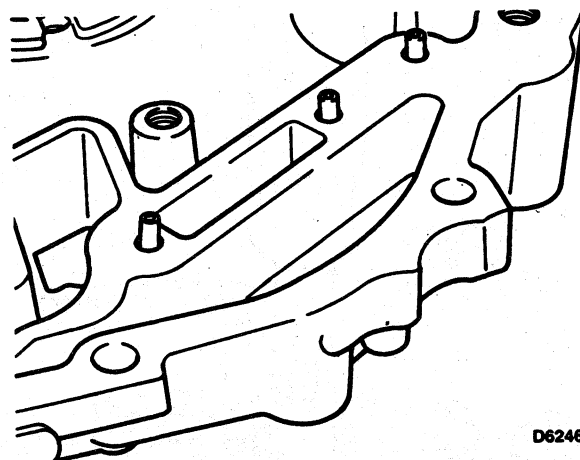
D6245-A

3. Install manual valve detent spring and position tab in locator hole. Tighten bolt to 9-12 N·m (7-9 lb-ft).



D5938-A

4. Start bimetal retaining pins in cover.

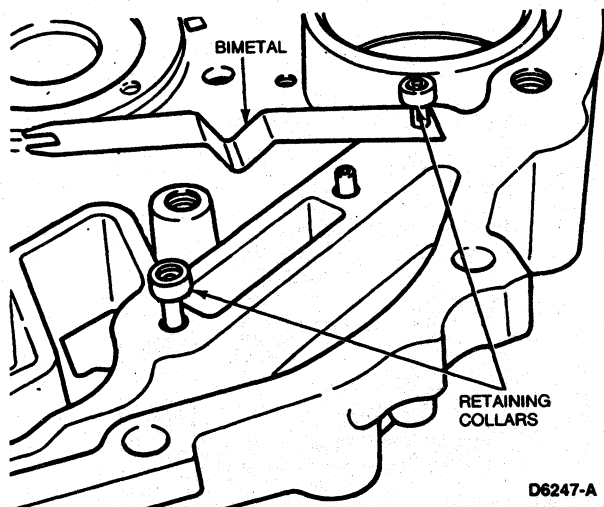


D6246-A

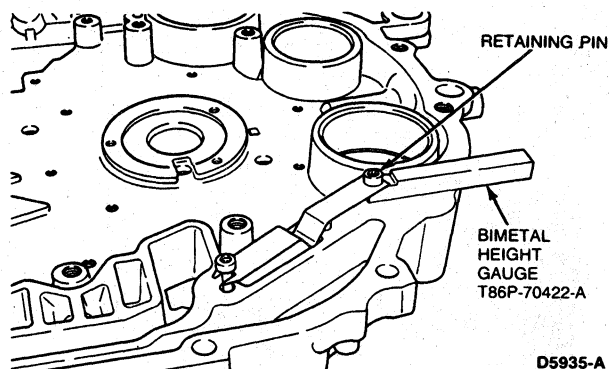


## DISASSEMBLY AND ASSEMBLY (Continued)

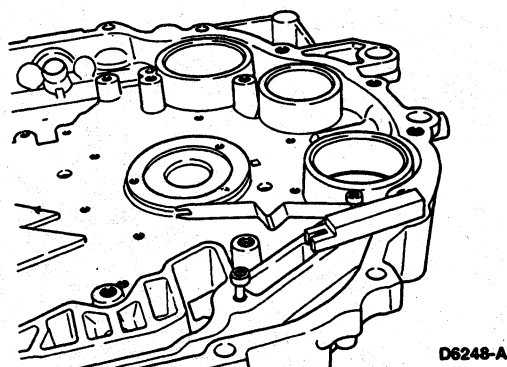
5. Place end of bimetal with hole over front retaining pin. Install bimetal retaining collars.



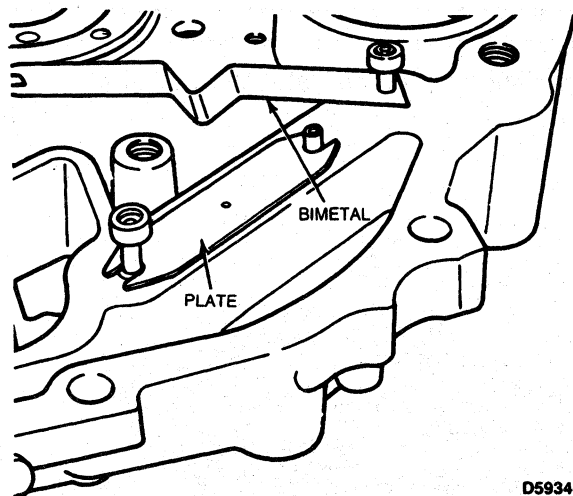
6. Place Bimetal Height Gauge T86P-70422-A or equivalent against retaining pin and under bimetal.
7. Gently tap retaining collar onto pin until it seats against tool edge.



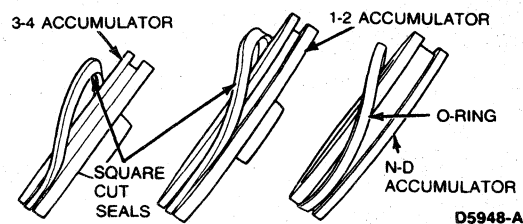
8. Engage slotted end of bimetal under rear retaining pin and retaining collar and repeat Steps 6 and 7 for slotted end of bimetal.
9. Remove slotted end of bimetal and use Bimetal Height Gauge T86P-70422-A or equivalent to set center pin at correct height.



10. Position plate slotted ends onto rear and middle retaining pins. Install slotted end of bimetal under retaining collar.

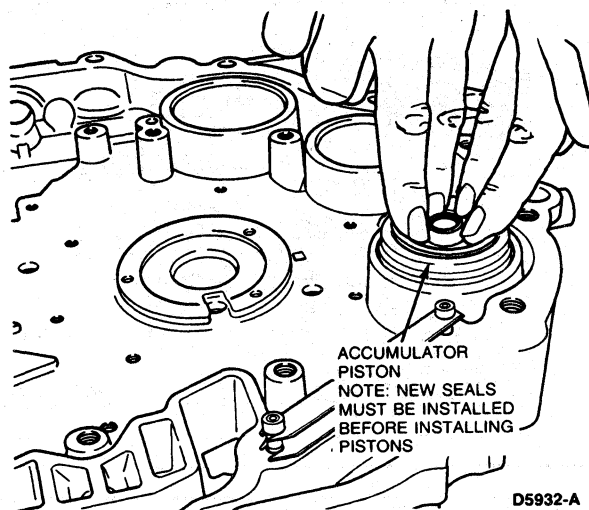


11. Install new seals and O-rings on accumulator pistons.

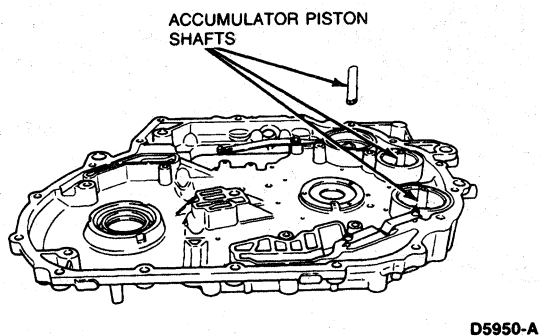


**DISASSEMBLY AND ASSEMBLY (Continued)**

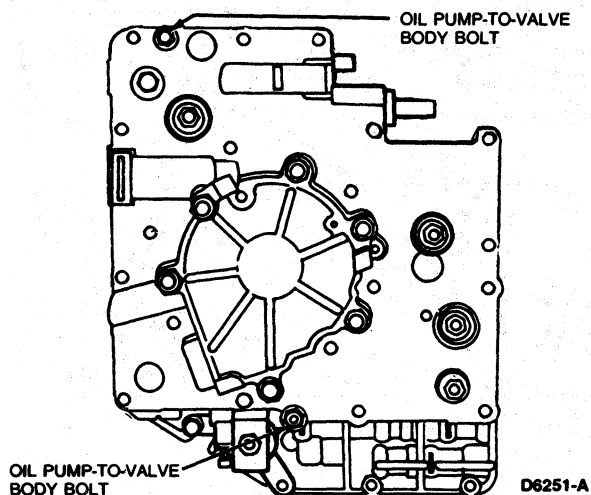
12. Install accumulator pistons into their proper cylinder.



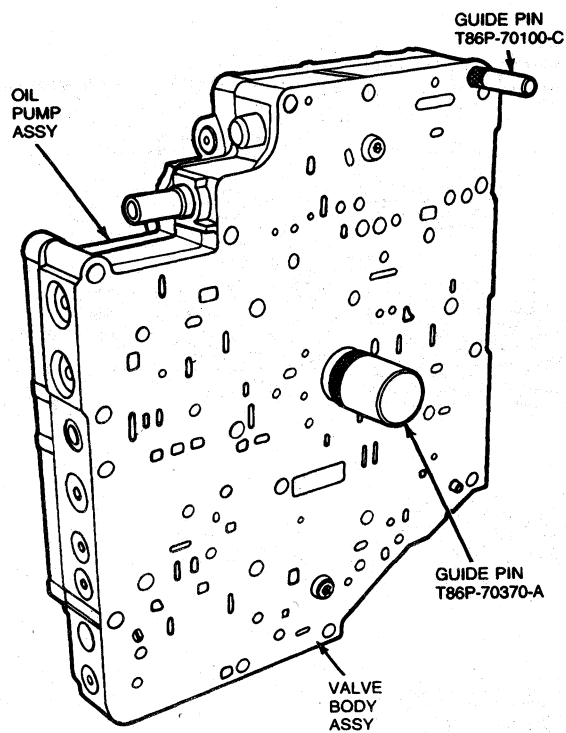
13. Install three accumulator piston shafts.

**Oil Pump and Valve Body Assembly****Disassembly**

Remove two 8mm bolts attaching oil pump-to-valve body and separate valve body from oil pump. Remove gasket and discard.

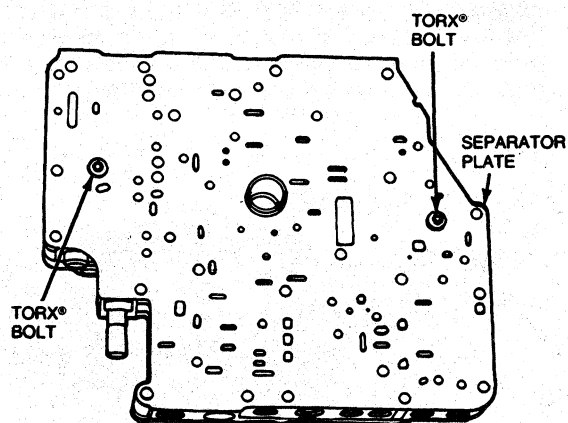
**Assembly**

1. Position valve body on oil pump using a new gasket.
2. Insert Valve Body-to-Oil Pump Guide Pins T86P-70370-A and T86P-70100-C or equivalent, as shown. Install two valve body-to-oil pump retaining bolts and tighten to 9-12 N·m (7-9 lb-ft).



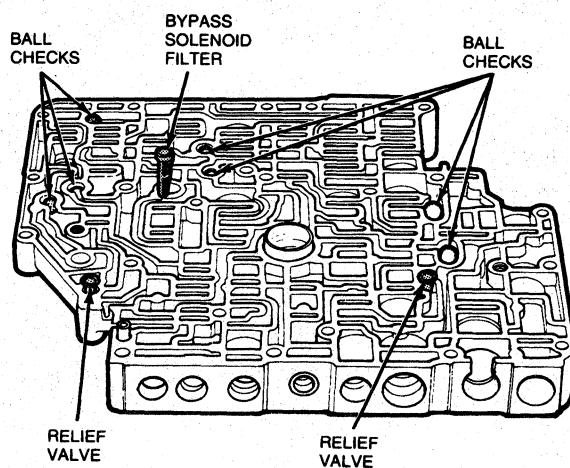
**DISASSEMBLY AND ASSEMBLY (Continued)****Valve Body****Disassembly**

1. Place valve body on bench with separator plate up, and remove two Torx® bolts retaining separator plate to valve body.
2. Remove separator plate and gasket.



D6249-A

3. Remove seven ball checks, two relief valves and bypass solenoid filter. Clean filter.



D6252-B

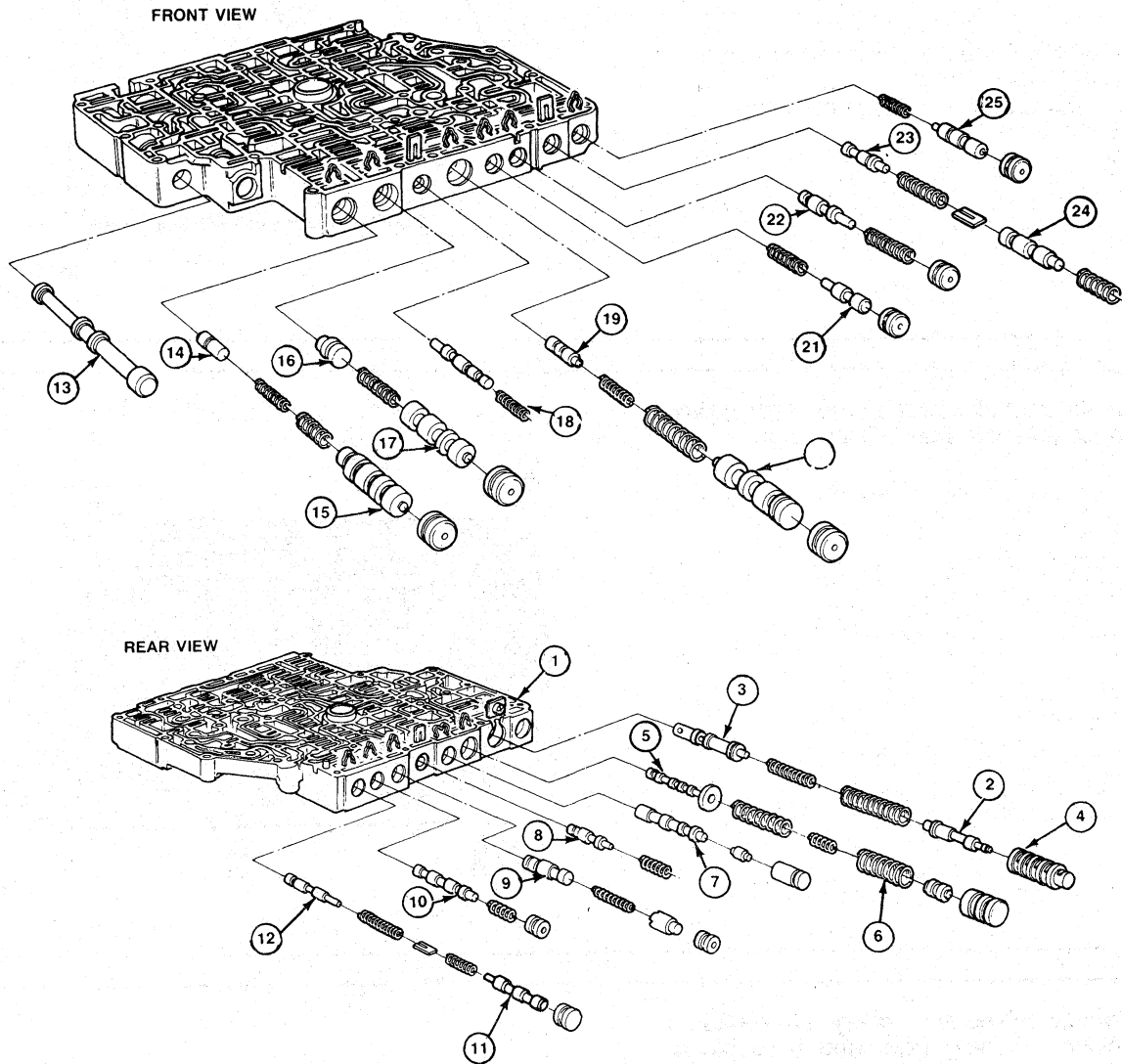
4. The individual valves and springs are removed by removing retaining clips and bore plugs. Refer to the following illustrations for valve and spring locations. Clean valves, springs and valve body as necessary.

## DISASSEMBLY AND ASSEMBLY (Continued)

**CAUTION:** Most valves are aluminum and cannot be removed using a magnet. Remove valves by tapping valve body on palm of hand to slide valves out of bores. It may be necessary to remove valves and

springs using a pick. If it is necessary to use a pick, use extreme caution to prevent damaging valves or valve bores.

**CAUTION:** Do not turn the throttle valve adjusting screw.

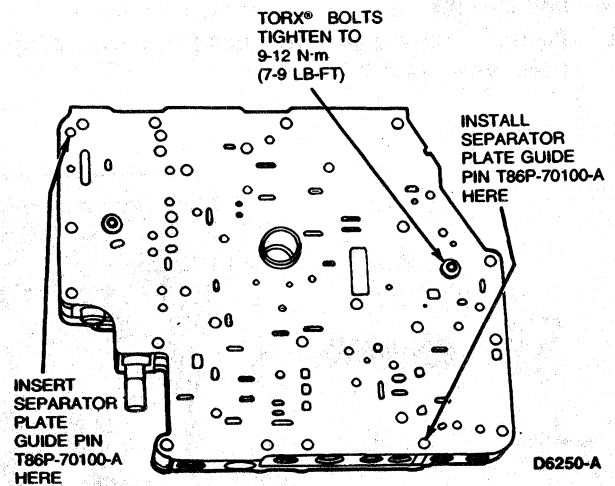


1. VALVE BODY
2. THROTTLE VALVE (TV)
3. TV PLUNGER
4. TV VALVE SLEEVE
5. MAIN REGULATOR VALVE
6. MAIN REGULATOR BOOST VALVE
7. CONVERTER CLUTCH CONTROL VALVE
8. CONVERTER REGULATOR VALVE
9. ACCUMULATOR REGULATOR VALVE
10. BACKOUT VALVE
11. TV/LINE MODULATOR VALVE
12. 4-3 SCHEDULING VALVE
13. MANUAL VALVE

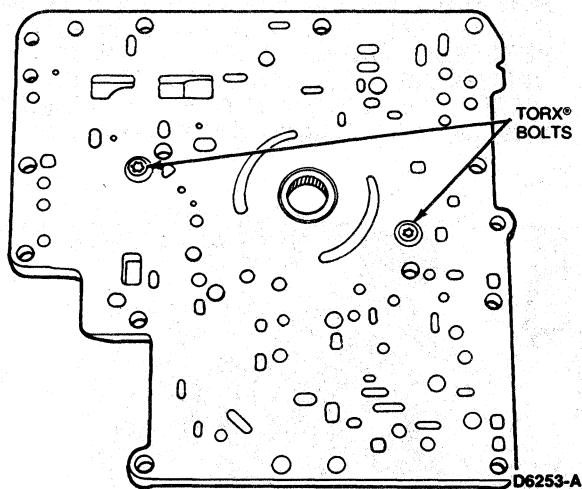
14. 2-3 TV MODULATOR VALVE
15. 2-3 SHIFT VALVE
16. 1-2 THROTTLE DELAY VALVE
17. 1-2 SHIFT VALVE
18. 2-1 SCHEDULING VALVE
19. 3-4 TV MODULATOR VALVE
20. 3-4 SHIFT VALVE
21. 2-4 INHIBIT VALVE
22. 3-2 CONTROL VALVE
23. N-D ENGAGEMENT VALVE
24. TV LIMIT VALVE
25. 2-3 SERVO REGULATOR VALVE

**DISASSEMBLY AND ASSEMBLY (Continued)****Assembly**

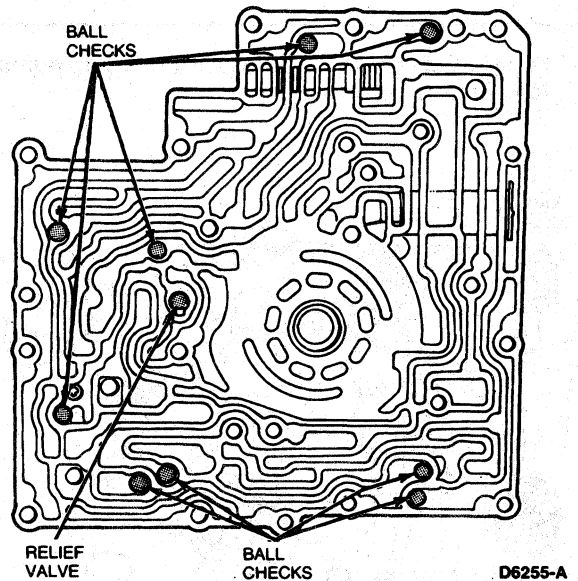
1. Install bypass solenoid filter.
2. Assemble valves and springs into valve body.
3. Install ball checks, relief valves and bypass solenoid filter. Refer to illustration under Disassembly, Step 3.
4. Install separator plate with new gasket on valve body.
5. Install Separator Plate Guide Pins T86P-70100-A or equivalent as shown. Install two Torx® bolts in valve body as shown and tighten to 9-12 N·m (7-9 lb-ft).

**Oil Pump****Disassembly**

1. Remove two Torx® bolts retaining separator plate to oil pump housing.

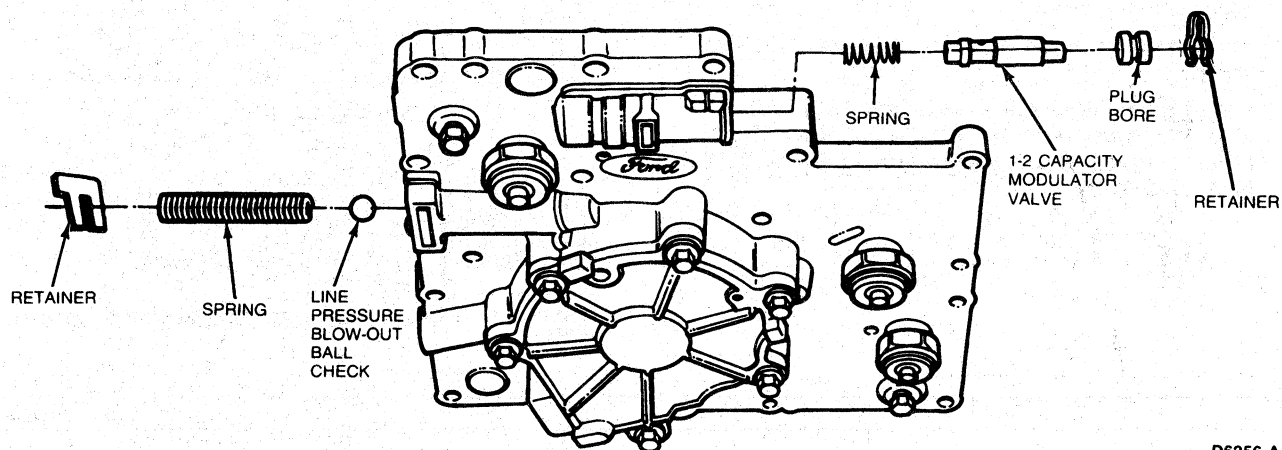


2. Remove ball checks and relief valve.



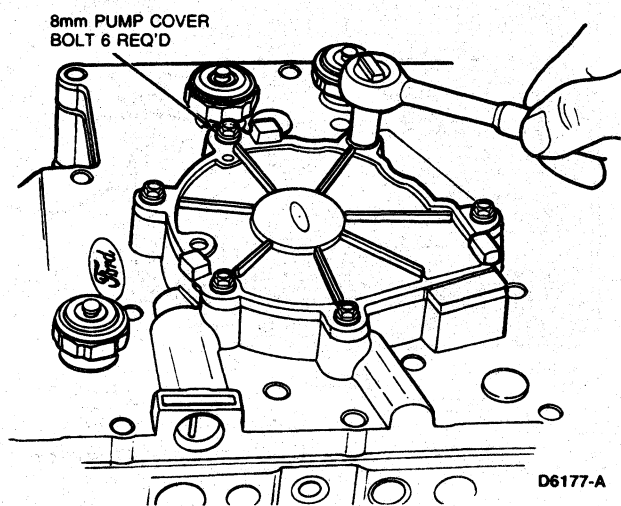
**DISASSEMBLY AND ASSEMBLY (Continued)**

3. Remove retaining clip for line pressure blowoff ball and spring.
4. Remove 1-2 capacity modulator retainer, plug bore, valve and spring.



D6256-A

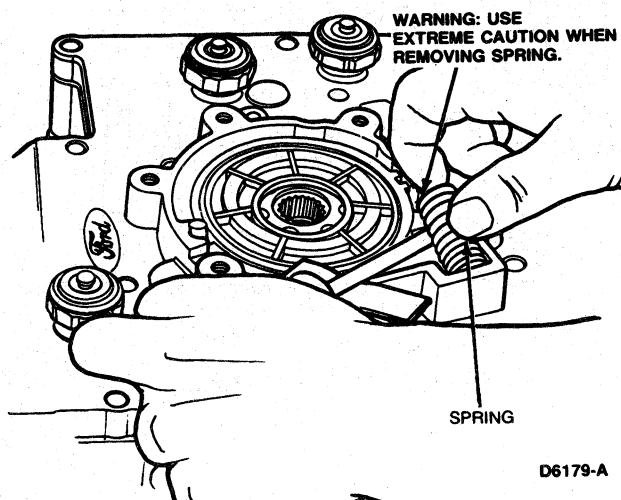
5. Remove six bolts retaining pump cover to pump housing and remove.



D6177-A

6. Remove bore spring by prying spring out of housing.

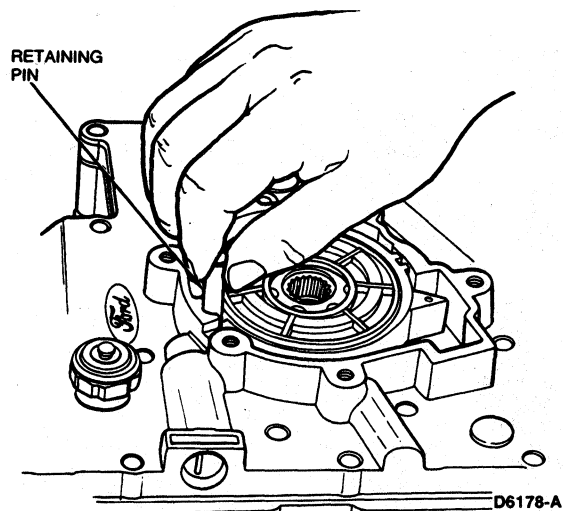
**WARNING: USE EXTREME CAUTION WHEN REMOVING SPRING TO PREVENT PERSONAL INJURY. PLACE A PIECE OF CARDBOARD OR SUITABLE MATERIAL UNDER SCREWDRIVER TO PREVENT DAMAGE TO HOUSING GASKET SURFACE.**



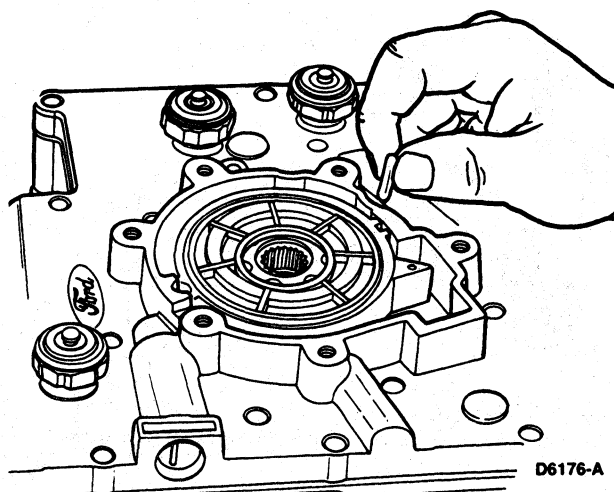
D6179-A

**DISASSEMBLY AND ASSEMBLY (Continued)**

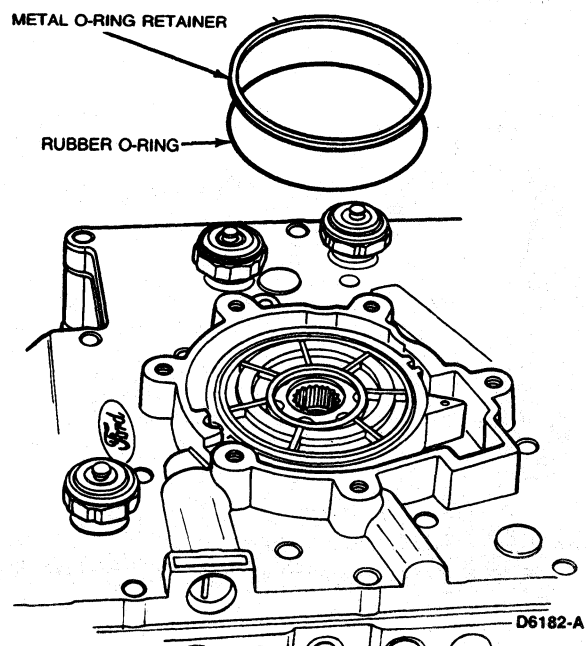
7. Remove outside vane support retaining pin.



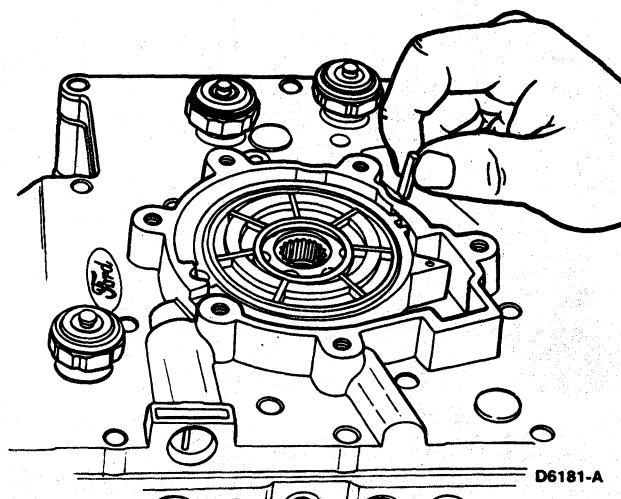
9. Remove and discard side seal.



8. Remove metal O-ring retainer and O-ring from outer vane support. Discard O-ring.

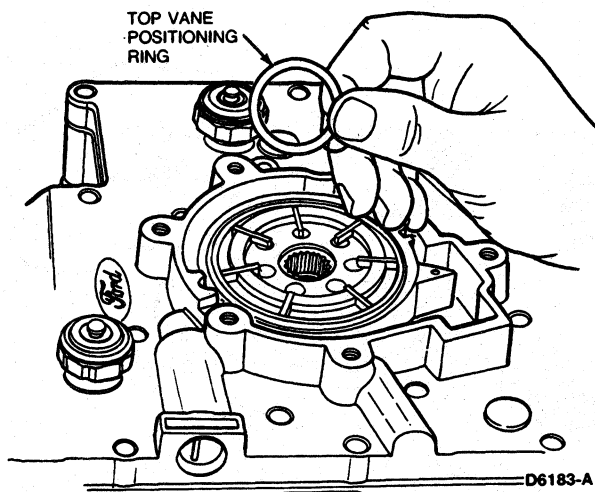


10. Remove side seal support.

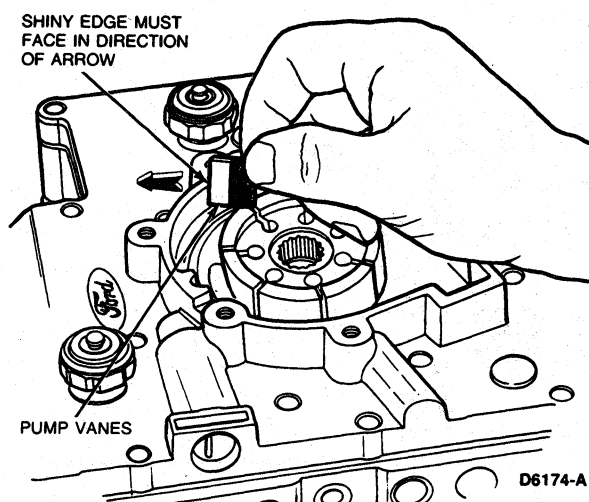


**DISASSEMBLY AND ASSEMBLY (Continued)**

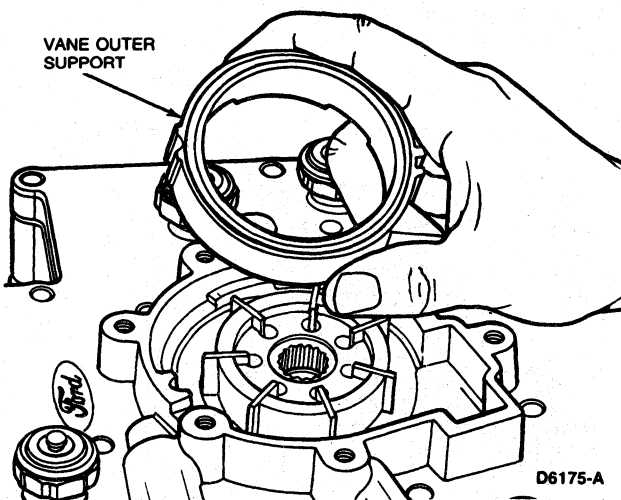
11. Remove top vane positioning ring.



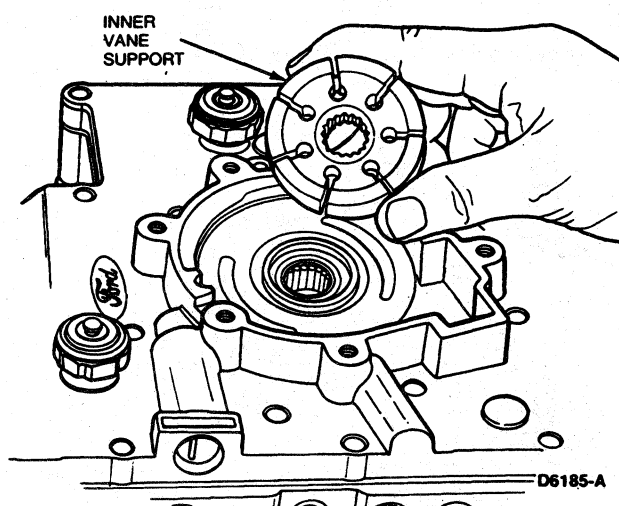
13. Remove seven vanes from rotor.



12. Remove outer vane support.



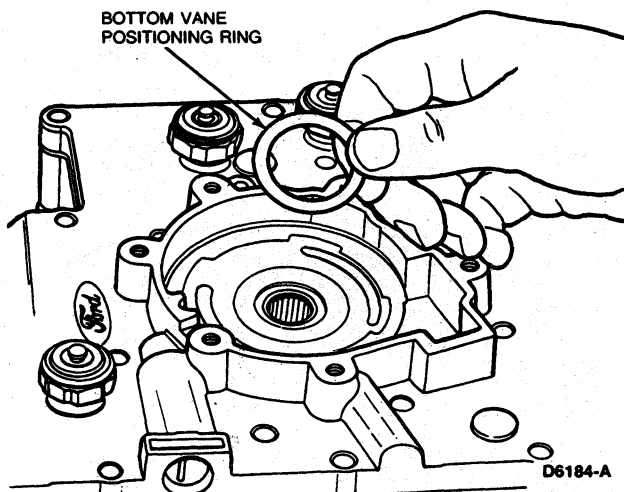
14. Remove inner vane support.



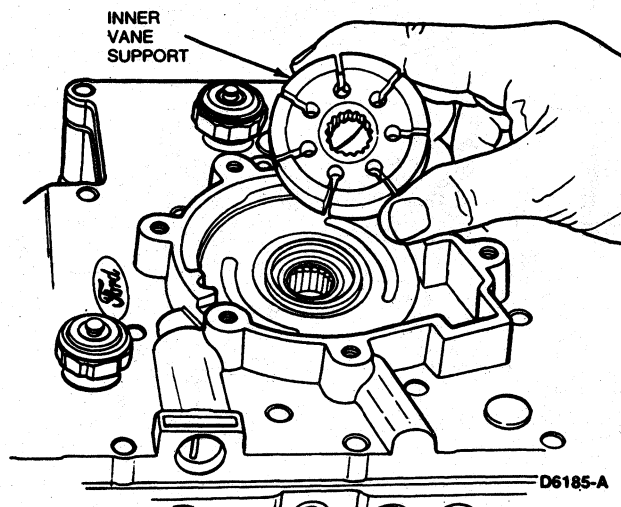


**DISASSEMBLY AND ASSEMBLY (Continued)**

15. Remove bottom vane positioning ring.

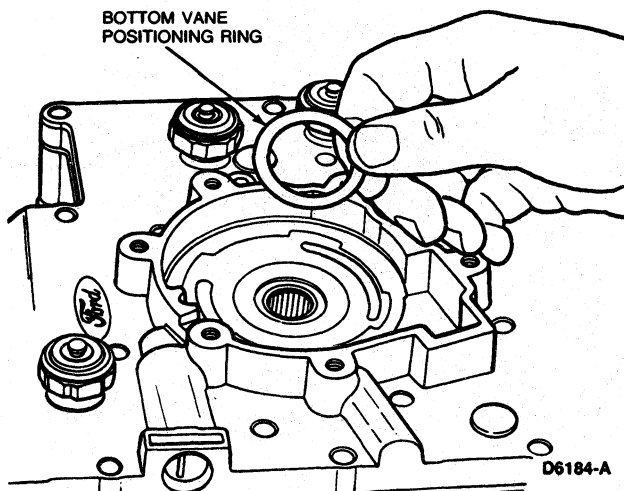


2. Install inner vane support with small inside diameter counter bore facing up.

**Assembly**

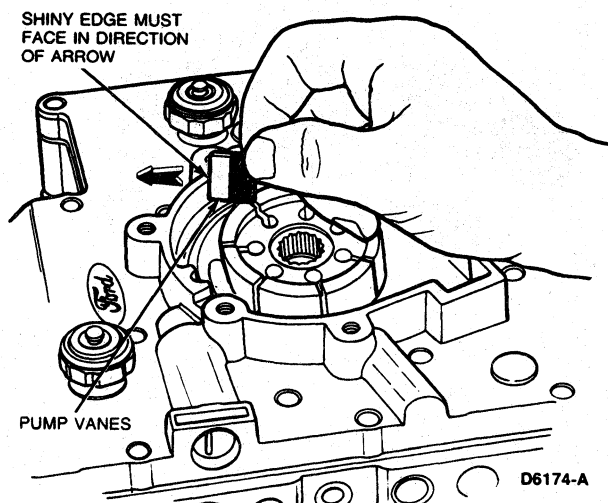
**NOTE:** The only serviceable parts in the oil pump are the seals. If any other parts of the oil pump are damaged or worn, the entire pump assembly must be replaced.

1. Install bottom vane positioning ring.



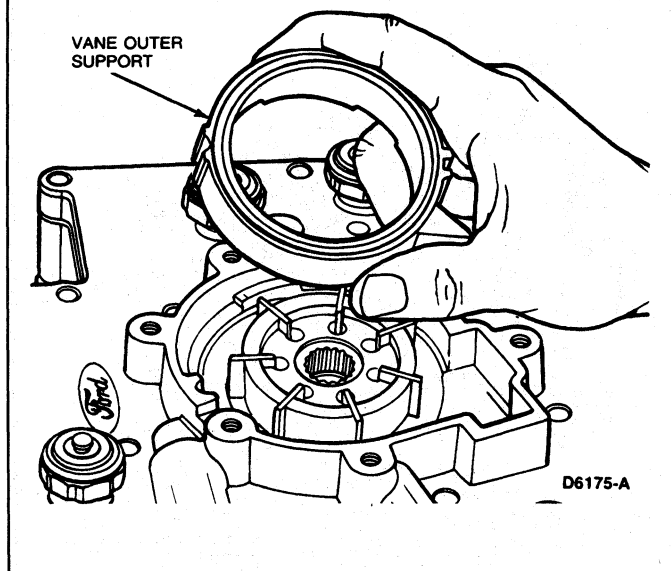
3. Install seven vanes in inner vane support.

**NOTE:** Shiny portion of vane blade is installed toward outer vane support.

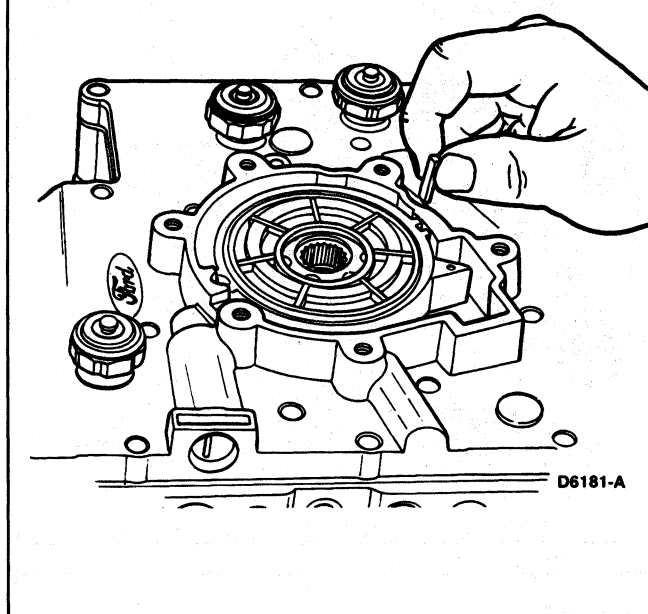


## DISASSEMBLY AND ASSEMBLY (Continued)

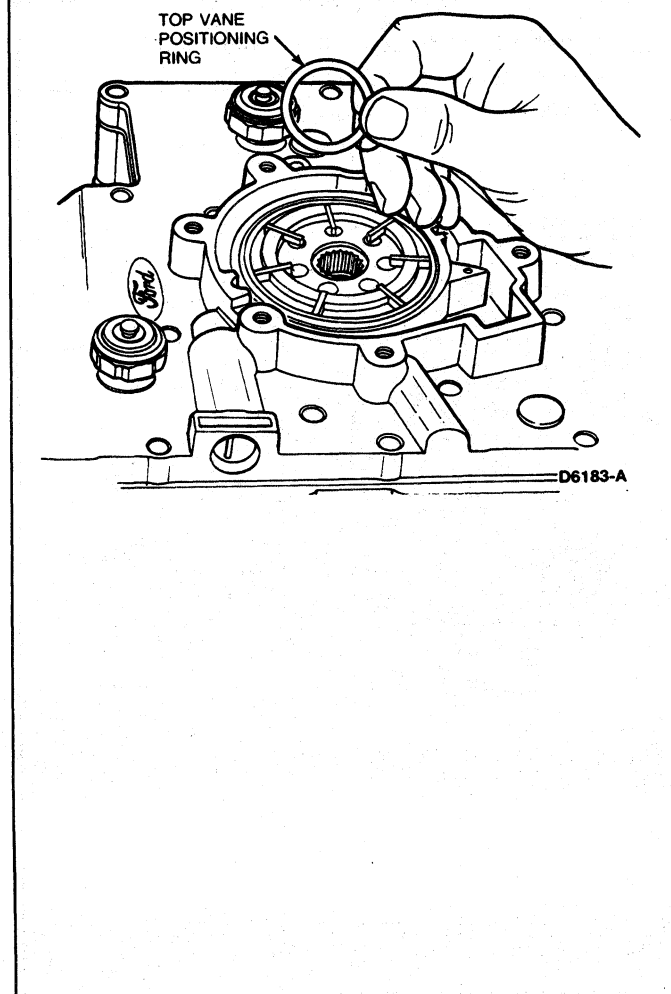
4. Install outer vane support.



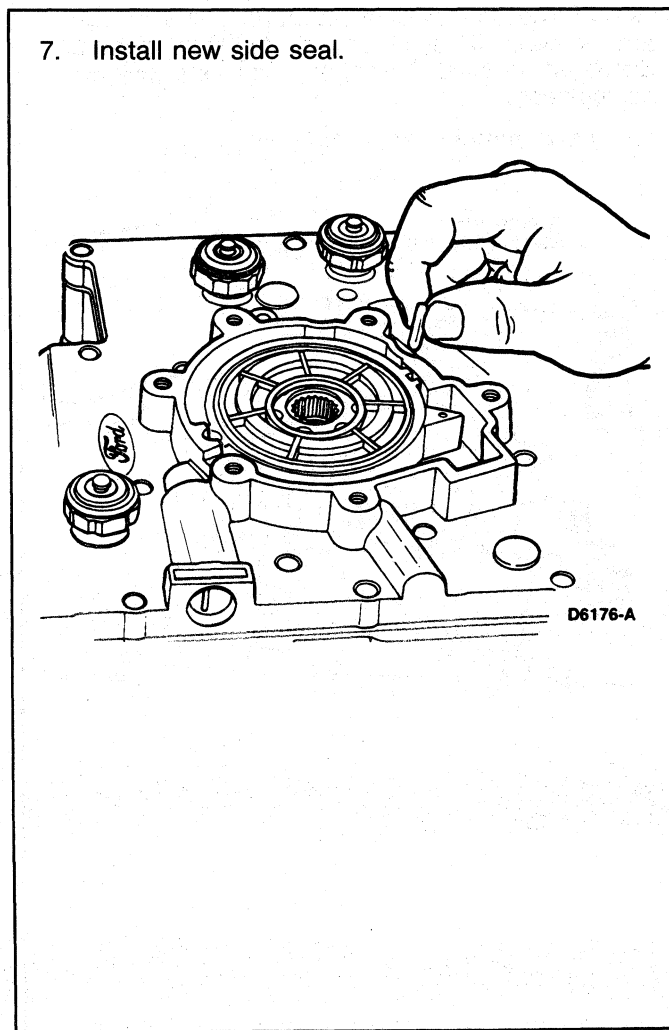
6. Install new side seal support.



5. Install top vane positioning ring.

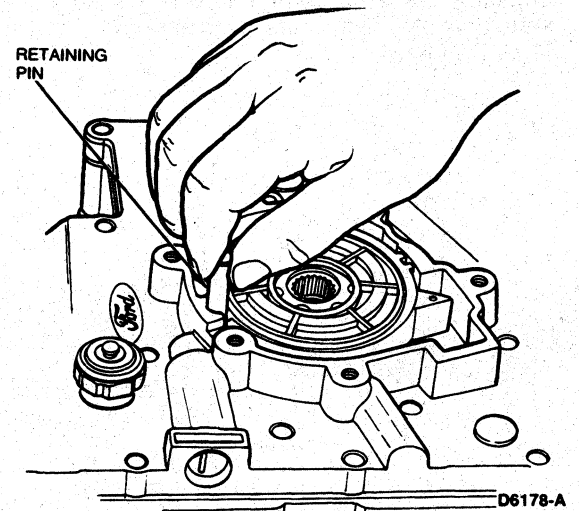


7. Install new side seal.

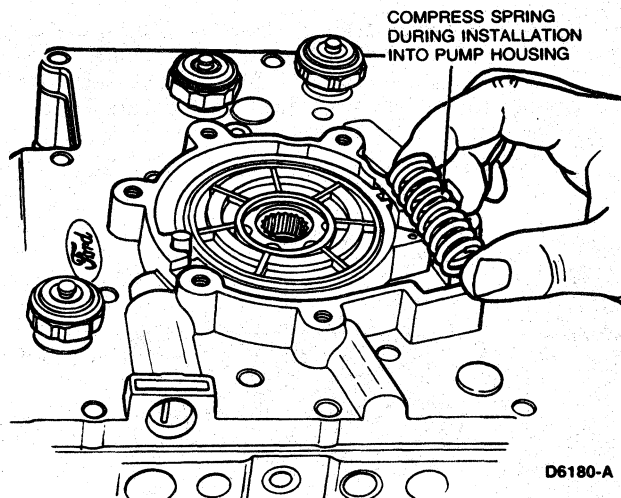


**DISASSEMBLY AND ASSEMBLY (Continued)**

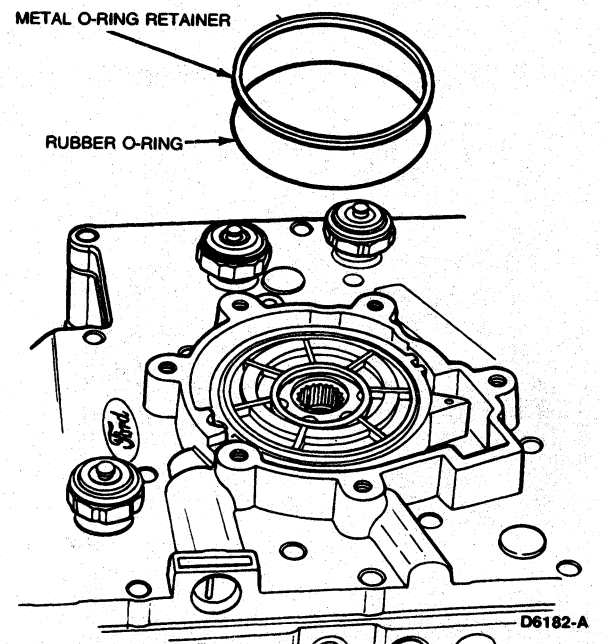
8. Install outer vane support retaining pin.



9. Install bore spring between case and tab on outer vane support.



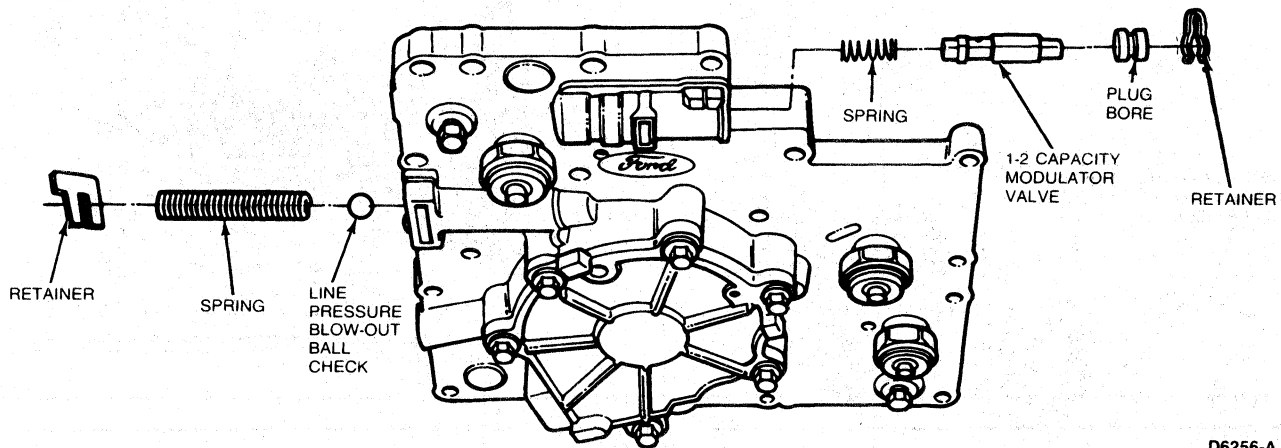
10. Install new O-ring in groove in outer vane support. Then, install metal O-ring retainer.



## DISASSEMBLY AND ASSEMBLY (Continued)

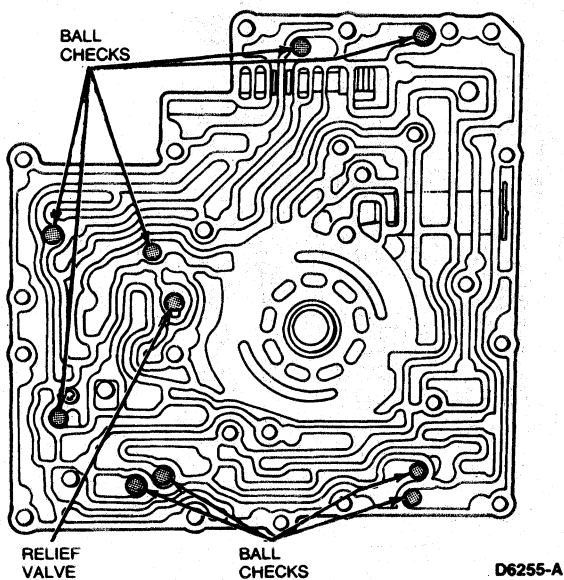
11. Install oil pump cover on oil pump housing and install six retaining bolts. Tighten bolts to 9-12 N·m (7-9 lb-ft).

12. Install line pressure blow-out ball and spring, and 1-2 capacity modulator valve spring, valve and plug bore in pump housing and install retaining clips.



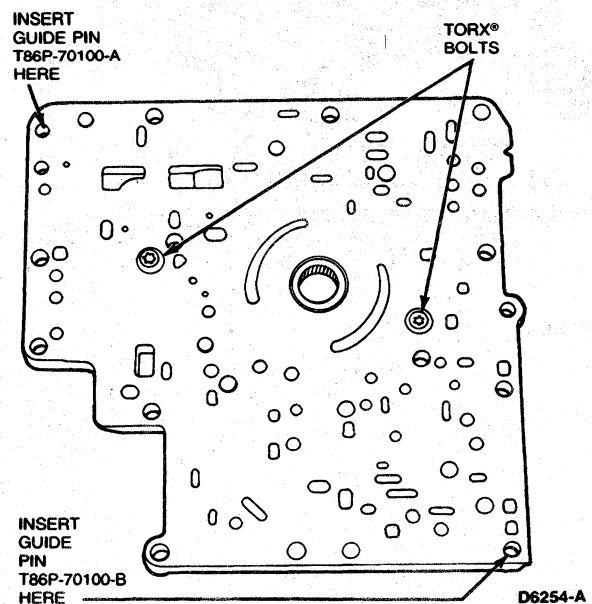
D6256-A

13. Install ball checks and relief valve.



D6255-A

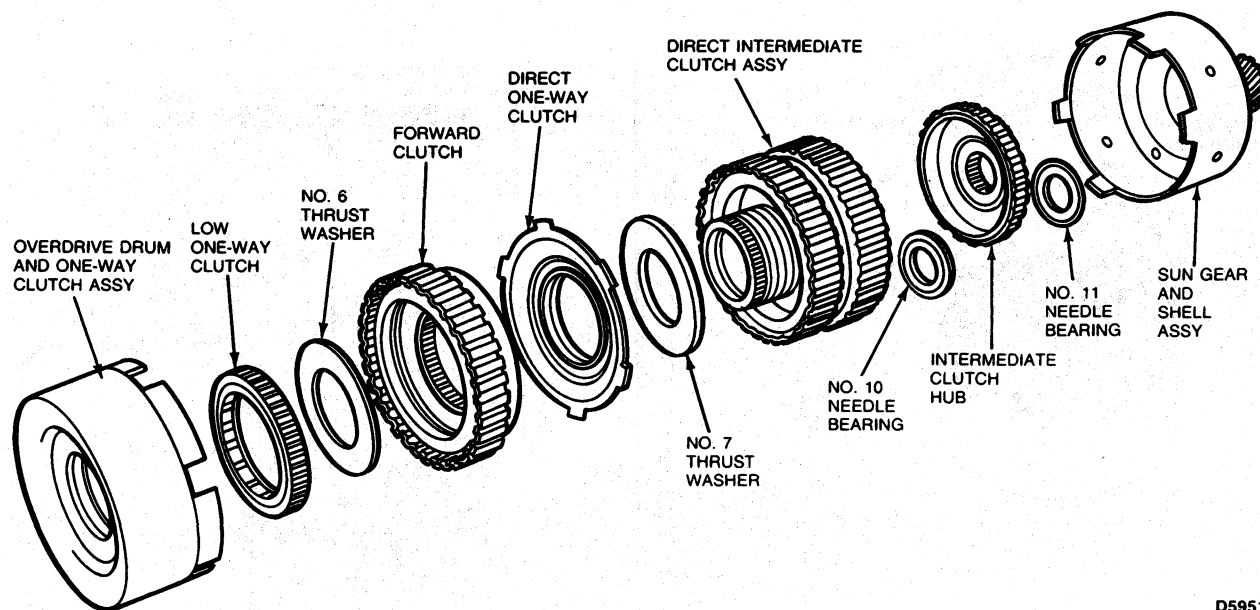
14. Position separator plate on pump housing using a new gasket. Insert Separator Plate Guide Pins T86P-70100-A and T86P-70100-B or equivalent as shown. Then, install two Torx® bolts. Tighten bolts to 9-12 N·m (7-9 lb-ft). Remove guide pins.



D6254-A

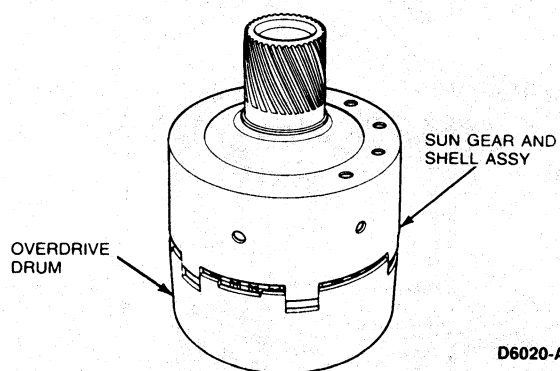
## DISASSEMBLY AND ASSEMBLY (Continued)

## Shell Assembly, Forward, Direct and Intermediate Clutches

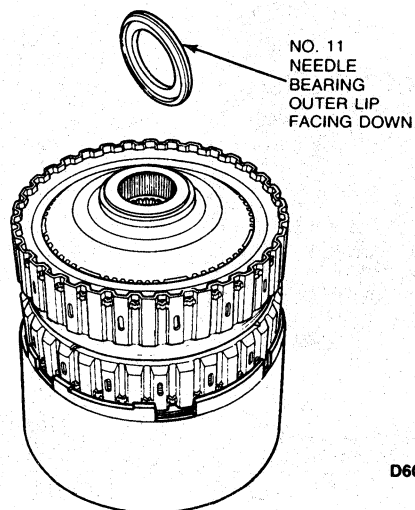


## Disassembly

1. Set assembly on overdrive drum.
2. Remove sun gear and shell assembly.

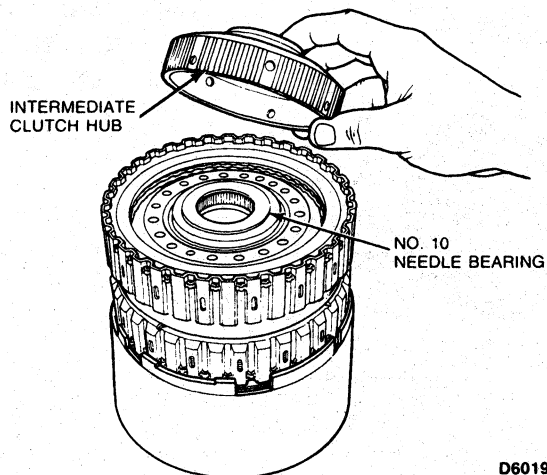


3. Remove No. 11 needle bearing.



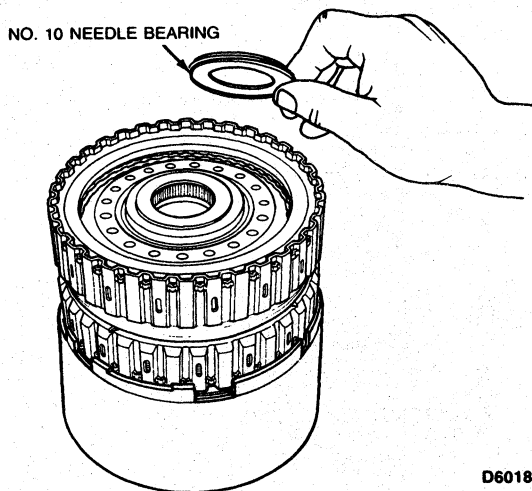
**DISASSEMBLY AND ASSEMBLY (Continued)**

4. Remove intermediate clutch hub.



D6019-A

5. Remove No. 10 needle bearing.

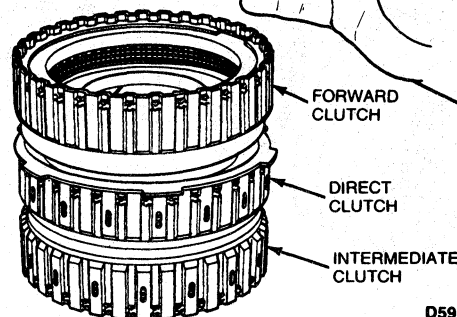


D6018-B

6. Turn assembly onto intermediate cylinder hub.  
7. Remove overdrive drum and one-way clutch assembly.

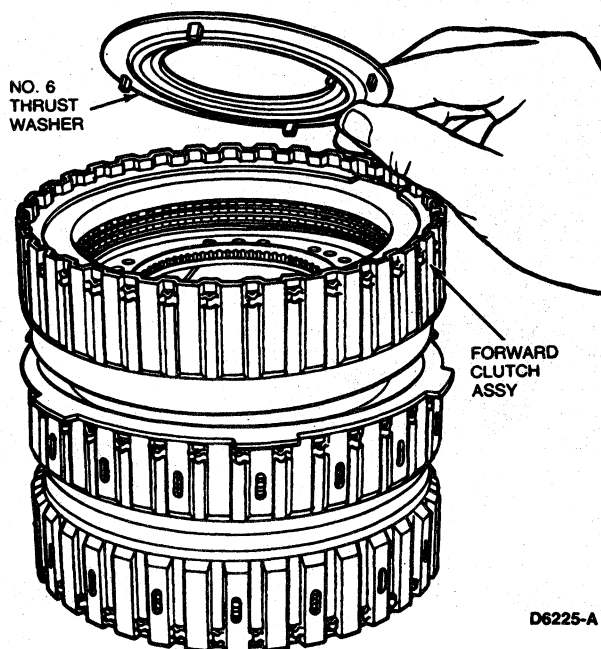
NOTE: ONE-WAY CLUTCH OUTER RACE GROOVE MUST BE VISIBLE, IF PROPERLY INSTALLED. CLUTCH MUST TURN COUNTERCLOCKWISE

OVERDRIVE DRUM AND ONE-WAY CLUTCH ASSY



D5907-B

8. Remove No. 6 thrust washer.

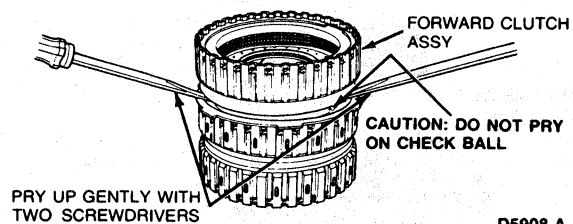


D6225-A

**DISASSEMBLY AND ASSEMBLY (Continued)**

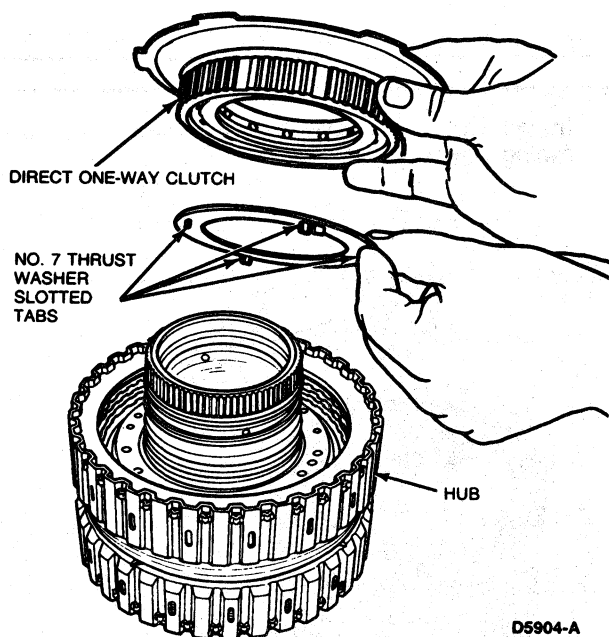
9. Remove forward clutch assembly by prying up on each side with two screwdrivers.

NOTE: Direct clutch hub O-ring seals retain forward clutch on hub. Pry evenly and do not locate screwdriver ends on or near forward clutch check ball.



D5908-A

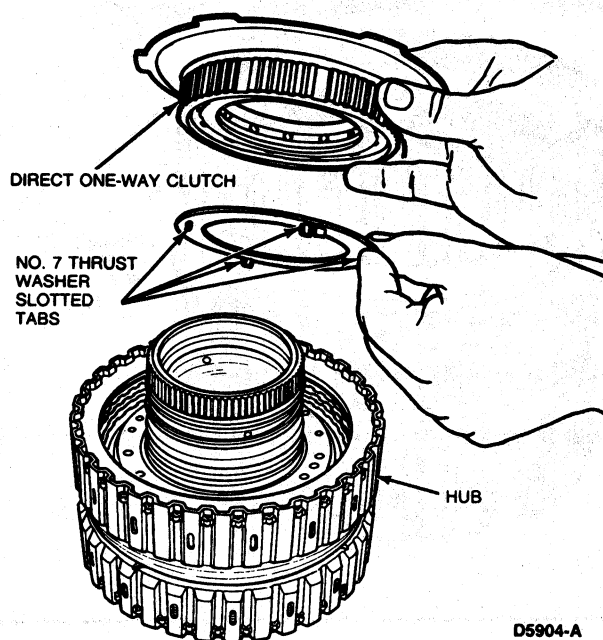
10. Remove direct one-way clutch and No. 7 thrust washer.



D5904-A

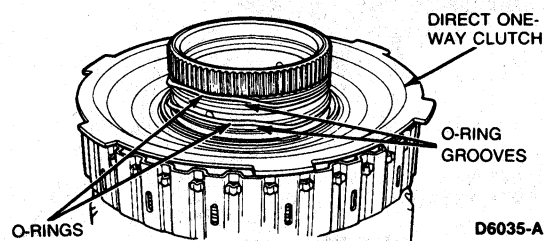
**Assembly**

1. Set on intermediate clutch cylinder.
2. Install No. 7 thrust washer into direct clutch being sure tabs are aligned with slots in direct clutch.
3. Install direct one-way clutch and align onto clutch pack splines.



D5904-A

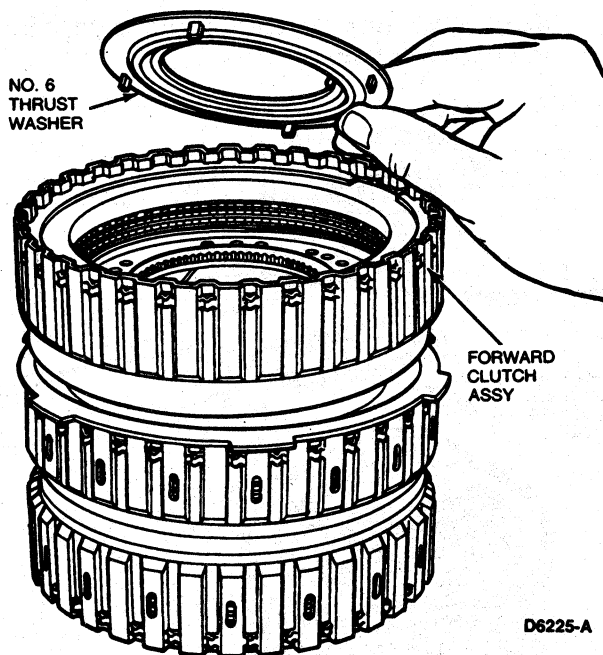
4. Install two O-ring seals.



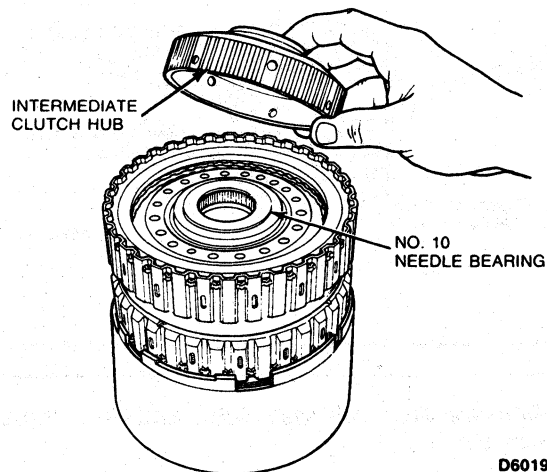
D6035-A

## DISASSEMBLY AND ASSEMBLY (Continued)

5. Install forward clutch assembly. **Use caution not to damage the O-ring seals on direct clutch hub.**
6. Install No. 6 thrust washer.

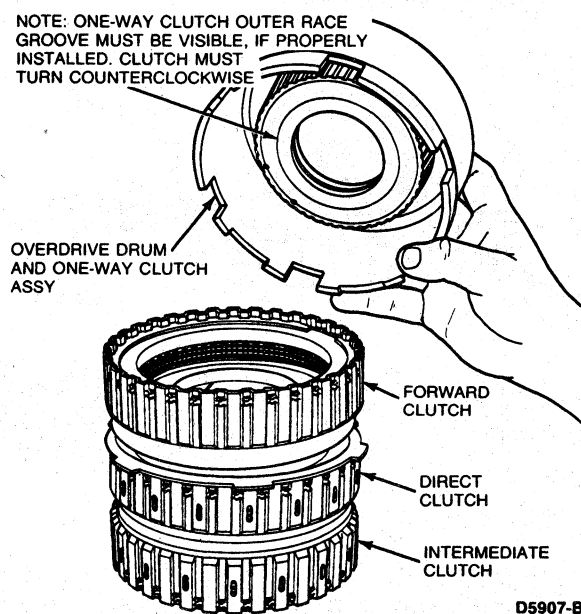


8. Turn assembly over and set on overdrive drum.
9. Install No. 10 needle bearing using grease to hold in place.
10. Install intermediate clutch hub with No. 10 needle bearing.

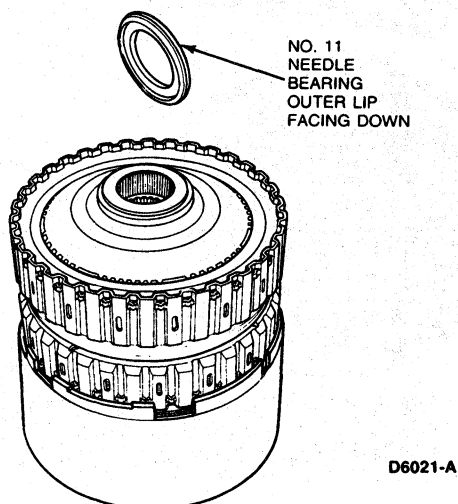


7. Install overdrive drum and one-way clutch assembly.

NOTE: ONE-WAY CLUTCH OUTER RACE GROOVE MUST BE VISIBLE, IF PROPERLY INSTALLED. CLUTCH MUST TURN COUNTERCLOCKWISE



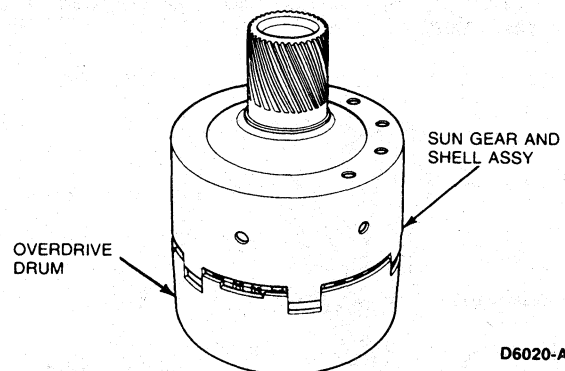
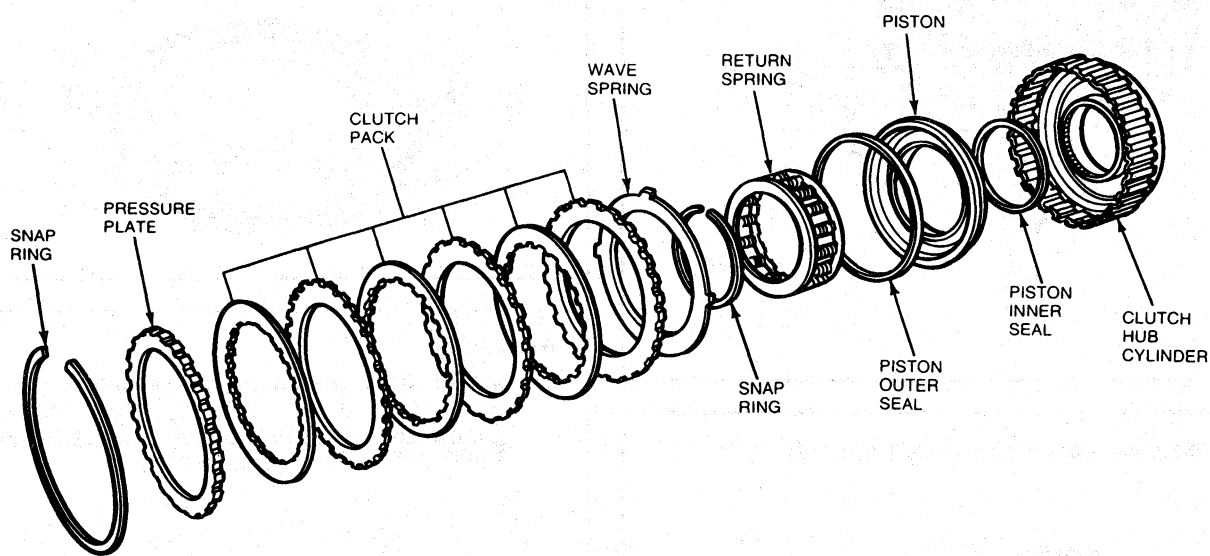
11. Install No. 11 needle bearing with outer lip facing down.



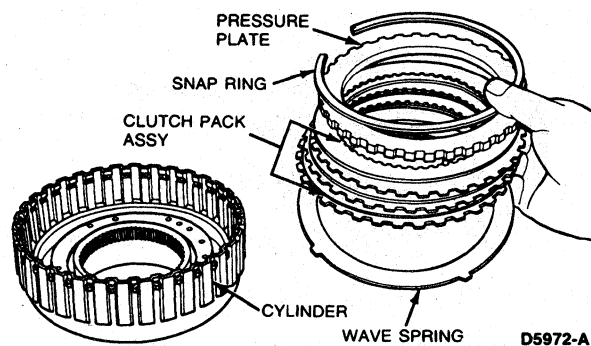


**DISASSEMBLY AND ASSEMBLY (Continued)**

12. Install sun gear and shell assembly.

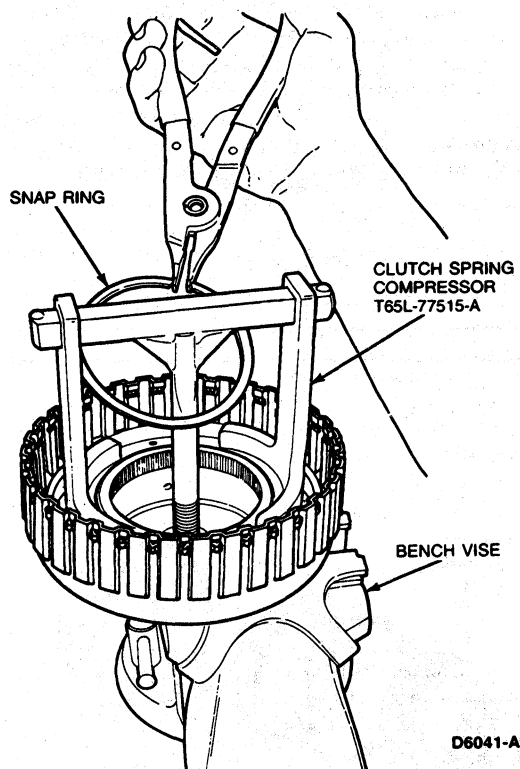
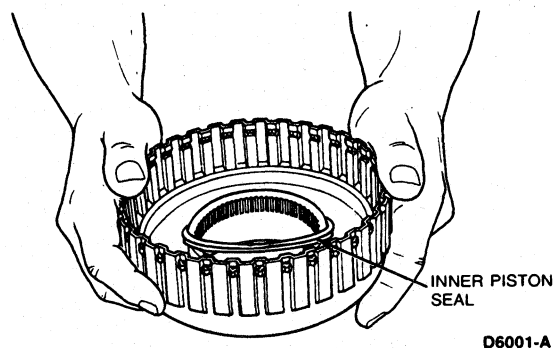
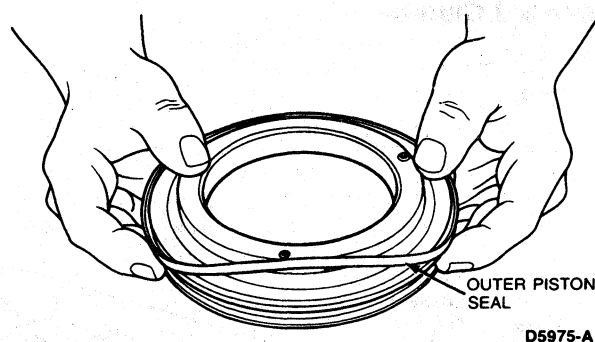
**Forward Clutch****Disassembly**

1. Remove snap ring, pressure plate, clutch pack and wave spring.

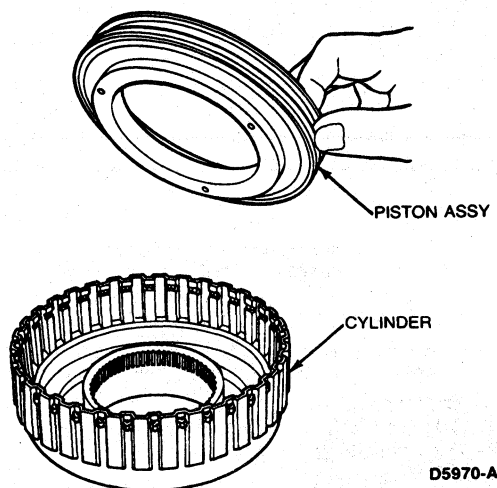


**DISASSEMBLY AND ASSEMBLY (Continued)**

2. Remove snap ring and return spring using Clutch Spring Compressor T65L-77515-A or equivalent.

**Inner Piston Seal****Outer Piston Seal**

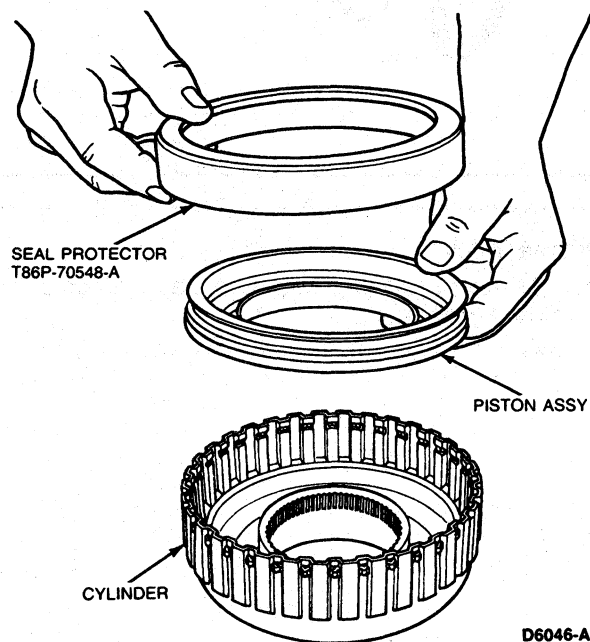
3. Remove piston assembly from hub.



4. Remove piston inner and outer seals.

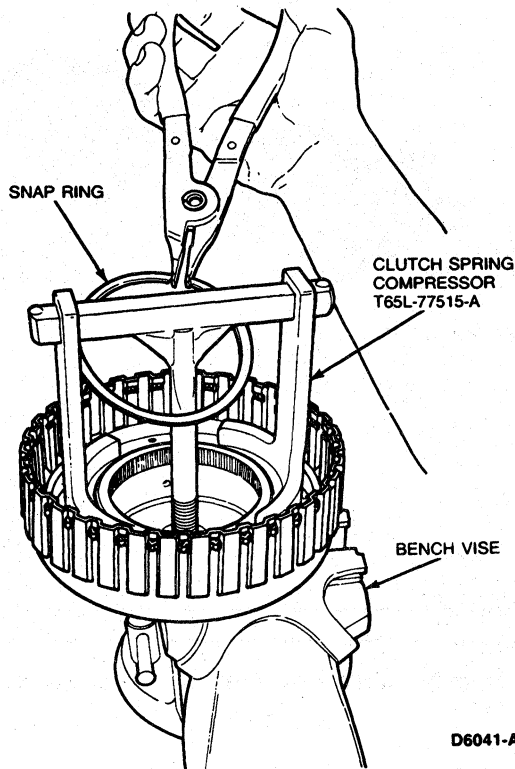
**Assembly**

1. Install inner and outer piston seals (lip seal facing toward bottom of cylinder) and install piston assembly using Clutch Seal Lip Protector T86P-70548-A or equivalent.

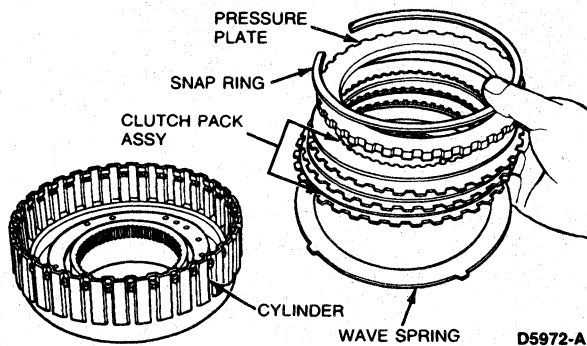


**DISASSEMBLY AND ASSEMBLY (Continued)**

2. Install return spring and snap ring using Clutch Spring Compressor T65L-77515-A or equivalent.



3. Install wave spring, clutch pack, pressure plate and snap ring.



4. Check clutch pack clearance using Dial Indicator TOOL 4201-C or equivalent. Push downward on the clutch pack with at least 44N (10 lbs) of force. Release pressure and zero dial indicator. Lift pressure plate to the bottom of the snap ring. Note dial indicator reading. Take two readings, 180 degrees apart, and determine the average of the two readings. The clearance should be 1.89-1.40mm (0.075-0.055 inch). If the clearance is not within specifications, selective snap rings are available in the following thicknesses:

1.24-1.34mm (0.049-0.053 inch)

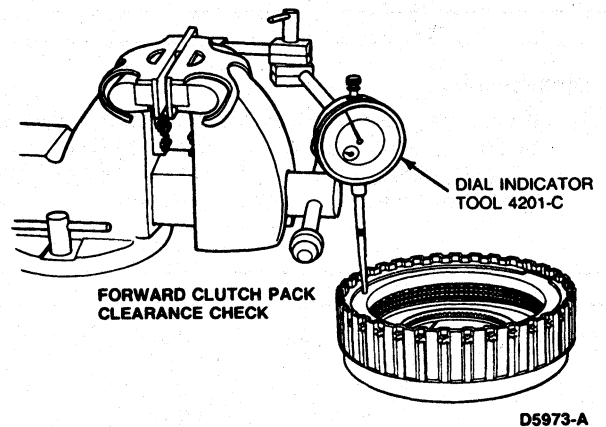
1.60-1.70mm (0.063-0.067 inch)

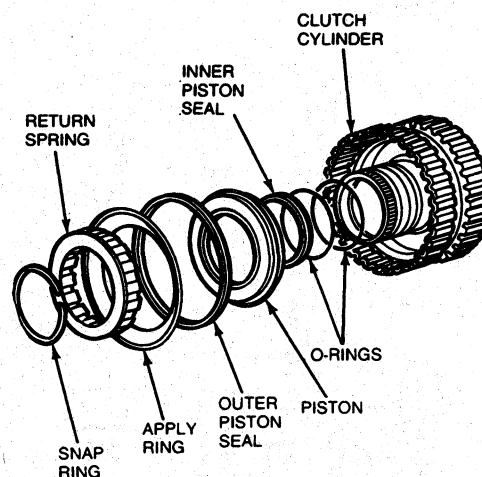
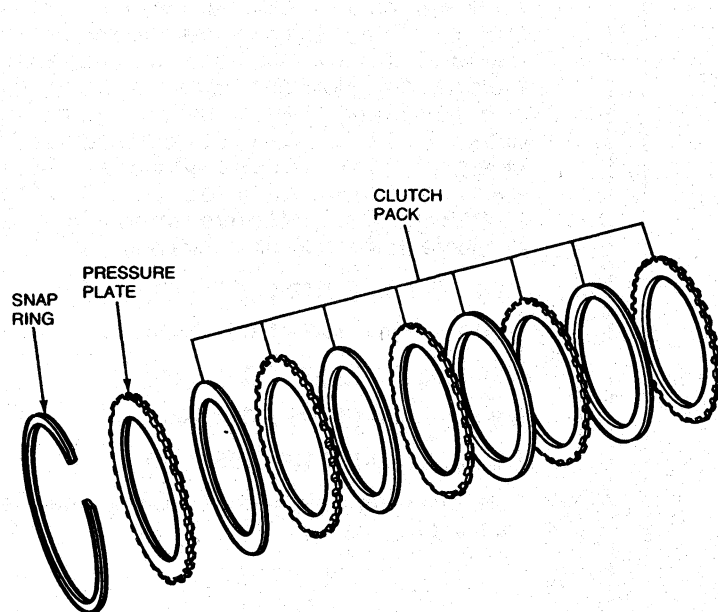
1.95-2.05mm (0.077-0.081 inch)

2.30-2.40mm (0.091-0.094 inch)

2.65-2.75mm (0.104-0.108 inch)

After installing the correct snap ring check the clearance.

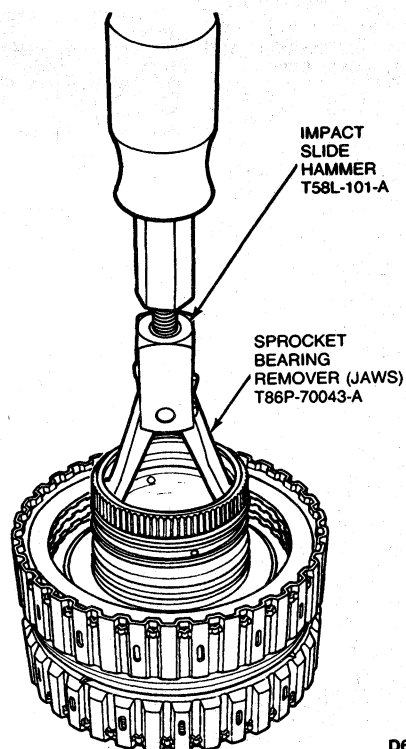


**DISASSEMBLY AND ASSEMBLY (Continued)****Direct Clutch**

D5953-A

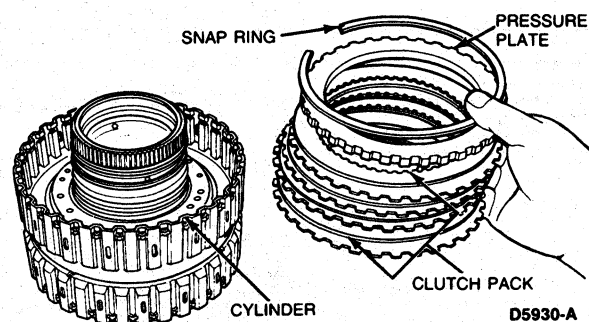
**Disassembly**

1. If required remove direct/intermediate cylinder bushing using Sprocket Bearing Removal Adapter Jaws T86P-70043-A and Impact Slide Hammer T58L-101-A or equivalent.



D6037-A

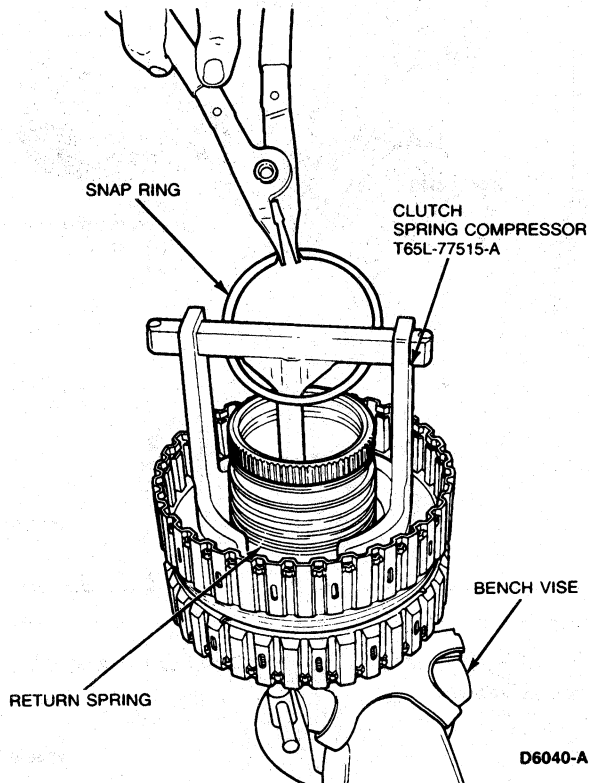
2. Remove snap ring, pressure plate and clutch pack.



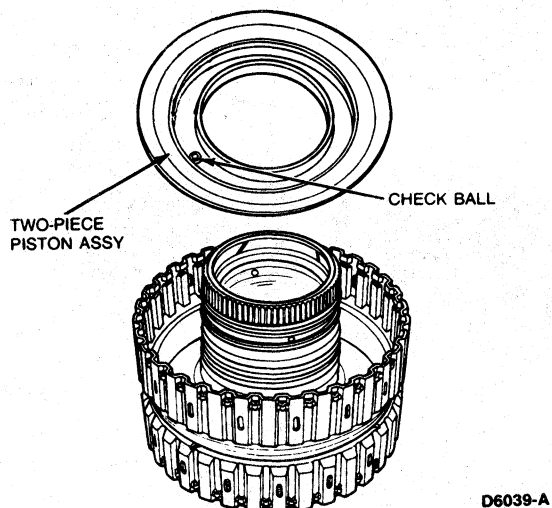
D5930-A

**DISASSEMBLY AND ASSEMBLY (Continued)**

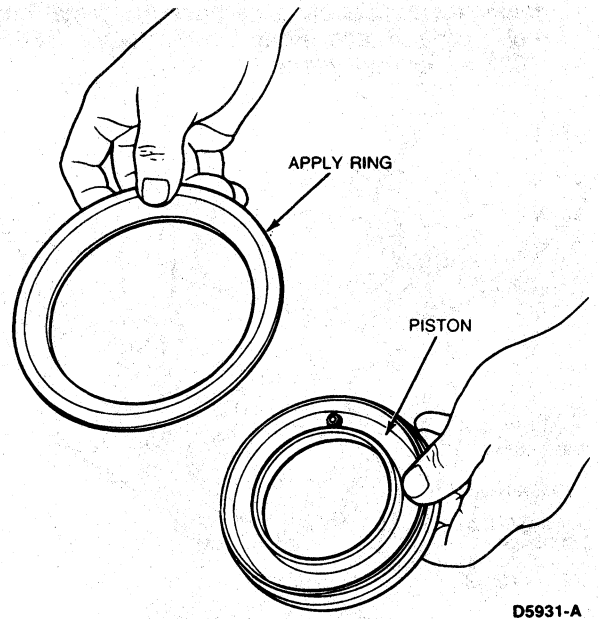
3. Remove snap ring and return spring using Clutch Spring Compressor T65L-77515-A or equivalent.



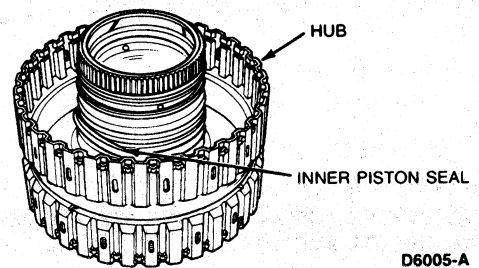
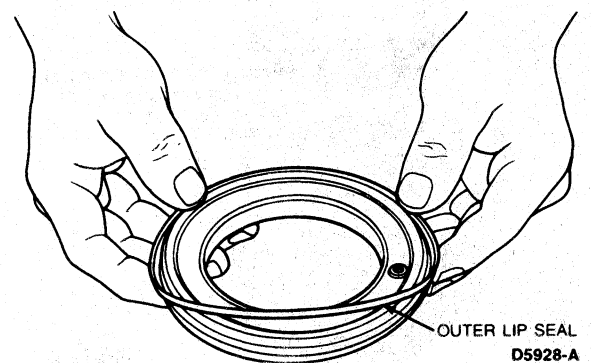
4. Remove two-piece piston assembly.



5. Disassemble two-piece piston.

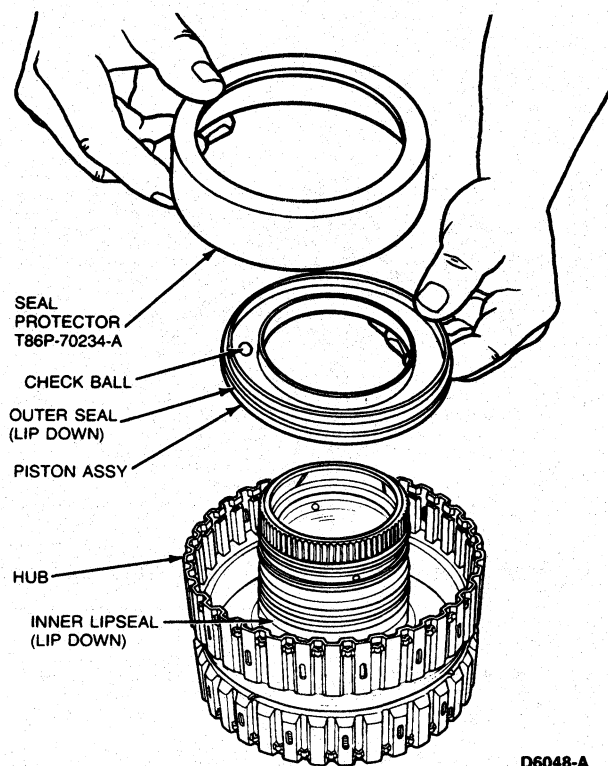


6. Remove piston inner and outer lip seals.

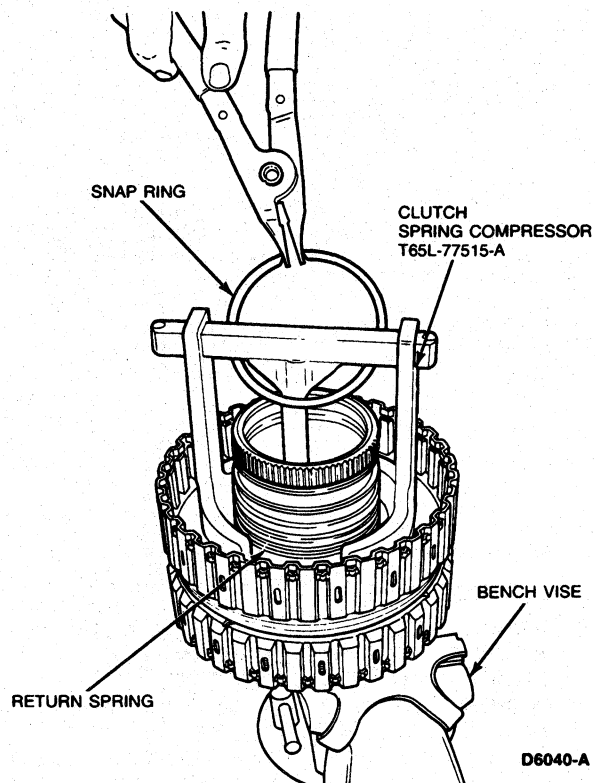
**Inner Piston Seal****Outer Piston Seal**

**DISASSEMBLY AND ASSEMBLY (Continued)****Assembly**

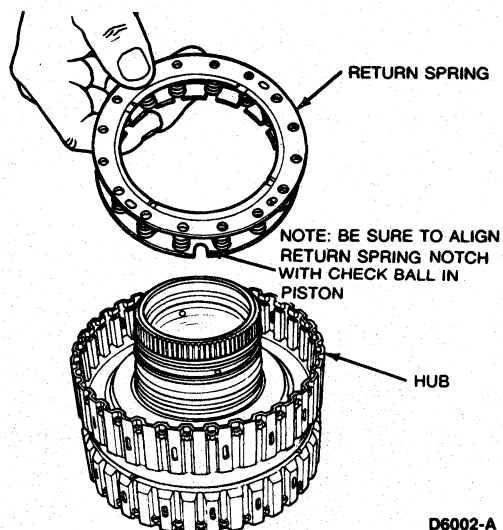
1. Install inner and outer piston lip seals (lip seals facing toward bottom of cylinder) and install into hub using Piston Seal Lip Protector T86P-70234-A or equivalent.



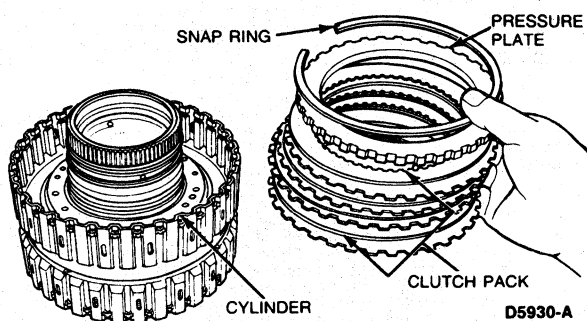
5. Install snap ring using Clutch Spring Compressor T65L-77515-A or equivalent.



2. Install piston outer ring.
3. Verify free movement of check ball.
4. Install return spring in cylinder aligning return spring notch with check ball in piston.

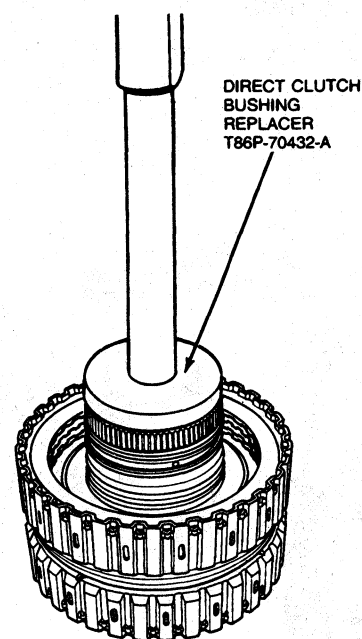


6. Install clutch pack, pressure plate and snap ring into cylinder.



**DISASSEMBLY AND ASSEMBLY (Continued)**

7. If removed, install direct clutch bushing using Clutch Bushing Replacer T86P-70373-A or equivalent.

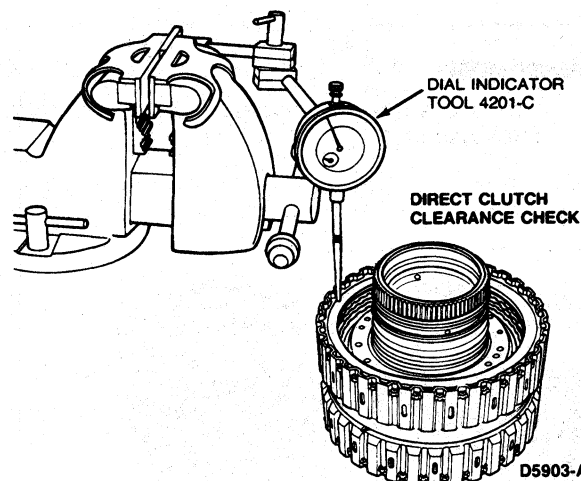


D6038-A

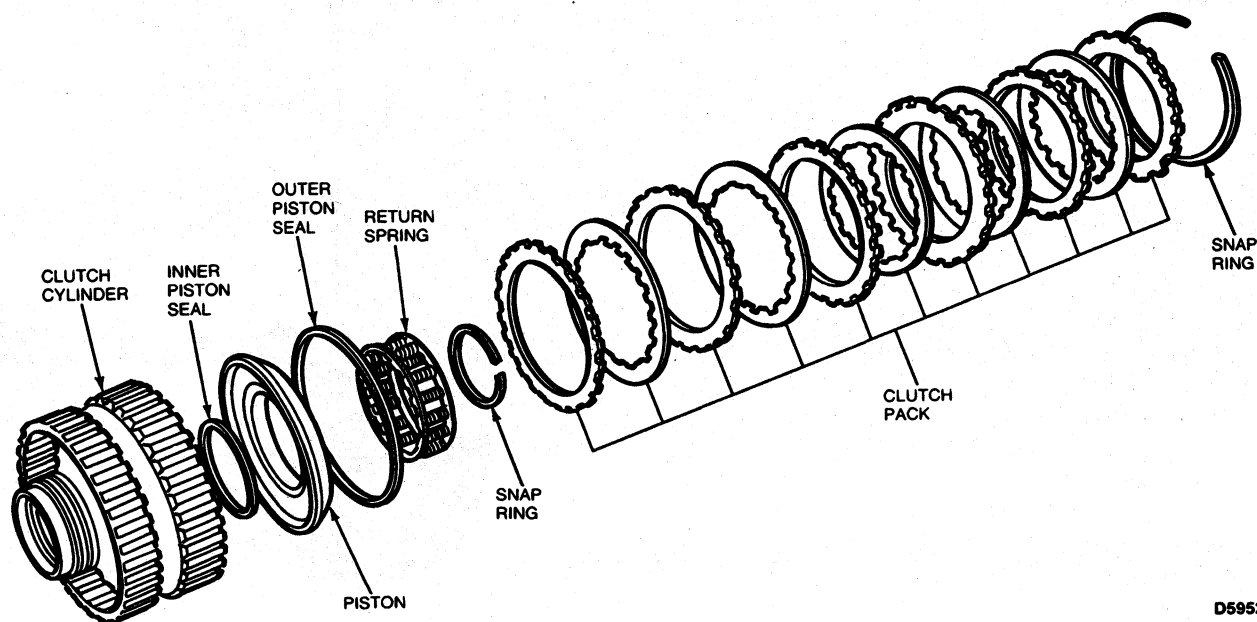
8. Check clutch pack clearance using Dial Indicator TOOL 4201-C or equivalent. Push downward on the clutch pack with 44N (10 lbs) of force. Release pressure and zero dial indicator. Lift pressure plate to the bottom of the snap ring. Note dial indicator reading. Take two readings, 180 degrees apart, and determine the average of the two readings. The clearance should be: (3-Plate) (4-Plate) 0.78-1.29mm (0.031-0.051 inch). If the clearance is not within specification, selective snap rings are available in the following thicknesses:

1.24-1.34mm (0.049-0.053 inch)  
1.66-1.76mm (0.065-0.069 inch)  
2.08-2.18mm (0.082-0.086 inch)  
2.50-2.60mm (0.098-0.102 inch)  
2.92-3.02mm (0.115-0.119 inch)

After installing the correct snap ring, check the clearance.



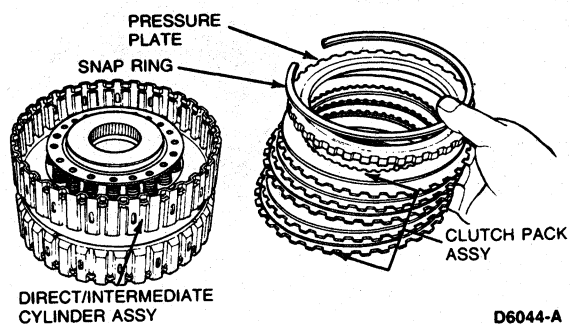
D5903-A

**DISASSEMBLY AND ASSEMBLY (Continued)****Intermediate Clutch**

D5952-A

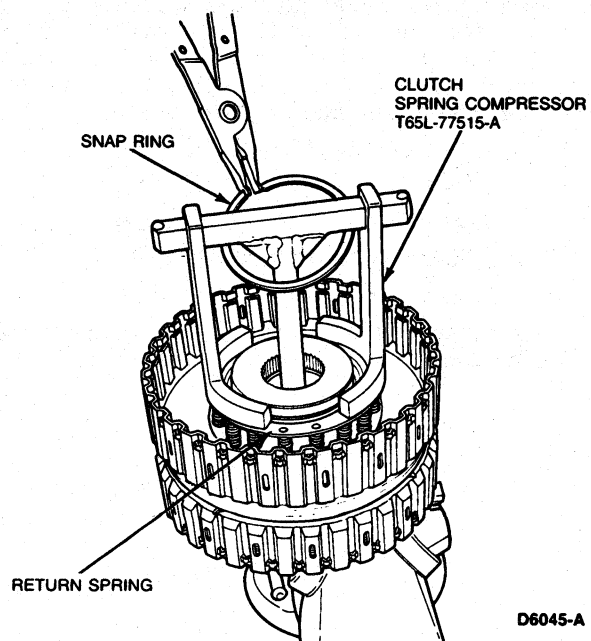
**Disassembly**

1. Remove snap ring, pressure plate and clutch pack assembly.



D6044-A

2. Remove snap ring and return spring, using Clutch Spring Compressor T65L-77515-A or equivalent.

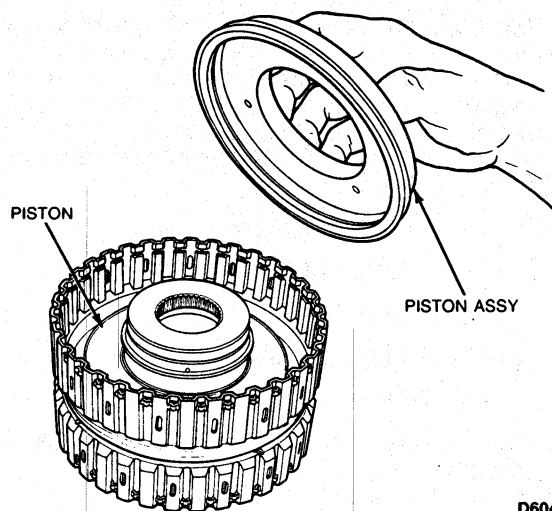


D6045-A



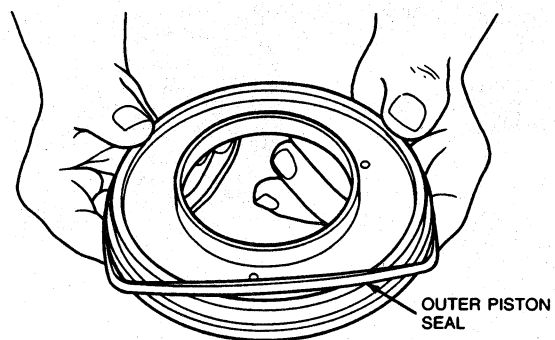
**DISASSEMBLY AND ASSEMBLY (Continued)**

3. Remove piston assembly.

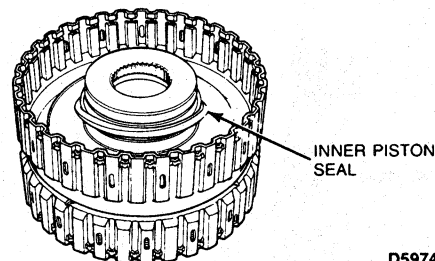


D6043-A

4. Remove piston inner and outer seals.

**Outer Piston Seal**

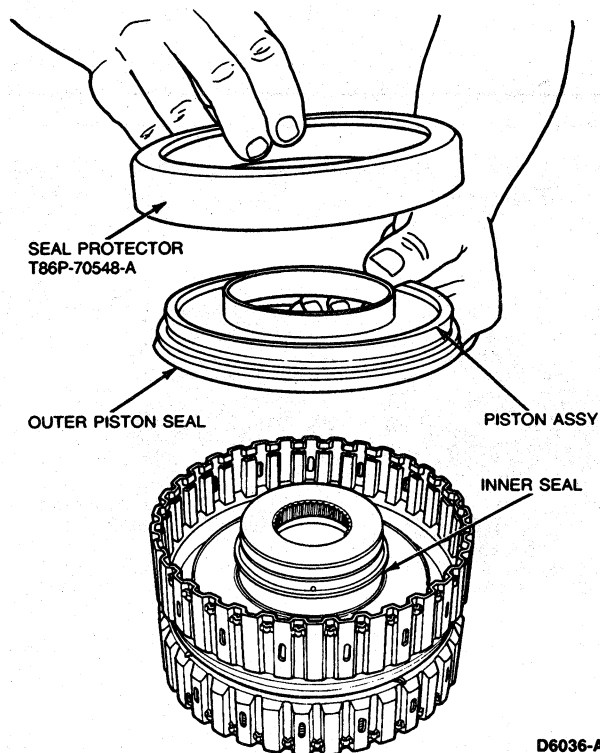
D5969-A

**Inner Piston Seal**

D5974-A

**Assembly**

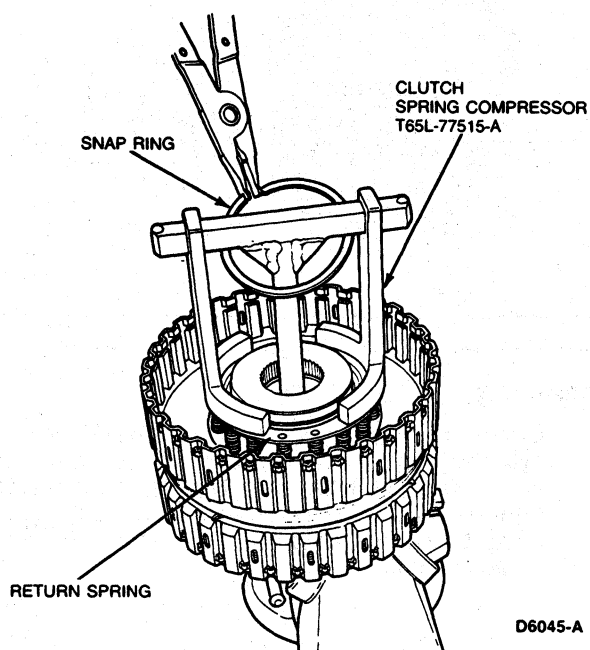
1. Check for free movement of check ball in cylinder. Install inner lip seal on cylinder hub and outer piston lip seal (lips facing towards bottom of cylinder) on piston and install piston using Clutch Seal Lip Protector T86P-70548-A or equivalent.



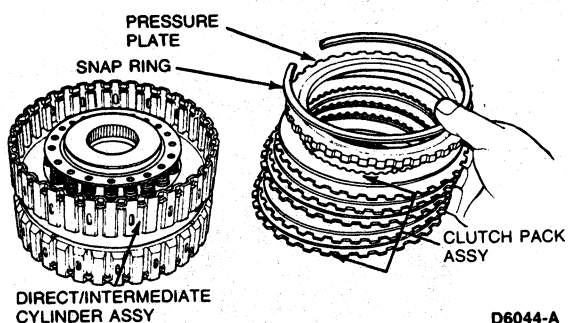
D6036-A

**DISASSEMBLY AND ASSEMBLY (Continued)**

2. Install snap ring and return spring using Clutch Spring Compressor T65L-77515-A or equivalent.



3. Install clutch pack, pressure plate and snap ring.



4. Check clutch pack clearance using Dial Indicator TOOL 4201-C or equivalent. Push downward on the clutch pack with 44N (10 lbs) of force. Release pressure and zero the dial indicator. Lift pressure plate to the bottom of the snap ring. Note dial indicator reading. Take two readings, 180 degrees apart, and determine the average of the two readings. The clearance should be: (4-Plate) 1.02-1.51mm (0.040-0.059 inch). If the clearance is not within specification, selective snap rings are available in the following thicknesses:

1.11-1.21mm (0.044-0.048 inch)

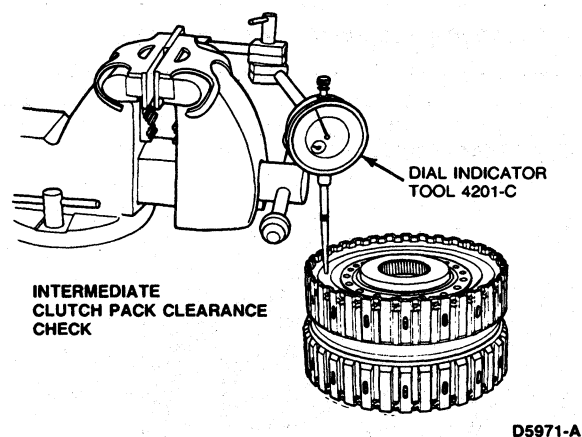
1.51-1.61mm (0.059-0.063 inch)

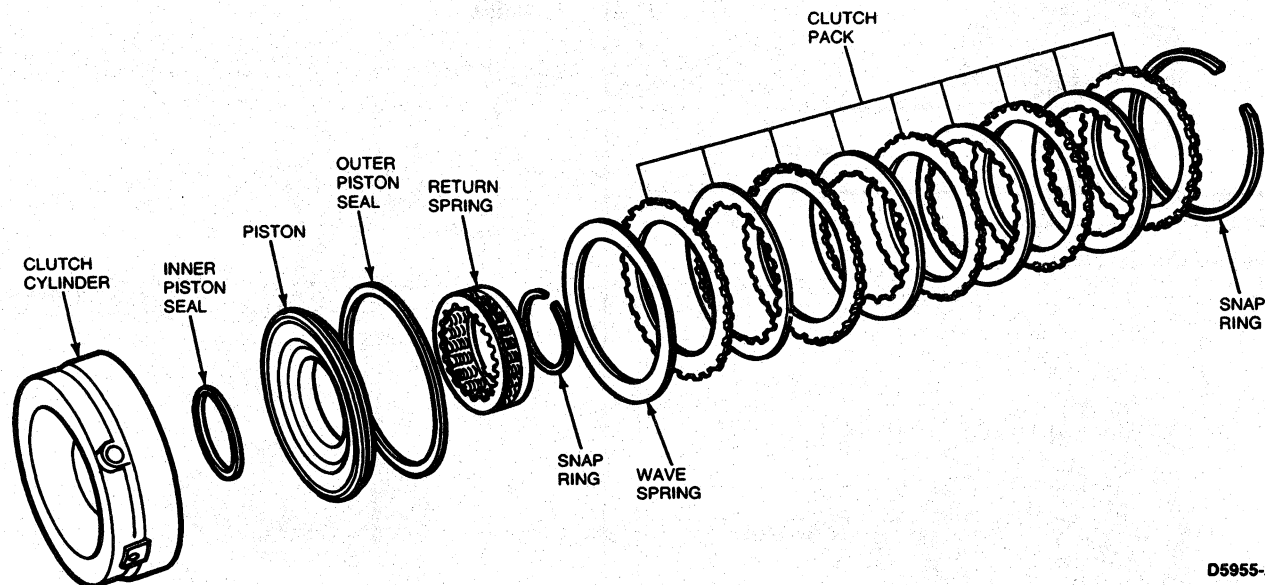
1.91-2.01mm (0.075-0.079 inch)

2.31-2.41mm (0.091-0.095 inch)

2.71-2.81mm (0.107-0.111 inch)

After installing the correct snap ring, check the clearance.

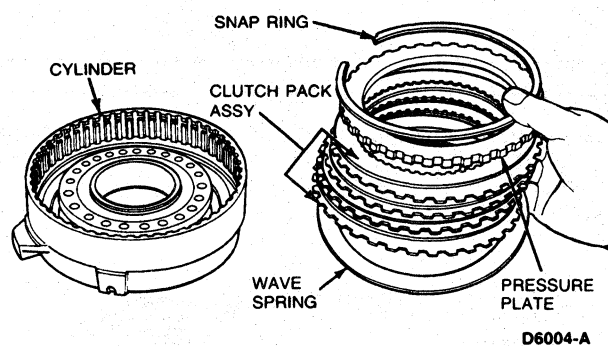


**DISASSEMBLY AND ASSEMBLY (Continued)****Reverse Clutch**

D5955-A

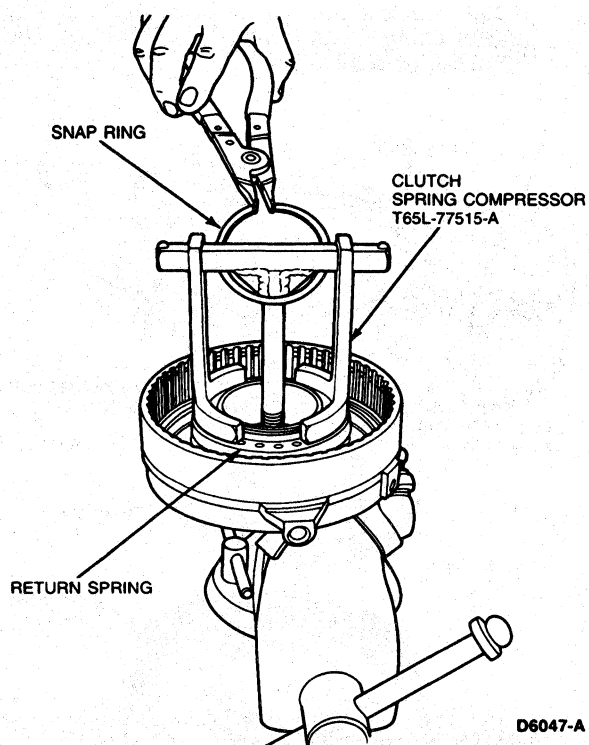
**Disassembly**

1. Remove snap ring, pressure plate, clutch pack and wave spring.



D6004-A

2. Using Clutch Spring Compressor T65L-77515-A or equivalent remove snap ring and return spring.

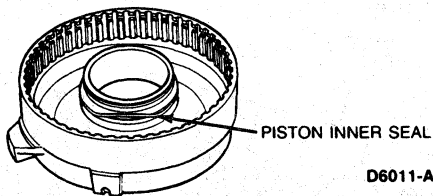


D6047-A

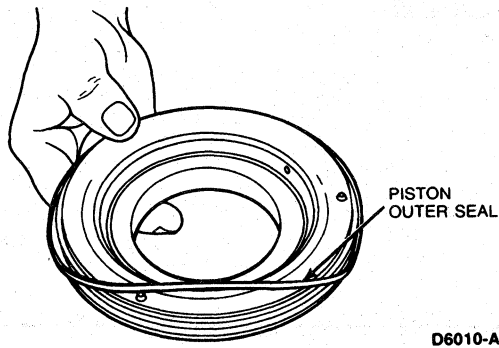
3. Lift out piston and remove piston inner and outer seals.

## DISASSEMBLY AND ASSEMBLY (Continued)

## Piston Inner Seal

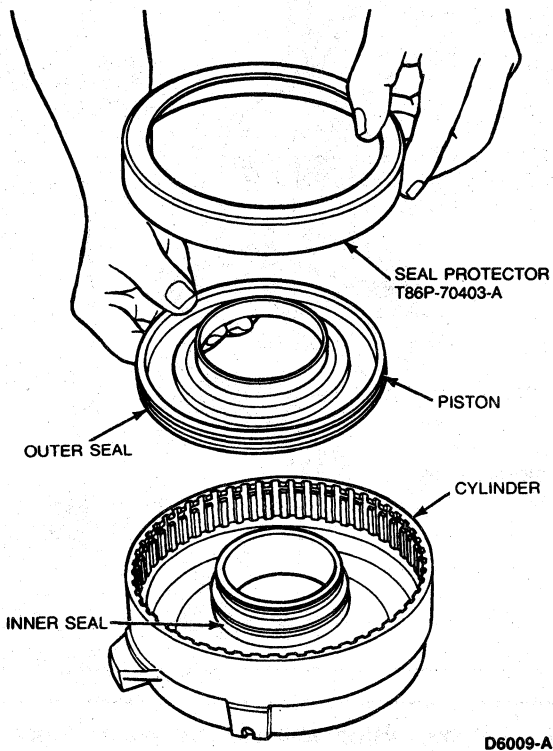


## Piston Outer Seal

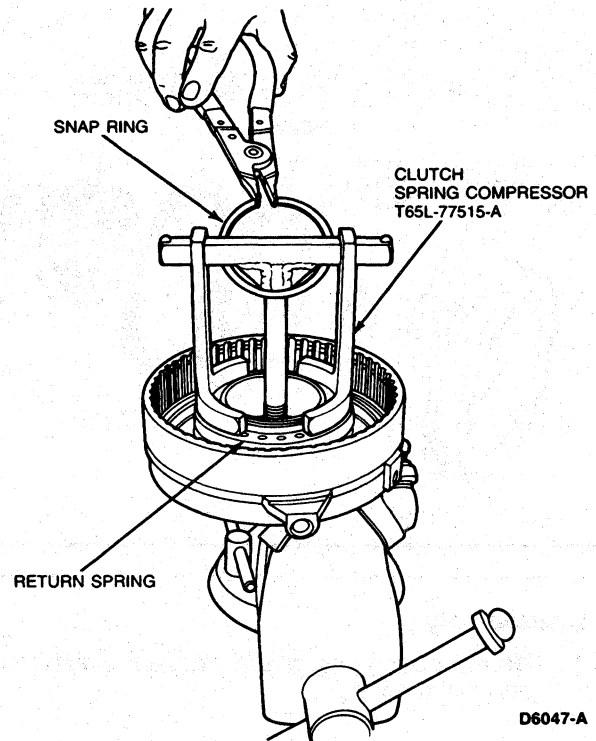


## Assembly

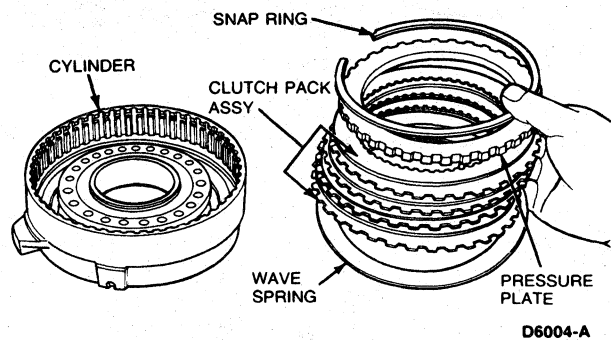
1. Install inner and outer piston lip seals, (lips facing toward bottom of cylinder) and install piston using Clutch Seal Lip Protector T86P-70403-A or equivalent.



2. Install snap ring and return spring using Clutch Spring Compressor T65L-77515-A or equivalent.



3. Install wave spring, clutch pack, pressure plate and snap ring.



**DISASSEMBLY AND ASSEMBLY (Continued)**

4. Check clutch pack clearance using Dial Indicator TOOL 4201-C or equivalent. Push downward on the clutch pack with 44N (10 lbs) of force. Release pressure and zero dial indicator. Lift pressure plate to the bottom of the snap ring. Note dial indicator reading. Take two readings, 180 degrees apart, and determine the average of the two readings. The clearance should be: 0.97-1.63mm (0.038-0.064 inch). If the clearance is not within specification, selective snap rings are available in the following thicknesses:

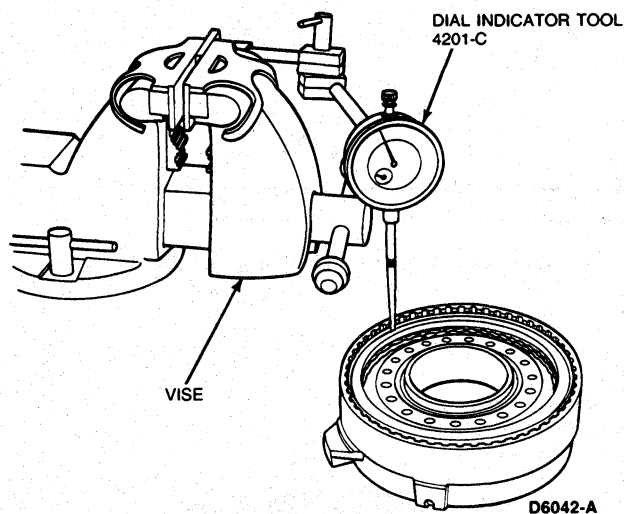
1.52-1.62mm (0.059-0.064 inch)

1.98-2.08mm (0.078-0.081 inch)

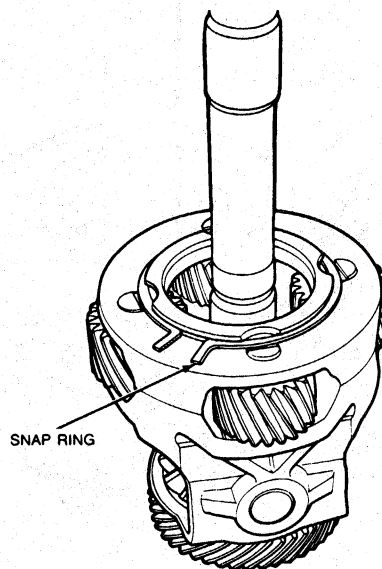
2.45-2.55mm (0.096-0.100 inch)

2.92-3.02mm (0.115-0.118 inch)

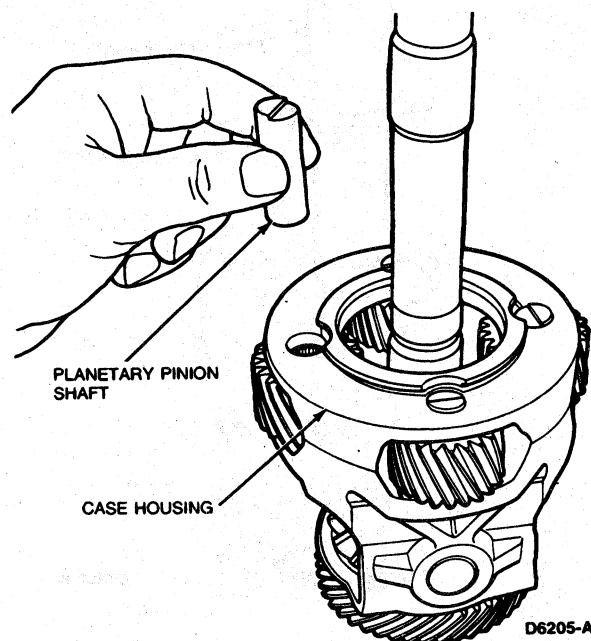
After installing the correct snap ring, check the clearance.

**Differential and Gear Set****Disassembly**

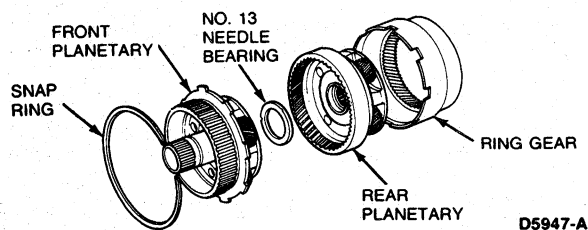
1. Remove planetary pinion shaft retaining snap ring.



2. Using a magnet, work planetary pinion shafts out of differential case housing.

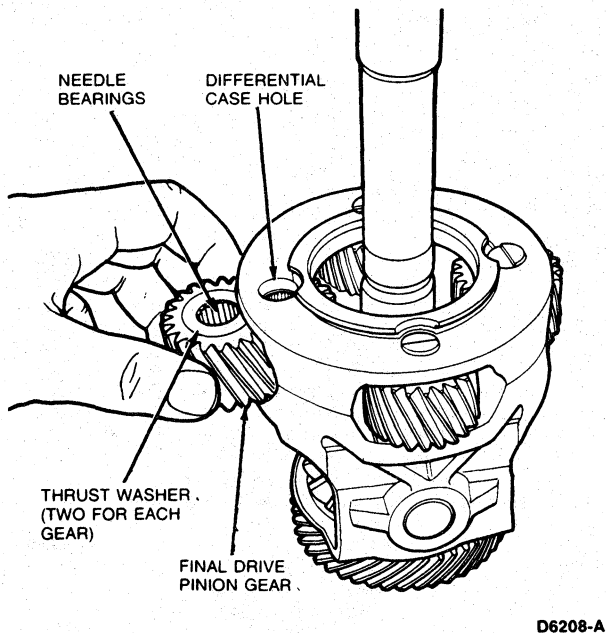
**Planetary Assembly****Disassembly and Assembly**

1. Remove snap ring.
2. Remove front planetary.
3. Remove No. 13 needle bearing.
4. Remove rear planetary from shell and ring gear assembly.
5. To assemble, reverse Steps 1 through 4.

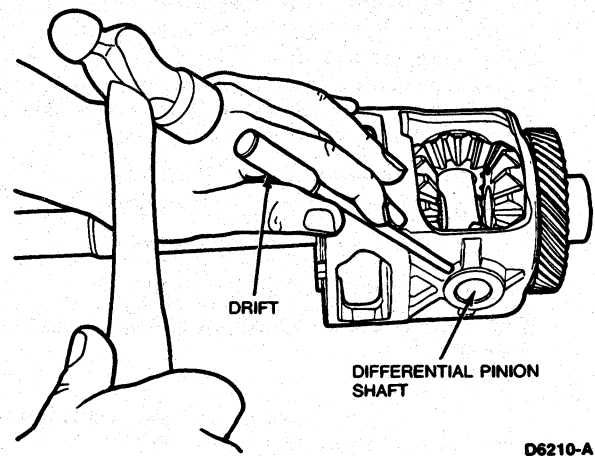


**DISASSEMBLY AND ASSEMBLY (Continued)**

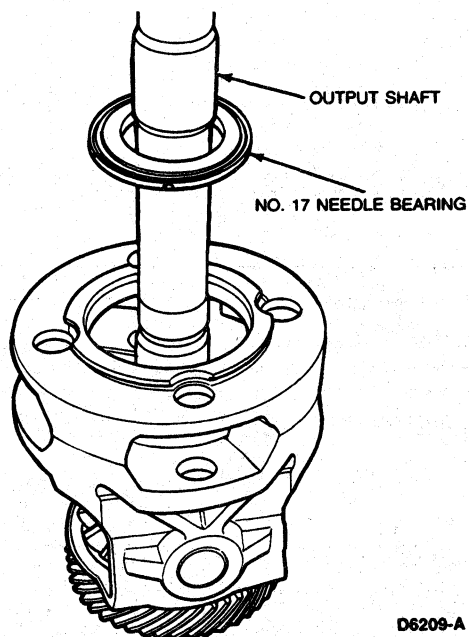
3. Slide out pinion gears and thrust washers.
4. Inspect needle bearings and pinion shafts. Replace, if necessary.



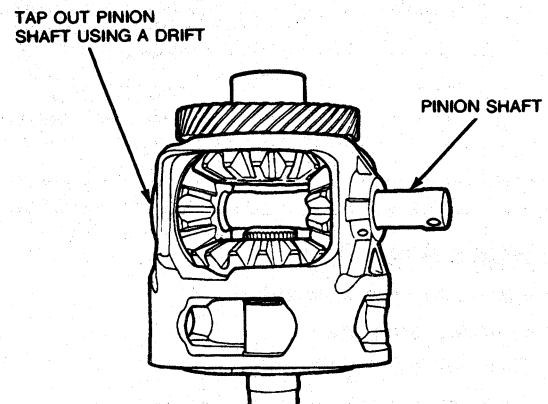
6. Using a drift, drive out differential pinion shaft roll pin.



5. Remove No. 17 needle bearing from top of differential planetary assembly.

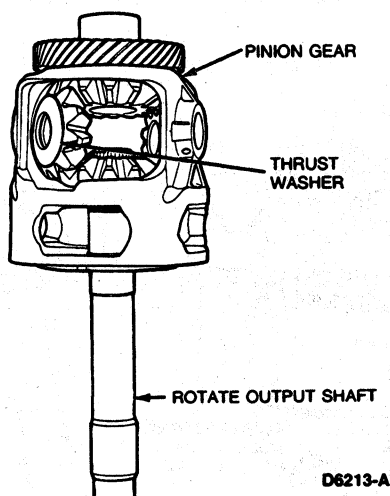


7. Tap out pinion shaft using a drift.

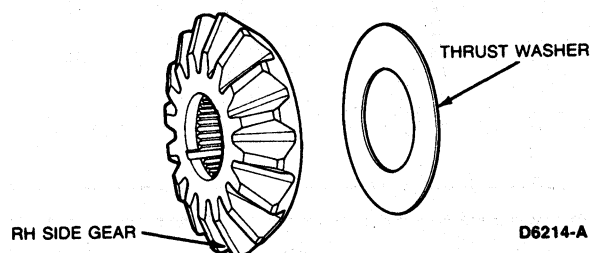


**DISASSEMBLY AND ASSEMBLY (Continued)**

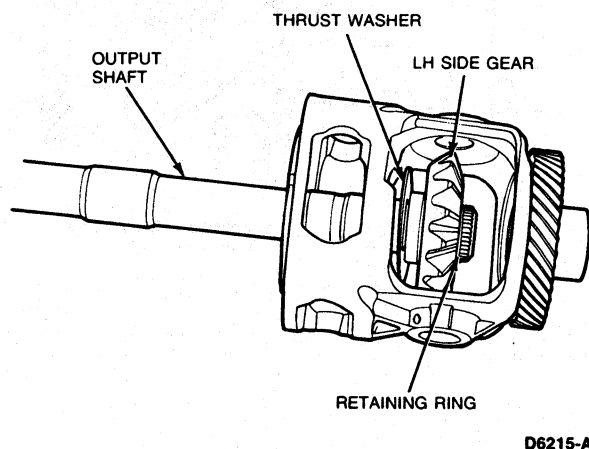
8. Remove pinion gears and thrust washers by rotating output shaft.



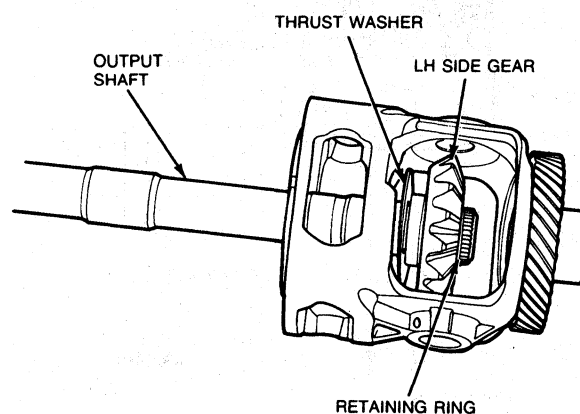
9. Remove RH side gear and thrust washer.



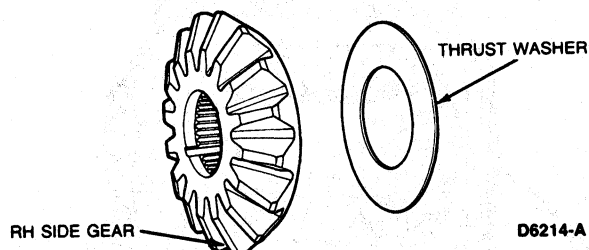
10. Push output shaft toward center of housing, and slide LH side gear upward to gain access to retaining ring.  
 11. Remove retaining ring and slide output shaft out of differential case. Remove pinion gear and thrust washer.

**Assembly**

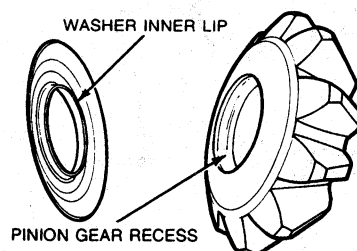
1. With output shaft inside of differential case, slide thrust washer and LH side gear onto output shaft.  
 2. Install retaining ring and slide gear down over retaining ring.



3. Install thrust washer and RH side gear into differential case.

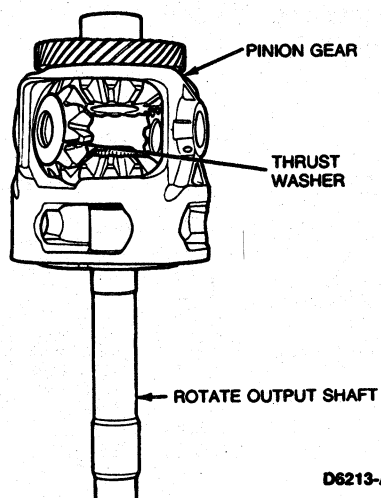


4. Install thrust washers on pinion gears being sure inner lips on washers are seated in recess in pinion gears.

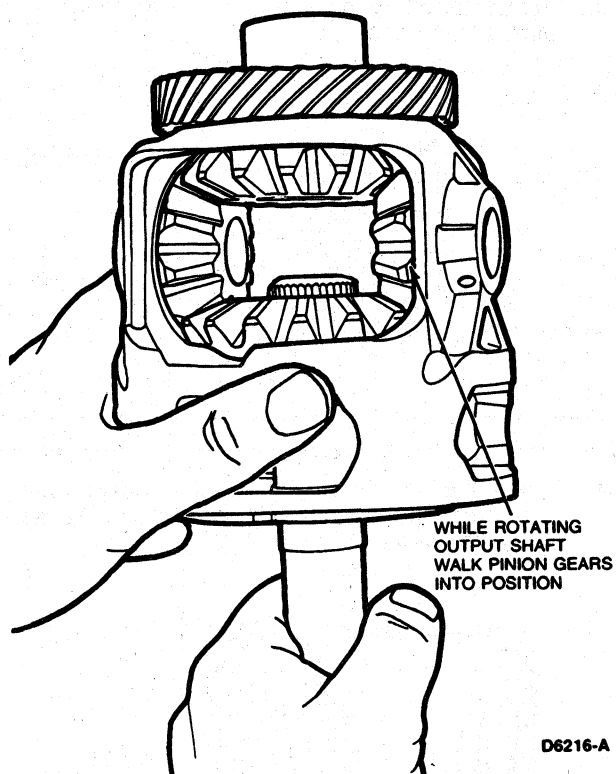


**DISASSEMBLY AND ASSEMBLY (Continued)**

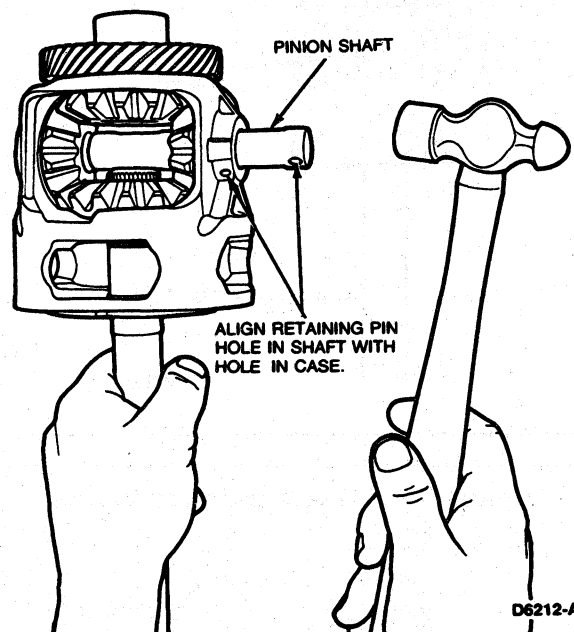
5. Position pinion gears on side gears being sure teeth on all gears are engaged and rotate output shaft.



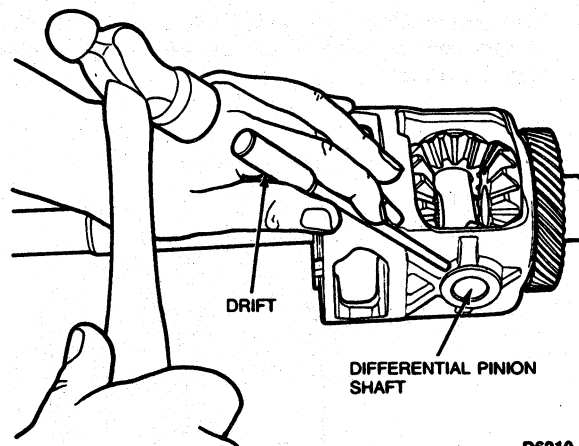
6. While rotating the output shaft, walk pinion gears into position.



7. Tap pinion shaft through differential case and pinion gears, making sure to align retaining pin hole in shaft with hole in differential case.



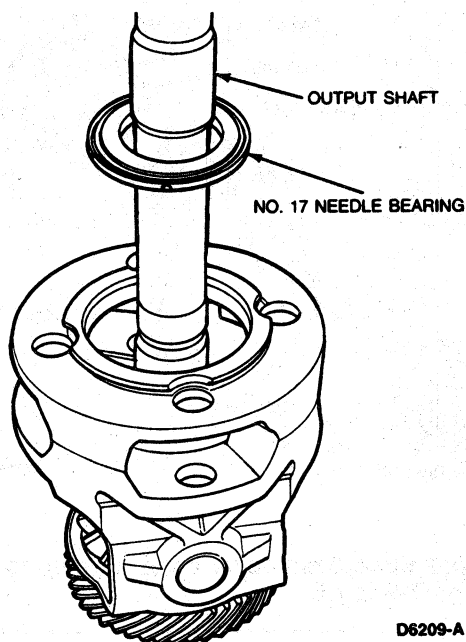
8. Using a drift, tap in differential pinion shaft roll pin.





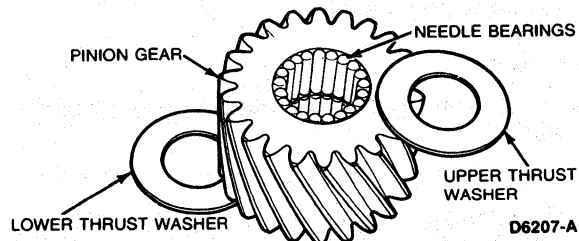
## DISASSEMBLY AND ASSEMBLY (Continued)

9. Install No. 17 needle bearing over output shaft and seat on planetary housing with positioning tabs facing up.

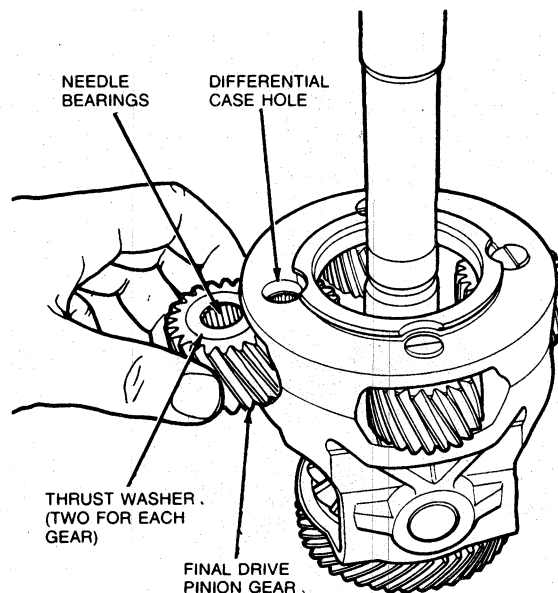


10. Install upper and lower pinion gear thrust washers onto pinion gear.

NOTE: It may be necessary to use a little grease to hold thrust washers, needle bearings and spacer in position. Install and align final drive pinion gears with differential case holes.

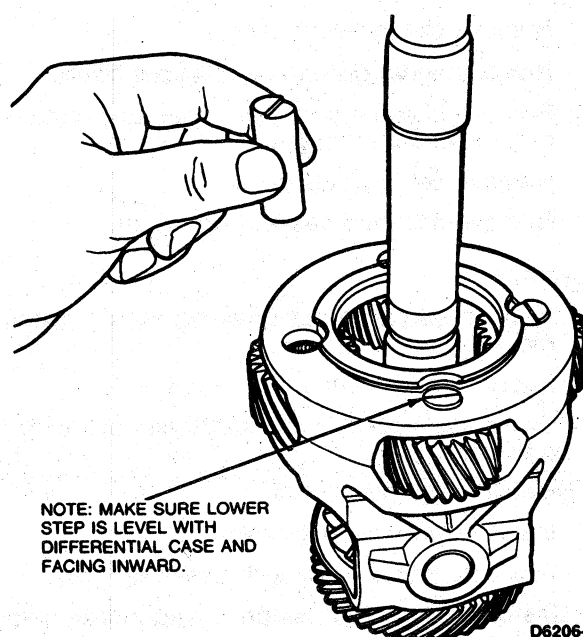


NOTE: Make sure all needle bearings, thrust washers and spacer are in position.



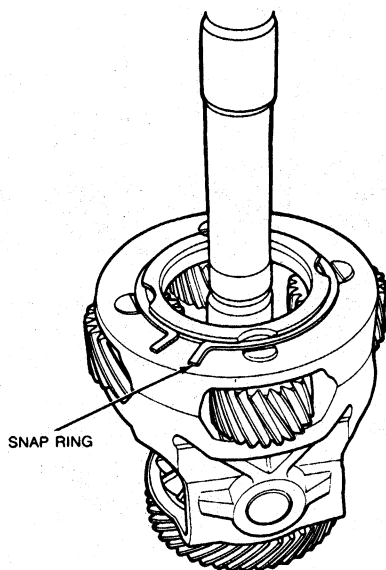
11. Push final drive pinion shafts through differential case and gears until lower step on shaft is level with differential case.

NOTE: Use care when installing pinion shafts to prevent disturbing needle bearings.



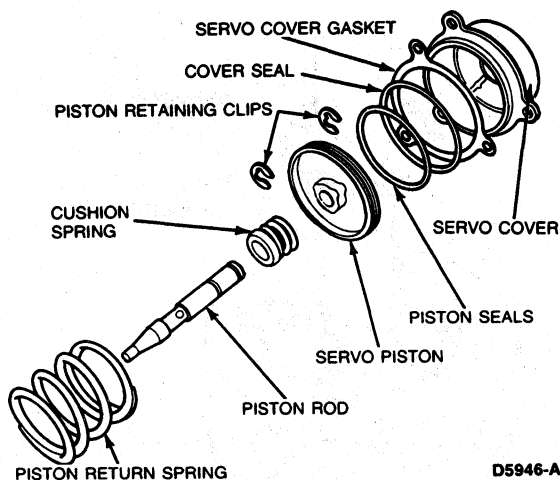
**DISASSEMBLY AND ASSEMBLY (Continued)**

12. Install final drive pinion shaft retaining ring in differential case grooves.



D6204-A

9. Install assembled servo components into case.  
NOTE: Make sure return spring is correctly positioned in case.



D5946-A

10. Install three 8mm cover bolts. Tighten to 9-12 N·m (7-9 lb-ft).

**Low-Intermediate Servo****Disassembly**

1. Remove three 8mm cover bolts.
2. Remove piston return spring.
3. Remove servo piston and rod from cover.
4. Remove piston rod retaining clips and remove rod and cushion spring.
5. Remove servo piston seal.
6. Remove seal and gasket from cover.

**Assembly**

1. Install front piston rod retaining clip on piston rod.
2. Install cushion spring and piston.
3. Compress assembly and install rear piston rod retaining clip.
4. Install servo piston seal.
5. Install cover seal and gasket.
6. Lubricate piston seals with petroleum jelly.
7. Install assembled piston components into servo cover.
8. Install piston return spring into cover.

**Overdrive Servo****Disassembly**

1. Remove three 8mm cover bolts, and remove return spring and rod.
2. Remove servo piston from cover.
3. Remove rear piston rod retaining clip and remove washer.
4. Remove servo piston and seal.
5. Remove cushion spring.
6. Remove front piston rod retaining clip.
7. Remove cover seal.

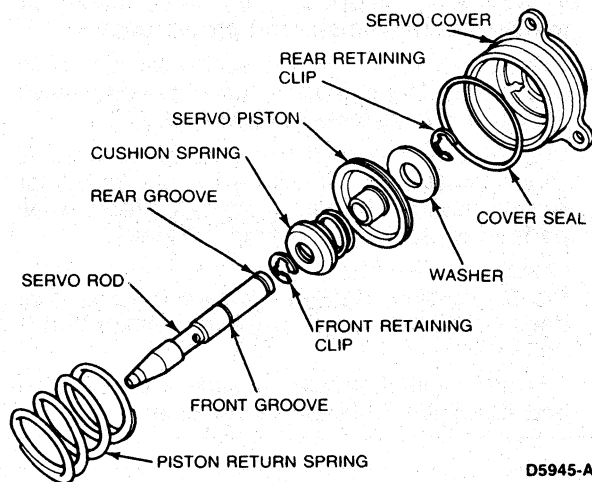
**Assembly**

1. Install front piston rod retaining clip on piston rod.
2. Install cushion spring, piston and washer.
3. Compress assembly and install rear piston rod retaining clip.
4. Lubricate piston seal with petroleum jelly.
5. Install cover seal.
6. Install assembled servo components into case and install cover.

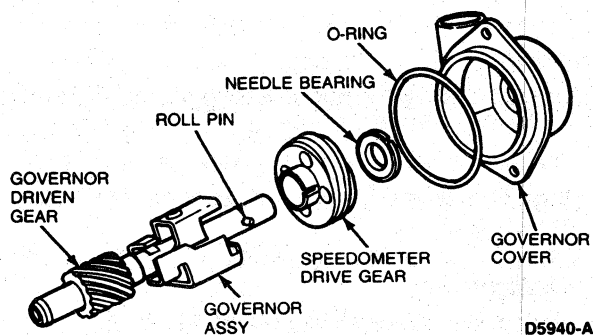
NOTE: Make sure return spring is correctly positioned in case.

**DISASSEMBLY AND ASSEMBLY (Continued)**

7. Install three 8mm cover bolts. Tighten to 9-12 N·m (7-9 lb-ft).

**Governor Assembly****Disassembly**

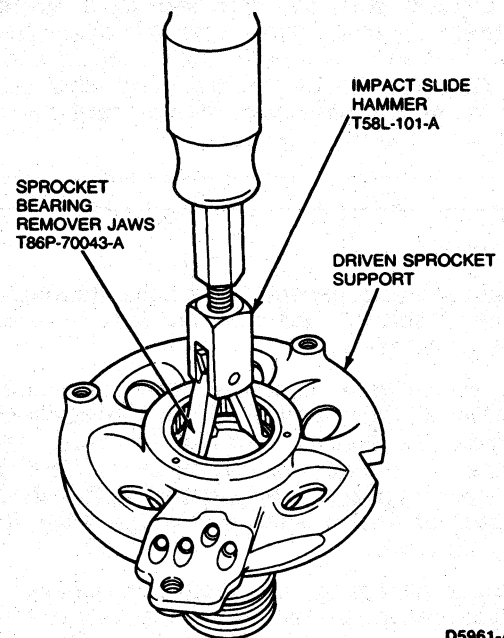
1. Remove two 8mm cover bolts and remove cover.
2. Remove seal and discard.
3. Remove the following components as an assembly:
  - Speedometer drive gear bearing.
  - Speedometer drive gear.
  - Governor assembly.
4. Remove speedometer drive bearing and gear from governor shaft.

**Assembly**

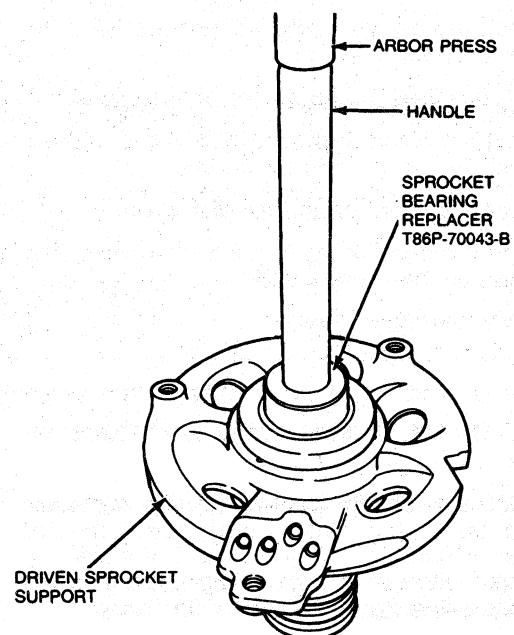
1. Push speedometer drive gear onto governor shaft aligning slots in gear with shaft roll pin.
2. Install speedometer drive gear bearing on speedometer drive gear with outer race facing up (black side).
3. Install new seal and cover.
4. Install two 8mm cover bolts. Tighten to 9-12 N·m (7-9 lb-ft).

**Driven Sprocket Support****Disassembly**

Remove driven sprocket support needle bearing using Sprocket Bearing Remover T86P-70043-A and Impact Slide Hammer T58L-101-A or equivalent.

**Assembly**

Press driven sprocket support needle bearing using sprocket bearing replacer with handle T86P-70043-B or equivalent.



## CLEANING AND INSPECTION

### Transaxle

Clean the parts with suitable solvent and use moisture-free air to dry off all parts and clean out fluid passages.

**The composition clutch plates, control valve body-to-screen gasket, bands and synthetic seals should not be cleaned in a vapor degreaser or with any type of detergent solution.** To clean these parts, wipe them off with a lint-free cloth. New clutch plates or bands should be soaked in the specified transmission fluid for 15 minutes before being assembled.

### Valve Body

1. Clean all parts, except check balls, thoroughly in clean solvent, and blow dry with moisture-free compressed air.
2. Inspect all valve and plug bores for scores. Check all fluid passages for obstructions. Inspect all mating surfaces for burrs and scores. **If needed, use crocus cloth to polish valves and plugs. Avoid rounding the sharp edges of the valves and plugs with the crocus cloth.**
3. Inspect all springs for distortion. Check all valves and plugs for free movement in their respective bores. Valves and plugs, when dry, must fall from their own weight in their respective bores.
4. Roll the manual valve on a flat surface to check for bent condition.

### Servo

1. Inspect the servo body for cracks and the piston bore for scores.
2. Check the fluid passages for obstructions.
3. Inspect the band and the struts for distortion. Inspect the band ends for cracks.
4. Inspect the servo spring for distortion.
5. Inspect the band lining for excessive wear and bonding to the metal band.
6. Replace damaged seals.

### Forward, Direct, Intermediate and Reverse Clutches

1. Inspect the clutch cylinder thrust surfaces, piston bore, and clutch plate serrations for scores or burrs. Minor scores or burrs may be removed with crocus cloth. Replace the clutch cylinder if it is badly scored or damaged.

2. Check the fluid passage in the clutch cylinder for obstructions. Clean out all fluid passages. Inspect the clutch piston for scores and replace if necessary. Inspect the check balls for freedom of movement and proper seating.
3. Check the clutch release spring for distortion and cracks. Replace the spring (including wave spring) if it is distorted or cracked.
4. Inspect the composition clutch plates, steel clutch plates, and clutch pressure plate for worn or scored bearing surfaces. Replace all parts that are deeply scored or burned.
5. Check the clutch plates for flatness and fit on the clutch hub serrations. Discard any plate that does not slide freely on the serrations or that is not flat.
6. Check the clutch hub thrust surfaces for scores and the clutch hub splines for wear.

### Output Shaft

1. Inspect the output shaft bearing surfaces for scores. If excessive clearance or scores are found, replace shaft and inspect components.
2. Check the splines on the output shaft for wear, replace the shaft if the splines are excessively worn. Inspect all the bushings.

### One-Way Clutches

1. Inspect the outer and inner races for scores or damaged surface areas where the rollers or sprags contact the races.
2. Inspect the rollers, sprags and springs for excessive wear or damage.
3. Inspect the spring and case for bent or damaged spring retainers.

### Governor

1. Inspect the governor shaft seal for cracks, excessive scoring or cuts.
2. Inspect balance weight retaining pin for wear.
3. Inspect pressure balls for scoring and free movement.
4. Check spring for distortion, damage or misalignment.
5. Inspect the governor drive and driven gear and speedometer drive gear. Replace, if the teeth are broken, chipped or excessively worn.

### Case

Inspect the case for cracks and stripped threads. Inspect the gasket surfaces and mating surfaces for burrs. Check the vent for obstructions, and check all fluid passages for obstructions and leakage.

Inspect the case bushing for scores. Check all parking linkage parts for wear or damage.

## CLEANING AND INSPECTION (Continued)

If the transaxle case thread is damaged, service kits may be purchased from local jobbers. To service a damaged thread, the following procedures should be carefully followed.

1. Drill out the damaged threads, **using the same drill size as the thread OD**. For example, use a 5/16-inch drill for a 5/16 X 18 thread.
2. Select the proper special tap and tap the drilled hole. The tap is marked for the size of the thread being repaired. Thus, the special tap marked 5/16 X 18 will not cut the same thread as a standard 5/16 X 18 tap. It does cut a thread large enough to accommodate the insert, and after the insert is installed the original thread size (5/16 X 18) is restored.
3. Place the insert on the tool and adjust the sleeve to the length of the insert being used. Press the insert against the face of the tapped hole. Turn the tool clockwise and wind the insert into the hole until the insert is 1/2-turn below the face.
4. Working through the insert, bend the insert tang straight up and down until it breaks off at the notch.
5. Improperly installed inserts can be removed with extractor tool. Place the extractor tool in the insert so that the blade rests against the top coil 1/4 to 1/2 turn away from the end of the coil. Tap the tool sharply with a hammer so that the blade cuts into the insert. Exert downward pressure on the tool and turn it counterclockwise until the insert is removed.

### Planetary Carriers

**Individual parts of the planet carriers are not serviceable except for the differential components.**

1. The pins and shafts in the planet assemblies should be checked for loose fit and/or complete disengagement. Use a **new planet assembly** if either condition exists. Before installing a planet assembly, the shaft welds should also be checked.
2. Inspect the pinion gears for damaged or excessively worn teeth.
3. Check for free rotation of the pinion gears.

### Thrust Bearings

Wash the thrust bearings thoroughly in cleaning solvent. Blow the bearings dry with compressed air.

Make certain the bearings are clean and then lubricate with transmission fluid. Replace any bearings and races which show signs of pitting or roughness.

### Stator to Impeller Interference Check

1. Position the stator support assembly on a bench with the spline end pointing up.
2. Mount a converter on the stator support with the splines on the one-way clutch inner race engaging the mating splines of the stator support.
3. Hold the stator support stationary, and try to rotate the torque converter both clockwise and counterclockwise. The converter should rotate freely without any signs of interference or scraping within the converter assembly.
4. If there is an indication of scraping, the trailing edges of the stator blades may be interfering with the leading edges of the impeller blades. In such cases, replace the converter.

### Converter and Oil Cooler

When internal wear or damage has occurred in the transaxle, metal particles, clutch plate material, or band material may have been carried into the converter and oil cooler. These contaminants are a major cause of recurring transaxle troubles and **MUST** be removed from the system before the transaxle is put back into service.

Whenever a transaxle has been disassembled to replace worn or damaged parts or because the valve body sticks from foreign material, the converter and oil cooler **MUST** be cleaned by using a mechanically agitated cleaner, such as Rotunda model 014-00028 or equivalent.

The lack of a drain plug in the AXOD converter increases the amount of residual flushing solvent retained in the converter after cleaning. This retained solvent is not acceptable and a method of diluting it is required. The following procedure is to be used after removal of the AXOD torque converter from the cleaning equipment.

1. **Thoroughly drain** remaining solvent through the hub.
2. Add 1.9L (2.0 U.S. quarts) of clean transmission fluid to the converter. Agitate by hand.
3. **Thoroughly drain** solution through the converter hub.

### Transaxle Fluid Drain and Refill

Normal maintenance and lubrication requirements do not necessitate periodic automatic transaxle fluid changes. If a major service, such as a clutch band, bearing, etc., is required in the transaxle, it will have to be removed for service. **At this time the converter, transaxle cooler and cooler lines must be thoroughly flushed to remove any dirt.**

**CLEANING AND INSPECTION (Continued)**

When used under continuous or severe conditions the transaxle and torque converter should be drained and refilled with fluid as specified.

**CAUTION: Use of a fluid other than specified could result in transaxle malfunction and/or failure.**

Refer to Vehicle Certification Label affixed to left front door lock face panel or door pillar for transaxle code.

When filling a dry transaxle and converter, refer to Specifications for capacity. Check the fluid level.

Procedures for partial drain and refill, due to in-vehicle service operation, are as follows:

1. Raise vehicle on a hoist or jackstands. Refer to the Pre-Delivery manual, Section 50-04.
2. Place a drain pan under transaxle.

3. Loosen pump and valve body cover bolts and drain.
4. Loosen lower pan attaching bolts and drain fluid from transaxle.
5. When fluid has drained to level of pan flange, remove rest of pan bolts working from the RH side and allow it to drop and drain slowly.
6. When all fluid has drained from transaxle, remove and thoroughly clean the pan. Discard gasket.
7. Place a new gasket on pan, and install pan on transaxle.
8. Fill transaxle to correct level.
9. Lower vehicle.

**Oil Cooler Tube Leakage**

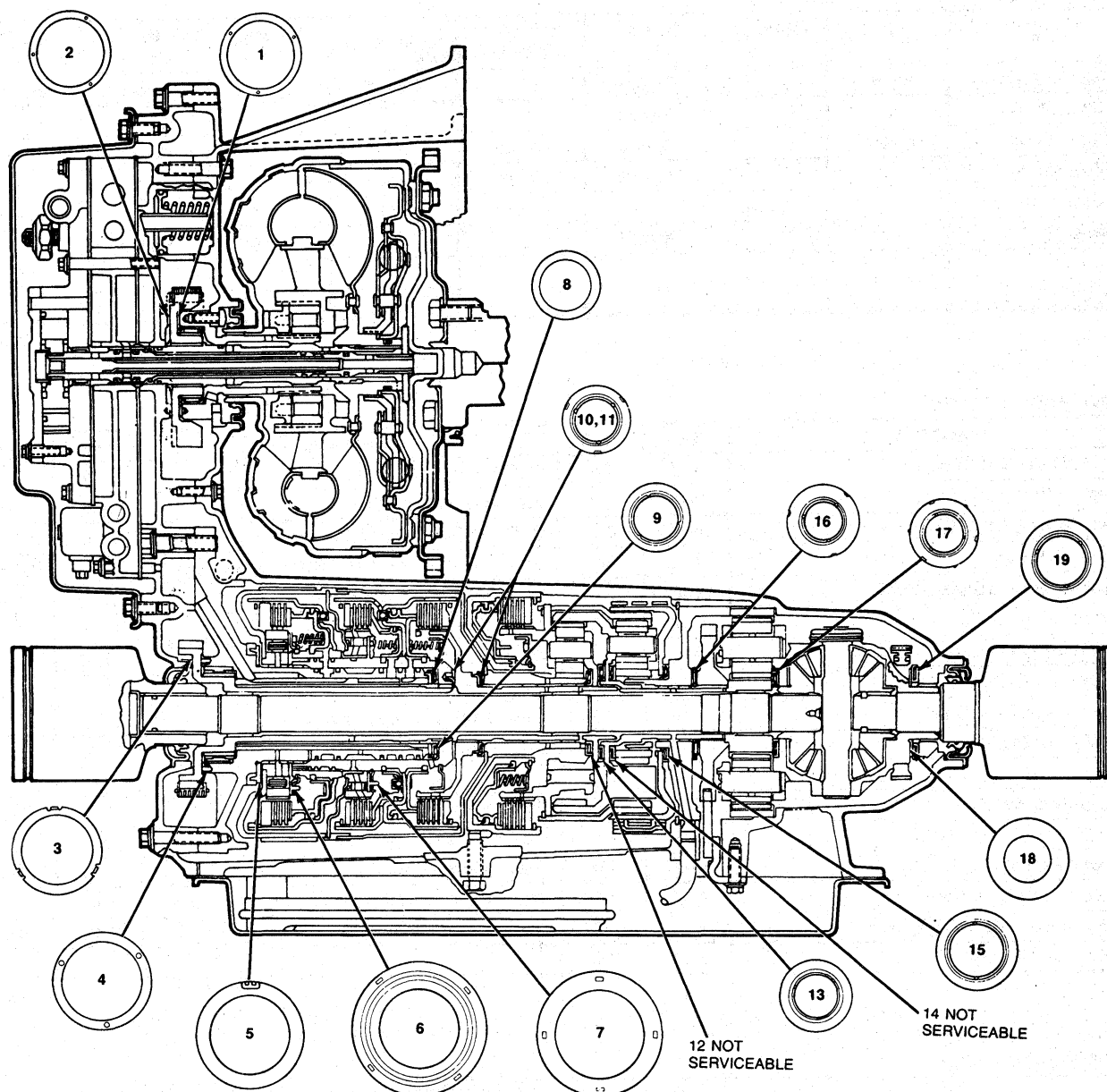
When fluid leakage is found at the oil cooler, the cooler must be replaced. Refer to Section 27-03.

When one or more of the fluid cooler steel tubes must be replaced, each replacement tube must be fabricated from the same size steel tubing as the original line.

Using the old tube as a guide, bend the new tube as required. Add the necessary fittings, and install the tube.

After the fittings have been tightened, add fluid as needed and check for fluid leaks.

## THRUST WASHER AND NEEDLE BEARING LOCATION



ITEM	PART NO.	DESCRIPTION
1	7G019	WASHER THRUST (NYLON) (DRIVE SPROCKET/STATOR SUPPORT)
2	7G019	WASHER THRUST (NYLON) (DRIVE SPROCKET/STATOR SUPPORT)
3	7G096	WASHER THRUST (STEEL BACKED BRONZE) CASE COVER/DRIVEN SPROCKET)
4	7G115	WASHER THRUST (NYLON) (DRIVEN SPROCKET/SUPPORT)
5	7D014	WASHER THRUST (NYLON) (SELECTIVE) (SUPPORT/FORWARD CLUTCH)
6	7D076	WASHER THRUST (NYLON) (FORWARD CLUTCH O.W.C. RACE)
7	7G116	WASHER THRUST (NYLON) (DIRECT CLUTCH/DIRECT O.W.C)
8	7G273	WASHER THRUST (PHENOLIC) (SELECTIVE) (DRIVEN SPROCKET SUPPORT—REAR)
9	7G128	BEARING ASSEMBLY (DIRECT CLUTCH HUB)
10	7G239	BEARING ASSEMBLY (FRONT SUN GEAR)
11	7G239	BEARING ASSEMBLY (FRONT SUN GEAR)
12	7G104	NOT SERVICEABLE
13	7G177	BEARING ASSEMBLY (PLANETARY THRUST—CENTER)
14	7G105	NOT SERVICEABLE
15	7G178	BEARING ASSEMBLY (REAR SUN GEAR)
16	7G106	BEARING ASSEMBLY (FINAL DRIVE GEAR—FRONT)
17	7G107	BEARING ASSEMBLY (FINAL DRIVE GEAR—REAR)
18	7G103	WASHER THRUST (STEEL) (SELECTIVE) (DIFFERENTIAL CARRIER)
19	7G112	BEARING ASSEMBLY (DIFFERENTIAL CARRIER)

## SPECIFICATIONS

## CLUTCH AND BAND APPLICATION CHART

Gear	Lo-Int Band	Overdrive Band	Forward Clutch	Intermediate Clutch	Direct Clutch	Reverse Clutch	Low One-Way Clutch	Direct One-Way Clutch
1st Gear Manual Low	Applied		Applied		Applied		Applied	Applied
1st Gear (Drive)	Applied		Applied				Applied	
2nd Gear (Drive)	Applied		Applied	Applied			Holding	
3rd Gear (Drive)			Applied	Applied	Applied			
4th Gear (Overdrive)		Applied		Applied	Applied			Holding
Reverse (R)			Applied			Applied	Holding	
Neutral (N)								
Park (P)								

CD6171-A

## TORQUE SPECIFICATIONS

Description	N·m	Lb·Ft	Description	N·m	Lb·Ft
Separator Plate to Main Control	9-12	7-9	Chain Cover to Case (10 mm)	9-12	7-9
Separator Plate to Pump Body	9-12	7-9	Pump Body to Chain Cover	9-12	7-9
Detent Spring to Chain Cover	9-12	7-9	Oil Pan to Case (Lower Reservoir)	14-16	10-12
Dust Cover to Case	9-12	7-9	Main Control Cover to Chain Cover (Upper Reservoir)	14-16	10-12
TV Control Lever to Chain Cover	9-12	7-9	Manual Lever to Manual Shaft	16-22	12-16
Solenoid to Main Control	9-12	7-9	Park Abutment to Case	27-30	20-22
Low-Intermediate Servo Cover to Case	9-12	7-9	Chain Cover to Case (13 mm)	27-30	20-22
Overdrive Servo Cover to Case	9-12	7-9	Case to Chain Cover (13 mm)	27-30	20-22
Pump Cover to Pump Body	9-12	7-9	Chain Cover to Front Support (13 mm)	27-30	20-22
Filler Tube to Case	9-12	7-9	Chain Cover to Front Support (7 mm)	34-48	25-35
Governor Cover to Case	9-12	7-9	Differential Brace to Case	34-48	25-35
Case to Stator Support	9-12	7-9	Engine to Case/Case to Engine	55-68	41-50
Case to Chain Cover (10 mm)	9-12	7-9	Case to Reverse Clutch Screw	10-12	7-9
Oil Pump Assy. to Main Control	9-12	7-9	Case to Reverse Clutch Nut	34-47	25-35
Neutral Start Switch to Case	9-12	7-9	Pressure Tap Plug for Chain Cover and Pump Body	8-12	6-9
Valve Body/Solenoid to Chain Cover	9-12	7-9	Pressure Switch to Pump Body	8-12	6-9
Bracket Tubes to Case	9-12	7-9			

CD5981-B

## TORQUE SPECIFICATIONS

Bolt	N·m	Lb·Ft
Transaxle to Engine	55-68	41-50
Control Arm to Knuckle	50-60	36-44
Stabilizer U-Clamp to Bracket	81-95	60-70
Stabilizer to Control Arm	133-169	98-125
Brake Hose Routing Clip	11	8
Tie Rod to Knuckle①	31-47	23-35
Manual Cable Bracket	14-27	10-20
Starter	41-54	30-40
Dust Cover	9-12	7-9
Torque Converter to Flywheel	31-53	23-39
Insulator to Bracket	75-90	55-70
Insulator Bracket to Frame	55-70	40-50
Insulator Mount to Transmission	34-45	25-33

① Tighten to minimum specified torque, continue tightening to nearest cotter pin slot.

CD6257-B

## FLUID CAPACITY

Type	Liters	Quarts
Ford Part No. XT-4-H, Ford Specification ESP-M2C166-A	12.46	13.1

CD6170-B

Description	N·m	Lb·Ft
Cooler Line Fittings at Radiator	11-16①	8-12
Transaxle	24-31①	18-23
Cooler Line Nut	16-24	12-18
Push Connector Fitting to Transaxle	24-31	18-23
Tube Nut to Connector	16-24	12-18
Threaded Connector to Oil Cooler	11-16	8-12

① 1/4 inch x 18 Straight Pipe Fitting

CD4507-B



**SPECIAL SERVICE TOOLS**

Tool Number	Description	Tool Number	Description
D79P-100-A	Slide Hammer — Universal	T86P-70023-A	Servo Rod Tool
T59L-100-B	Impact Slide Hammer	T86P-70043-A	Sprocket Bearing Remover
T58L-101-A	Impact Slide Hammer	T86P-70043-B	Sprocket Bearing Replacer
T57L-500-B	Bench Mount Holding Fixture	T86P-70100-A	Guide Pin
D80L-515-S	Puller Screw	T86P-70100-B	Guide Pin
D80L-522-A	Gear and Pully Support Bar	T86P-70100-C	Guide Pin
D80L-625-A	Bushing Protectors	T86L-70234-A	Piston Seal Lip Protector
D80L-630-3	Step Plate Adapter	T86P-70234-A	Output Shaft Seal Replacer
T00L-1175-AC	Seal Remover	T86P-70370-A	Guide Pin
T86P-1177-B	Output Shaft Seal Replacer	T86L-70373-A	Clutch Bearing Replacer
D81P-3504-N	Lock Nut Pin Remover	T86P-70389-A	Clutch Pack Lifting Tool
T86P-3514-A1	C.V. Joint Puller	T86P-70401-A	Converter Oil Seal Replacer
T86P-3514-A2	Screw Extension	T86L-70403-A	Seal Protector
T00L-4201-C	Dial Indicator	T86P-70422-A	Bimetal Height Gauge
D79P-6000-A	Engine Support Bar	T86P-70423-A	Direct Clutch Bearing Replacer
D81L-6001-D	Engine Lifting Bracket	T86L-70548-A	Clutch Seal Lip Protector
T74P-6700-A	Output Shaft Seal Remover	T86P-77265-AH	Disconnect Tool
T77L-7902-A	Holding Wire	T65L-77515-A	Clutch Spring Compressor
T80L-7902-A	End Play Checking Tool	T81P-78103-A	Slide Hammer Adapter
T80L-7902-C	End Play Checking Tool	<b>ROTUNDA EQUIPMENT</b>	
T81P-7902-B	One-Way Clutch Torque Tool		
T81P-7902-C	Torque Converter Handles	Model Number	Description
T86P-7902-A	Converter Guide Sleeve Tool	021-00007	Torque Converter Leak Test Kit
T86P-70001-A	Lube Tube Remover Tool	014-00737	Automatic Transmission Tester Kit
T86P-70023-B	Servo Rod Tool		

CD6258-B

# SECTION 17-25 Transaxle—ATX

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## VEHICLE APPLICATION

Taurus/Sable with 2.5L engine.

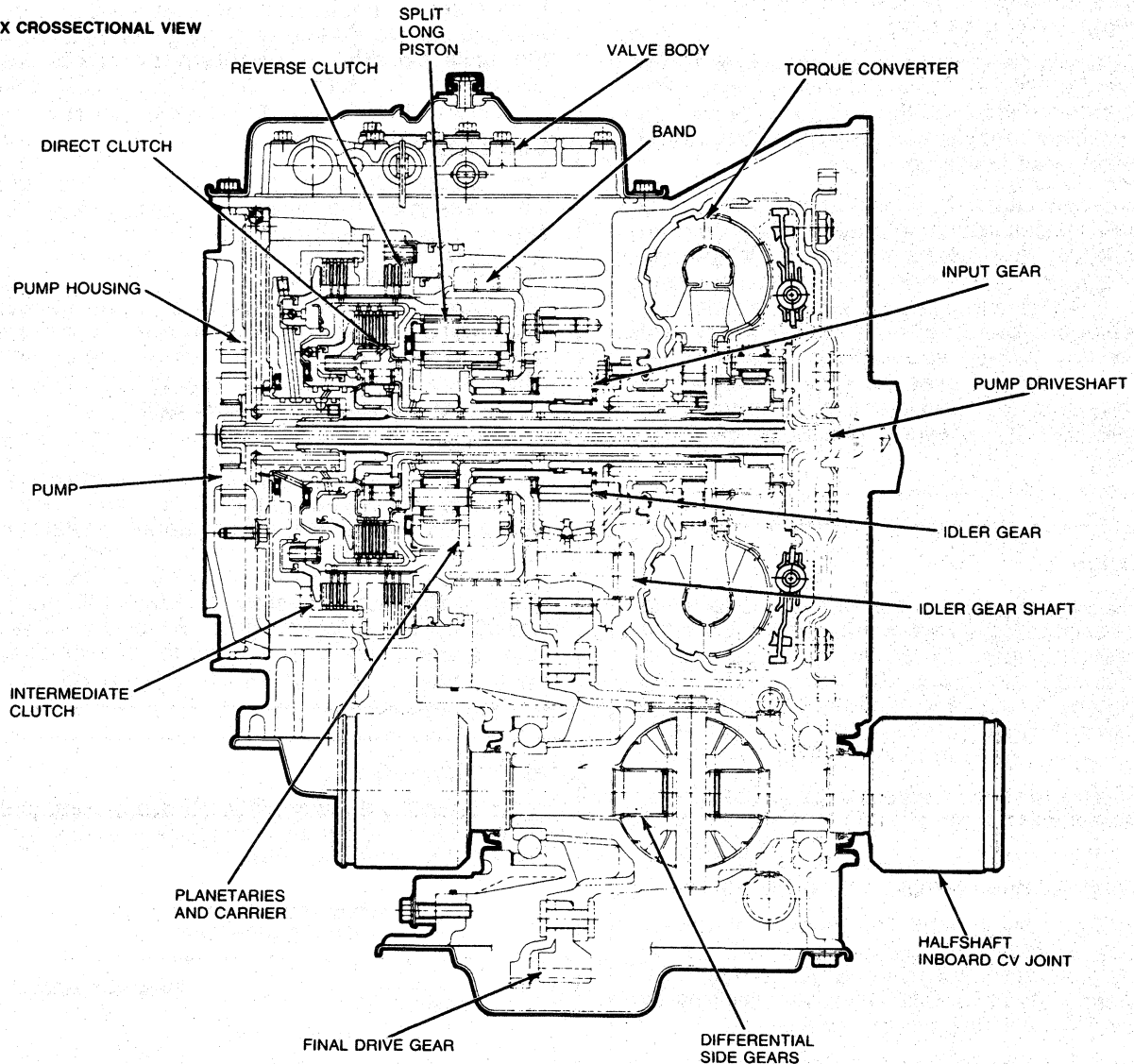
## DESCRIPTION AND OPERATION

The automatic transaxle (ATX) combines an automatic transmission and differential into a single powertrain component designed for front-wheel drive applications. The transmission and differential components are housed in a compact, one-piece case. When bolted together and installed in the vehicle, the engine/transaxle assembly is mounted transversely with the ATX on the LH side of the engine compartment.

The ATX uses three friction clutches, one band and a single one-way clutch. These components are

applied as necessary to transmit engine torque through a compound planetary gear set. The planetary provides three forward gear ratios and one reverse. The planetary transmits engine torque to the input gear which meshes with the idler gear. Meshing with the idler gear is the final drive (output) gear which is riveted to the differential case. When powerflow reaches the differential, engine torque flows outward to the wheels through the differential gears.

ATX CROSSSECTIONAL VIEW



D6304-B

## DESCRIPTION AND OPERATION (Continued)

### Torque Converter

The torque converter has the following:

- a. **Fluid Coupling:** It couples the engine to the gear train as a fluid coupling or fluid clutch. Put another way, it provides **hydraulic** drive or coupling between engine and gear train.
- b. **Torque Multiplication:** In certain operating conditions, it multiplies torque. That is, it provides extra reduction to match the engine output to the driveshaft.
- c. **Shock Absorber:** It absorbs the shock of gear shifting in the drivetrain.

ATX CLC converter resembles other ATX converters, but has a centrifugal clutch added. The torque converter changes the hydraulic coupling to a more efficient mechanical coupling as the speed of the input shaft builds up.

The converter clutch is designed to centrifugally engage at various operating speeds depending on vehicle model and driving conditions. When the clutch engages, a mechanical connection exists between the engine and rear wheels. This feature is provided to improve both driveline efficiency and fuel economy. While the clutch is engaged, the vehicle may respond in ways similar to driving with a manual transmission. This is normal and should not be considered as adverse indicating need for servicing.

### Gear Ranges

P—PARK position enables the transaxle differential shaft to be locked; thus preventing the vehicle from rolling either forward or backward. Because the differential case is mechanically locked by a parking pawl anchored in the case, the park position should not be selected until the vehicle has come to a stop. The engine may be started in the PARK position.

R—REVERSE enables the vehicle to be operated in a reverse direction.

N—NEUTRAL position enables the engine to be started and operated without driving the vehicle.

D—DRIVE range is used for all normal driving conditions and maximum economy. DRIVE range has three gear ratios, from the starting ratio to direct drive. Downshifts are available for safe passing by depressing the accelerator fully to the floor.

2—Intermediate range adds new performance for congested traffic or hilly terrain. It has the same starting ratio as Drive range, but prevents the transaxle from shifting above second gear to retain second gear for acceleration or engine braking as desired. Intermediate range can be selected at any vehicle speed. The transaxle will shift to second gear immediately and remain in second until the vehicle speed or the throttle position are changed to obtain first gear operation in the same manner as in Drive range.

1—Manual low range can be selected at any vehicle speed, the transaxle will shift to second gear immediately and remain in second until vehicle speed is reduced to approximately 48 k/mh (30 mph), at which time the transaxle will shift to first gear and remain in first gear regardless of speed or throttle position. This is particularly beneficial for maintaining maximum engine braking when continuous first gear operation is desirable.

### Downshifts

Under certain conditions the transaxle will downshift automatically to a lower gear range without moving the shift selector lever. There are three such categories of automatic downshifts: coast down, torque demand, and forced or kickdown shifts.

#### Coastdown

The coastdown downshift occurs as the name indicates, when the vehicle is coasting down to a stop.

#### Torque Demand

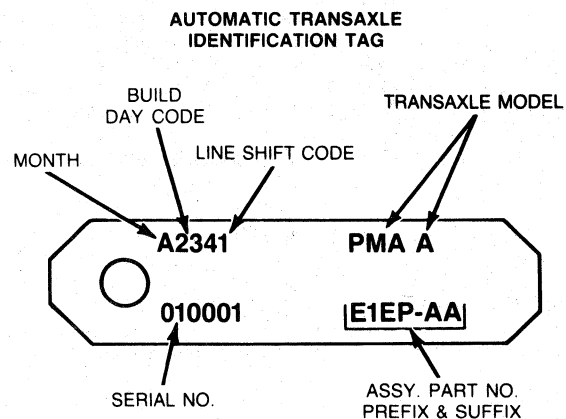
The second type of downshift is torque demand. The torque demand downshift occurs (automatically) during part throttle acceleration when the demand for torque is greater than the engine can provide at that gear ratio.

#### Kickdown

The third type of downshift is the kickdown. For maximum acceleration the driver can force a downshift by depressing the accelerator pedal to the floor. A forced downshift into second gear is possible between about 48 and 88 k/mh (30 and 55 mph). Below approximately 48 k/mh (30 mph) a forced kickdown to first gear will occur. All shift speeds specification are subject to variation due to tire size and engine calibration requirements.

### Identification Tag

When servicing the automatic transaxle, refer to the identification tag located under one of the valve body cover attaching bolts.





## DESCRIPTION AND OPERATION (Continued)

1	N801003-S	BOLT & WSHR. ASSY (7A103 TO 7006) M6-1 X 40 (7 RECD.)	45	7F154	SPRING — REV. CLUTCH CUSHION	89	4A451	SHIM — DIFF. BEARING (SELECTIVE)	133	N605785-S2	BOLT — M8-1.25 X 16 HEX FLANGE (13 RECD.)
2	7F370	BODY & SLEEVE ASSY. — OIL PUMP	46	7F153	SPRING & RET. ASSY. — REV. CLUTCH	90	4020	BALL BEARING — DIFF.	134	7F376	SEAL — MANUAL CONTROL LEVER
3	7C011	GEAR — OIL PUMP DRIVEN	47	N800633-S	SEAL — 196.0MM	91	N647416-S2	RIVET — M10 X 38 SOLID FLAT HD (REF. ONLY — PRODUCTION)	135	7A256	LEVER ASSY. — MANUAL CONTROL
4	7C009	GEAR ASSY. — OIL PUMP DRIVE	48	7D042	PISTON — REVERSE CLUTCH	92	N800746-S	BOLT — M10 X 1.5 X 40 HEX HD (10 RECD.) SERVICE ONLY	136	7341	INSULATOR — GEAR SHIFT ARM
5	7F402	INSERT — OIL PUMP DRIVE GEAR	49	7D043	SEAL — REV. CL. PISTON — OUTER	93	7A233	GEAR — OUTPUT SHAFT PARK	137	7A247	SWITCH ASSY. — NEUTRAL START
6	7N265	SEAL — OIL PUMP	50	7D044	SEAL — REV. CL. PISTON — INNER	94	7F343	GEAR — FINAL DRIVE OUTPUT	138	4471-S2	WASHER — #12 FLAT (2 RECD.)
7	7B328	SHAFT — OIL PUMP DRIVE	51	7F341	CYLINDER — REVERSE CLUTCH	95	N800380-S	DIFF. ASSY. — TRANSAXLE	139	N800723-S2	WASHER — 6.0MM HELICAL SPG. LK. (2 RECD.)
8	7D043	SUPPORT & BSHG. ASSY. — OIL PUMP	52	7A623	BEARING — ONE-WAY CLUTCH	96	4026	GEAR — SPEED DRIVE	140	N800670-S2	BOLT — M6-1.0 X 40 HEX FLANGE HD. (2 RECD.)
9	N805772-S	BOLT (7A108 TO 7F370) M6-1 X 16MM LG. (5 RECD.)	53	7F366	SPRING & ROLLER ASSY. — ONE-WAY CLUTCH	97	17285	DIFF. ASSY. — TRANSAXLE	141	7F281	LEVER ASSY. — THROTTLE VALVE — OUTER
10	7F425	SEAL — INTERM. CLUTCH — INNER (TEFLON)	54	7F369	WASHER — DIRECT CL. CYL. THRUST	98	4228	WASHER — TRANSAXLE DIFF. SIDE GR. THRUST	142	N620041-S2	NUT — M8 X 1.25 HEX
11	7F367	OIL PUMP THRUST WASHER (SELECTIVE)	55	7N107	GEAR ASSY. — 1ST-3RD REVERSE SPEED	99	4236	GEAR — TRANSAXLE DIFF. SIDE	143	7F394	CLIP — GOV. COVER RETAINING
12	7A136	GASKET — OIL PUMP	56	7F348	RACE & BRG. ASSY. — PLANT THRUST REAR	100	4215	PISTON — TRANSAXLE DIFF.	144	7A301	COVER — GOVERNOR
13	7F374	BRG. ASSY. — INTERM. CLUTCH DRUM THRUST	57	7F473	PLANE ASSEMBLY	101	4230	WASHER — TRANSAXLE DIFF. PINION THRUST	145	N801011-S	SEAL — 77.9MM X 3.40 RECT. SECT.
14	N801098-S	RING — 17.0 RETAINING RD. WIRE EXTERNAL	58	7A398	WASHER — PLANETARY THRUST — FRONT	102	N800979-S2	WASHER — 4.75MM X 38.1MM	146	17292	RETAINER — SPEED DRIVEN GEAR
15	7F389	CYLINDER — INTERM. CLUTCH	59	7D043	DRUM & SUN GEAR ASSY. — LOW INTERM.	103	4211	SHAFT — TRANSAXLE DIFF. PINION	147	N800674-S	PIN — 3MM X 19.9 DOWEL HRDN.
16	7F225	SEAL — INTERM. CLUTCH PISTON — INNER	60	7F362	BAND ASSY. — LOW INTERM.	104	N605770-S2	BOLT — M6-1 X 12 HEX FLANGE HD.	148	N800635-S	SEAL — 25.06MM X 2.6 O-RING
17	7F224	SEAL — INTERM. CLUTCH PISTON — OUTER	61	7D034	BEARING ASSY. — TRANSFER	105	7A228	TUBE ASSY. — OIL FILTER	149	17271	GEAR — SPEED DRIVEN
18	7C005	PISTON — INTERM. CLUTCH	62	7F380	WASHER — INTERM. SUN GR. THRUST	106	7A220	GROMMET (SEAL FILLER TUBE TO CASE)	150	7C053	GOVERNOR ASSEMBLY
19	7F351	SHAFT — INTERM. CLUTCH	63	7F368	BOLT — M8-1.25 X 25.0 HEX FLANGE HD (5 RECD.)	107	7N243	IDENTIFICATION TAG	151	7F401	SUPPORT ASSY. — CONV. REACTOR
20	7F222	RET. & SPRING ASSY. — INTERM. CLUTCH	64	N605787-S100	HOUSING — FINAL DRIVE GEAR	108	7A220	BOLT — M6-1 X 14MM LG (10 RECD.)	152	7F402	SEAL ASSY. — CONV. IMP. HUB
21	N800644-S	RING — 111.76MM RETAINING EXTERNAL	65	7F334	BRG. ASSY. — FINAL DRIVE GEAR THRUST — REAR	109	N605771-S2	COVER ASSY. — MAIN CONTROL	153	7902	CONVERTER ASSEMBLY
22			66	7F405	GEAR — FINAL DRIVE INPUT	110	7B148	VENT ASSY. — MAIN CONTROL COVER	154	N646325-S	PIN — SPEED RETAINING
23	7F154	SPRING — REV. CLUTCH CUSHION	67	7F342	BRG. ASSY. — FINAL DRIVE INPUT	111	7G004	GROMMET — MAIN CONTROL COVER	155	1177	SEAL ASSY. — TRANSAXLE — DIFF.
24	7F220	PLATE — INTERM. CL. EXT. SPLINE	68	7F403	BRG. ASSY. — FINAL DRIVE GEAR THRUST — FRONT	112	7G005	GASKET — MAIN CONTROL COVER	156	7D430	STRUT — LOW INTERM. BAND ANCHOR
25	7E312	PLATE ASSY. — INTERM. CL. INT. SPLINE	69	7F404	RING — LOW & INTERM. BAND SERVO PISTON	113	7F396	SEAL — 103.5MM RET. FLAT INTERNAL	157	7D071	SHAFT — PARKING PAWL
26	7F226	PLATE — INTERM. CLUTCH PRESSURE	70	N800645-S	COVER — LOW & INTERM. BAND SERVO PISTON	114	N800671-S51M	SEAL — 103.5MM RET. FLAT INTERNAL	158	7A441	PAWL — PARKING BRAKE
27	7F424	SEAL — INTERM. CLUTCH — OUTER (TEFLON)	71	7F427	COVER — LOW & INTERM. BAND SERVO PISTON	115	7F422	SEAL — 103.5MM RET. FLAT INTERNAL	159	N802284-S	PLUG — 12.0MM CLIP
28	N800650-1-2-S	RING — RETAINING INT. (SELECTIVE)	72	7D027	COVER — LOW INTERM. BAND SERVO	116	7E170	PLATE — TRANS	160	7D070	SPRING — PARK PAWL RETURN
29	7F373	BRG. ASSY. — DIRECT & INTERM. CLUTCH	73	7D025	SEAL — LOW INTERM. SERVO PISTON — SMALL	117	N800670-S	BOLT — M6-1.0 X 40 HEX FLANGE HD (20 RECD.)	161	7D039	PIN — PARKING PAWL ROLLER
30	7F380	CYL. SHAFT & RACE ASSY. — DIRECT CLUTCH	74	N653108-S	RING — 15.8MM RETAINING EXTERNAL	118	7A100	CONTROL ASSY. — MAIN	162	7D169	ROLLER — PARKING BRAKE
31	7F234	SEAL — DIRECT CL. PISTON — INNER	75	7D024	SEAL — LOW INTERM. SERVO PISTON — LARGE	119	7D100	GASKET — MAIN CONTROL (BET. 7A092 & 7A008)	163	7E332	SPRING ASSY. — MANUAL VALVE DETENT
32	7C000	PISTON — DIRECT CL. PISTON OIL — OUTER	76	7D022	PISTON — LOW & INTERM. SERVO	120	7A008	GASKET — MAIN CONTROL (BET. 7A008 & 7006)	164	7F292	SPRING — THROTTLE VALVE CONTROL LEVER
33	7C117	RET. & SPRING ASSY. — DIRECT CLUTCH	77	7D028	SPRING — LOW INTERM. SERVO PISTON	121	7D100	PLATE — CONTROL VALVE BODY SEP.	165	7A180	SPRING — PARK PAWL RATCHETING
34	7F235	SPRING — DIRECT CLUTCH CUSHION	78	7F390	WASHER — 9.7MM X 30 X 2.5 FLAT STEEL	122	N605770-S2	BOLT — M6-1 X 12 HEX FLANGE HD (2 RECD.)	166	7E333	ACTUATOR — MANUAL LEVER
35	7B488	RING — 58.5MM RETAINING EXTERNAL	79	N800640-S	ROD — LOW INTERM. SERVO PISTON NOT AVAILABLE	123	N802807	PIN — TIMING (2.3L ONLY)	167	7C044	WASHER
36	N800643-S	PLATE — DIRECT CLUTCH EXT. SPLINE (AS RECD.)	80	7D023	GEAR & BRG. ASSY. — IDLER GEAR	124	N802884-S100	COMM. ASSY. PUSH-IN	168	7E333	LEVER — MANUAL VALVE DETENT — INNER
37	7B442	PLATE ASSY. — DIRECT CL. INT. SPLINE (AS RECD.)	81	7F475	SHAFT — IDLER GEAR	125	7E242	SCREEN ASSY. — GOV. OIL	169	7C044	NUT — STAMPED
38	7D239	PLATE — DIRECT CLUTCH PRESSURE	82	7F358	SEAL — 22.8 X 1.6 O-RING	126	N800673-S	PIN — 3.2MM X 25.65 DOWEL HRDN	170	7F446	SHAFT ASSY. — TV LEVER ACTUATING
39	7B477	RING — RETAINING INT. (SELECTIVE)	83	N800679-S	NUT — M25 X 1-12 POINT	127	7F333	CASE & HSG. ASSY.	171	7E333	NUT — M20 X 1.5 HEX
40	N800646-7-8-S	RING — RETAINING INT. (SELECTIVE)	84	N801218-S2	SEAL ASSY. — TRANSAXLE — DIFF.	128	7B304	GASKET — OIL FILTER	172	N800630-S	LEVER — PARK PAWL ACTUATING
41	N800654-S	RING — RETAINING INT.	85	1177	BOLT — M8-1.25 X 30 HEX FLANGE HD (6 RECD.)	129	7B155	FILTER ASSY. — OIL	173	7A118	SEAL — THROTTLE CONTROL LEVER SHAFT
42	7D408	PLATE — REVERSE CLUTCH PRESSURE	86	N605788-S100	RETAINER — DIFF. BEARING	130	N605771-S2	GASKET — OIL PAN	174	7F337	
43	7E312	PLATE ASSY. — REV. CL. INT. SPLINE	87	7F114	GASKET — DIFF. BEARING RETAINER	131	7A191	PAN — OIL			
44	7E315	PLATE — REV. CLUTCH EXT. SPLINE	88	7E345		132	7A264				

CD4563-C

## DIAGNOSIS AND TESTING

Troubleshooting the automatic transaxle is simplified by using the proven method of diagnosis. One of the most important things to remember is that there is a definite procedure to follow. Do not attempt short cuts or assume that someone else has done the critical checks or adjustments.

The following procedures are recommended for checking and/or verifying that the various components are adjusted and operating properly.

Rotunda model 014-00737 or equivalent tester, also may be used for testing automatic transaxles, if available.

### Linkage Check

#### Throttle Linkage

Check for wide open carburetor and linkage travel at full throttle. The carburetor full throttle stop must be contacted by the carburetor throttle linkage and there must be a slight amount of movement left in the transaxle throttle linkage. Ensure the throttle linkage return spring is connected and the carburetor throttle lever returns to a closed position.

#### Manual Linkage

This is a CRITICAL adjustment. Ensure the D detent in the transaxle corresponds exactly with the stop in the console. Hydraulic leakage at the manual valve can cause delay in engagements and/or slipping while operating if the linkage is not correctly adjusted.

### Transaxle Fluid Level Check

**CAUTION:** Vehicle should not be driven if fluid level is below the "DO NOT DRIVE" hole.

#### Transaxle—Operating Temperature

The automatic transaxle should be checked at an operating temperature of 66°C-77°C (150°F-170°F) (dipstick hot to the touch). The operating temperature may be obtained by driving 24-32 km (15-20 miles) of city-type driving with the outside temperature above 10°C (50°F).

#### Transaxle—Room Temperature

If the transaxle is not at an operating temperature of 66°C-77°C (150°F-170°F) and it becomes necessary to check the fluid level (such as pre-delivery), the fluid may be checked at room temperature of 21°C-35°C (70°F-95°F) (dipstick cool to touch).

#### Dipstick Reading

The fluid level on the dipstick should be within the cross-hatched area at operating temperature. The fluid level on the dipstick should read between the holes at room temperatures.

Check the fluid as follows:

1. With the transaxle in PARK, engine at idle rpm, foot brakes applied, and vehicle on level surface, move the transaxle selector lever through each range, allowing time in each range to engage transaxle. Return to PARK, applying parking brake fully, and block the wheels. Do not turn off the engine during the fluid level check.
2. Check all dirt from the transaxle fluid dipstick cap before removing the dipstick from the filler tube.
3. Pull the dipstick out of the tube, wipe it clean, and push it all the way back into the tube. Ensure it is fully seated.
4. Pull the dipstick out of the filler tube again, and check the fluid level.

**NOTE:** The fluid level indication on the dipstick will be different at operating temperature and room temperature. For the correct fluid level reading on the dipstick, follow the appropriate instructions stated previously.

Before adding fluid, ensure that the correct type will be used. If in doubt, check the Vehicle Certification Label affixed to the LH front door lock face panel or door pillar for the Transaxle Code. Also, the fluid is stamped on the dipstick.

**CAUTION:** If vehicle has been operated for an extended period at high speed, or in city traffic in hot weather, or vehicle is being used to pull a trailer, to obtain an accurate reading, the fluid has to cool, usually approximately 30 minutes after engine has been turned off.

**CAUTION:** Use of a fluid other than specified could result in transaxle malfunction and/or failure.

If necessary, add enough fluid through the filler tube to raise the level to the correct position. Do not overfill the transaxle. This will result in foaming, loss of fluid through the vent, and possible transaxle malfunction. If overfill occurs excess fluid must be removed.

5. Install the dipstick. Ensure it is fully seated in the tube.

If the transaxle fluid level is correctly established at 21°C-35°C (70°F-95°F), it will appear in the cross-hatch area on the dipstick when the transaxle reaches an operating temperature of 66°C-77°C (150°F-170°F). Do not overfill or underfill.

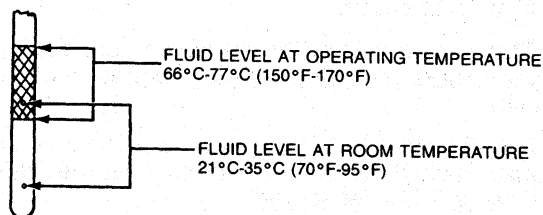
Overfill can cause the fluid to foam and spill out through the transaxle vent, resulting in a transaxle malfunction.

Underfill can result in transaxle loss of engagement or slipping. This condition is most evident in cold weather or when the vehicle is parked or being driven on a hill.



## DIAGNOSIS AND TESTING (Continued)

If the transaxle fluid level is checked when the fluid is at room temperature, the dipstick could indicate that fluid should be added if the dipstick is misread. If fluid is added at this time, an overfill condition could result when the fluid reaches operating temperatures of 66°C-77°C (150°F-170°F) (dipstick hot to touch).



D6432-A

### Transaxle Fluid Condition Check

1. Make the normal fluid check as outlined.
2. Observe color and odor of the fluid. It should be red; not brown or black. Odor can sometimes indicate an overheating condition or clutch disc or band failure.
3. Use an absorbent white facial tissue to wipe the dipstick. Examine the stain for evidence of solids (specks of any kind) and for antifreeze signs (gum or varnish on dipstick).

If specks are present in the oil or there is evidence of antifreeze, the transaxle oil pan must be removed for further inspection. If fluid contamination or transaxle failure is confirmed by further evidence of coolant or excessive solids in the oil pan, the transaxle must be disassembled and completely cleaned and serviced. This includes cleaning the torque converter and transaxle cooling system. It would be a waste of time to perform any further checks before cleaning and servicing the transaxle. During disassembly and assembly, all overhaul checks and adjustments of clearances and end play must be made. After the transaxle has been serviced, all diagnosis tests and adjustments listed in the Diagnosis chart must be completed to ensure the problem has been corrected.

### High or Low Fluid Level

A fluid level that is too high will cause the fluid to become aerated. Aerated fluid will cause low control pressure, and the aerated fluid may be forced out the vent.

A fluid level that is too low can affect the operation of the transaxle. Low level may indicate fluid leaks that could cause transaxle damage.

### Transaxle Fluid Leakage Checks

Check the speedometer cable connection at the transaxle. Replace the rubber seal if necessary.

Leakage at the oil pan gasket often can be stopped by tightening the attaching bolts to specification. If necessary, replace the gasket.

Check the fluid filler tube connection at the transaxle case. If leakage is found here, install a new seal.

Check the fluid lines and fittings between the transaxle and the cooler in the radiator tank for looseness, wear or damage. If leakage cannot be stopped by tightening a fluid line tube nut, replace the damaged parts. Refer to Oil Cooler and Steel Lines. When oil is found to be leaking between the case and the cooler line fitting, tighten the fitting to maximum specification. **Do not try to stop the oil leak by increasing the torque beyond specification. This may cause damage to the case threads.** If the leak continues, replace the cooler line fitting and tighten to specification. The same procedure should be followed for oil leaks between the radiator cooler and cooler line fittings.

Check the engine coolant in the radiator. If transaxle fluid is present in the coolant, the cooler in the radiator is probably leaking.

The cooler can be further checked for leaks by disconnecting the lines from the cooler fittings and applying 345-517 kPa (50-75 psi) air pressure to the fittings. Remove the radiator cap to relieve the pressure buildup at the exterior of the oil cooler tank. If the cooler is leaking and/or will not hold pressure, the cooler must be replaced.

If leakage is found at either the throttle control lever shaft or the manual lever shaft, replace either or both seals.

Oil soluble aniline or fluorescent dyes premixed at the rate of 2.5ml (1/2 teaspoon) of dye power to 0.23L (1/2 pint) of transaxle fluid have proven helpful in locating the source of fluid leakage. Such dyes may be used to determine whether an engine oil or transaxle fluid leak is present, or if the fluid in the oil cooler leaks into the engine coolant system. A black light must be used with the fluorescent dye solution.

Check the power steering gear system. The power steering gear system is positioned over the rear of the transaxle and is filled with transmission fluid. Leaks from the power steering gear may pool on the transaxle before dripping onto the ground, thus giving the appearance of being a transaxle fluid leak.

Inspect both components carefully before disassembling either. If the power steering gear (system) is found to be leaking, refer to the Body, Chassis and Electrical manual, Section 13-46.



**DIAGNOSIS AND TESTING (Continued)****Oil Cooler and Steel Lines**

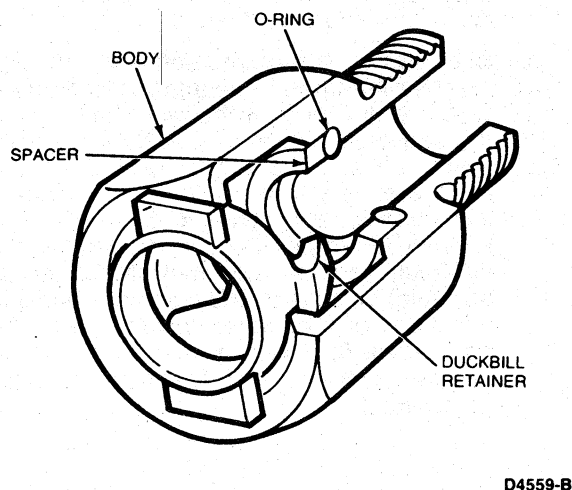
When fluid leakage is found at the oil cooler (in radiator), the cooler must be replaced. Refer to Section 27-03 for oil cooler replacement procedures.

When oil cooler steel lines need replacing, each replacement line must be fabricated from the same size steel line as the original. Using the old line as a guide, bend the new line as required. Add the necessary fittings and install the line. After the fittings have been tightened to specification, add fluid as needed and check for leaks.

NOTE: The cooler lines that are attached to the ATX transaxle are a push connect design and must be removed with a special tool. The cooler lines attached to the radiator use the conventional nut and flare fittings.

**Service Procedures****Oil Cooler Steel Lines Using Push Connect Fittings—Transaxle End Only**

1. If leakage is noted at the transaxle end of the cooler line(s) and the line appears to be sound, remove the affected cooler line from its push connect fitting using Cooler Line Disconnect Tool T86P-77265-AH or equivalent, and remove and discard the fitting from the transaxle. Replace the fitting with N804799-S100 (push connect fitting) and install the cooler line in the fitting. Push line into fitting. A click should be heard when the retainer engages the tube bead. Pull back on tube to ensure full engagement. Check for leakage. If leakage is noted, replace line. Again, remove line and fitting from transaxle.



D4559-B

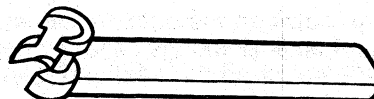
NOTE: For description on how to use Cooler Line Disconnect Tool T86P-77265-AH, refer to Cooler Line Disconnect Tool Usage.

2. Install an E2SZ-7D273-A or equivalent angled flare fitting in the transaxle. Tighten fitting to 24-31 N·m (18-23 lb-ft).
3. Cut approximately 76-102mm (3-4 inches) from the existing cooler line. From bulk stock cooler line steel tubing that is the equivalent of SAEJ526 welded low carbon lead/tin coated 5/16-inch OD, cut a piece of sufficient length and shape it to connect the existing line to the new flare fitting.
4. Clean all cut ends of both lines with the blade edge of the cutting tool to avoid line restrictions. Clean metal particles from the tube ends.
5. Install an 87944-S8 or equivalent flare nut on the transaxle end of the new cooler line section.
6. Connect the new cooler line section to the existing cooler line using a piece of 5/16-inch fuel line hose and two worm drive hose clamps. Use a sufficient length of fuel line hose to achieve a 38-51mm (1 1/2-2-inches) overlap of the ends of the cooler lines.
7. Connect the cooler line to the flare fittings. Tighten to 16-24 N·m (12-18 lb-ft).

**Cooler Line Disconnect Tool Usage  
Push Connect Fittings—Transaxle End Only**

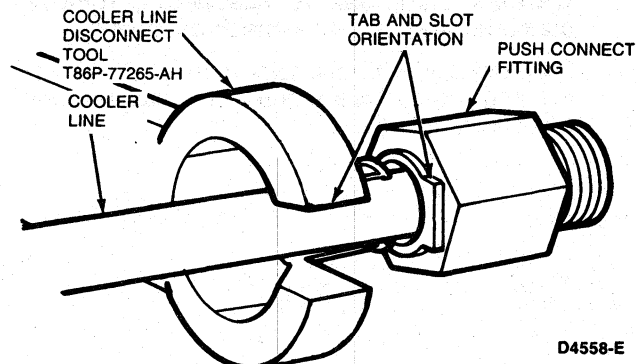
For transaxle cooler line service, Cooler Line Disconnect Tool T86P-77265-AH or equivalent is required. The illustration shows the tool end and its proper orientation for disassembly of tube from fitting. The purpose of the tool is to spread the "duck bill" retainer to disengage the tube bead. The following steps are necessary for use of the tool.

To facilitate use of the tool, clean the road dirt from the fitting before inserting the tool into the fitting. Also, it is important to avoid any contamination of the fitting and transaxle. Dirt in the fitting could cause an O-ring leak.



D6418-A

1. Slide the tool over the tube.
2. Align the opening of the tool with one of the two tabs on the fitting "duck bill" retainer.



D4558-E

**DIAGNOSIS AND TESTING (Continued)**

3. Firmly insert tool into fitting until it seats against the tube bead. (A definite click should be heard).
4. With thumb held against the tool, firmly pull back on tube until it disengages from fitting.

**CAUTION: Do not attempt to separate cooler line from fitting by prying with another tool. This will break the plastic insert in fitting and bend the cooler lines at the junction to the fitting.**

Before assembly of the lines in the fitting, visually inspect the plastic retainer in the fitting for a broken tab. If a tab is broken, the fitting must be replaced. Also visually inspect the cooler lines to ensure they are not bent at the junction of the fitting.

Tube assembly is accomplished by inserting the tube into the fitting until the retainer engages the tube bead. (A definite click should be heard). Pull back on the tube to ensure full engagement.

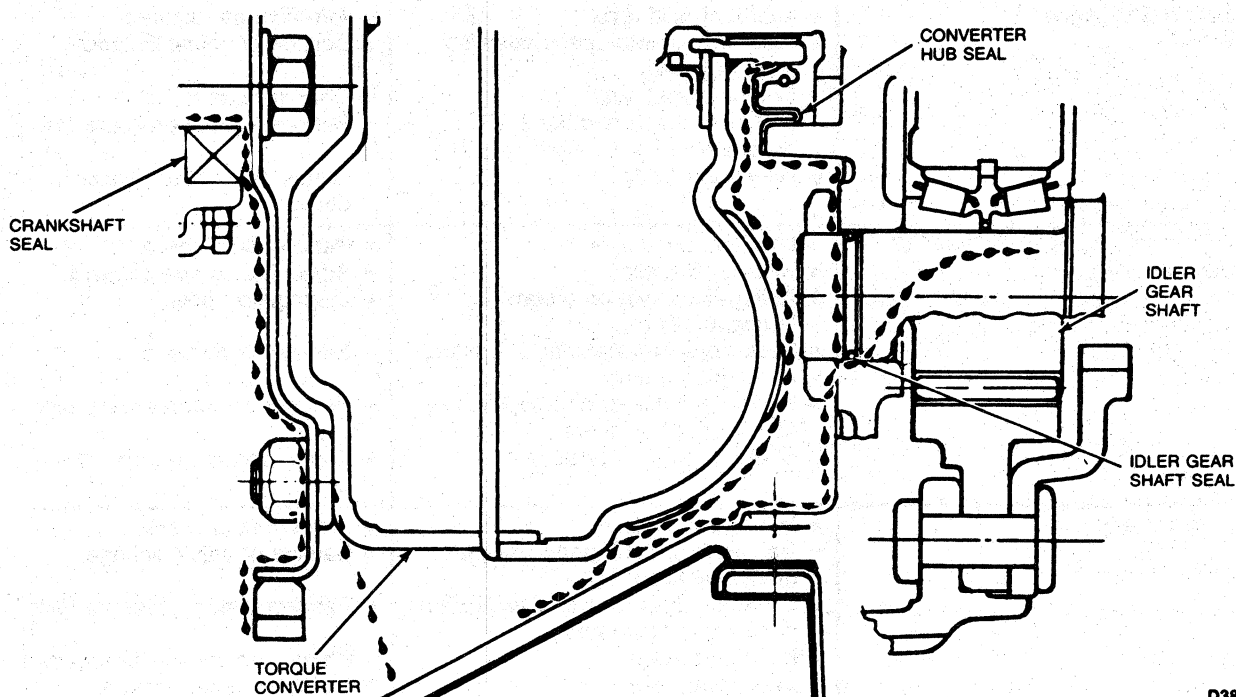
**Fluid Leakage in Converter Area**

In diagnosing and correcting fluid leaks in the converter area, use the following procedures to locate the exact cause of the leakage. Leakage at the front of transaxle as evidenced by fluid around the converter housing, may have several sources. By careful observation, it is possible in many instances, to pinpoint the source of the leak before removing the transaxle from the vehicle. The paths which the fluid can take to reach the bottom of the converter housing are as follows:

1. Fluid leaking by the converter hub seal lip will tend to move along the drive hub and onto the back of the impeller housing. Except in the case of a total seal failure, fluid leakage by the lip of the seal will be deposited on the inside of the converter housing only near the outside diameter of the housing.
2. Fluid leakage between the outside diameter of the converter hub seal and the case will wet the housing surface around the seal and follow to the outside.
3. Fluid leakage from the converter to flywheel stud weld will appear at OD of converter on back face of flywheel, and in the converter housing only near the flywheel. If a converter to flywheel stud leak is suspected, remove converter and pressure check as outlined.
4. Fluid leakage from the idler gear shaft will wet the housing surface around the shaft nut and down and outside.

5. Engine oil leaks are sometimes improperly diagnosed as transaxle front pump seal leaks. The following areas of possible leakage should also be checked to determine if engine oil leakage is causing the problem.
  - a. Leakage at the rocker arm cover may allow oil to flow over the converter housing or seep down between the converter housing and cylinder block causing oil to be present in or at the bottom of the converter housing.
  - b. Oil gallery plug leaks will allow oil to flow down the rear face of the block to the converter housing.
  - c. Leakage at the crankshaft seal will work back to the flywheel, and then into the converter housing.
6. The following procedures should be used to determine the cause of the leakage before service is made.
  - a. Remove the transaxle dipstick and note the color of the fluid. Original factory fill fluid is dyed red to aid in determining if leakage is from the engine or transaxle. Unless a considerable amount of makeup fluid has been added or the fluid has been changed, the red color should assist in pinpointing the leak.
  - b. Remove the converter housing cover. Clean off any fluid from the top and bottom of the converter housing, front of the transaxle case, and rear face of the engine and oil pan. Clean the converter area by washing with a suitable nonflammable solvent, and blow dry with compressed air.
  - c. Wash out converter housing and the front of the flywheel. The converter housing may be washed out using cleaning solvent and a squirt-type oil can. Blow all washer areas dry with compressed air.
  - d. Start and run the engine until the transaxle reaches its normal operating temperature. Observe the back of the block and top of the converter housing for evidence of fluid leakage. Raise the vehicle on a hoist and run the engine at fast idle, then at engine idle, occasionally shifting to the DRIVE and REVERSE ranges. Observe the front of the flywheel, back of the block (in as far as possible), and inside the converter housing and front of the transaxle case. Run the engine until fluid leakage is evident and the probable source of leakage can be determined.

## DIAGNOSIS AND TESTING (Continued)

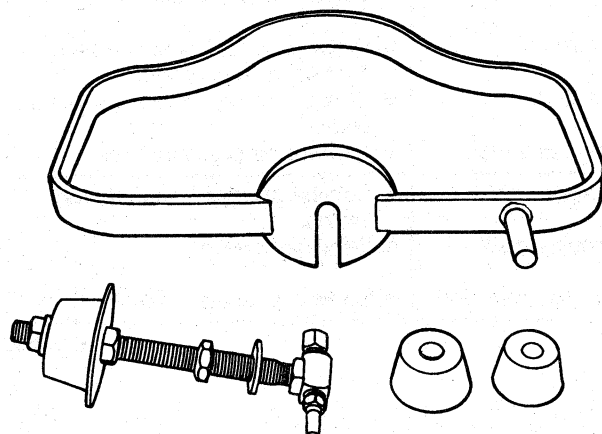


D3884-E

**Converter Leakage Check**

If welds on the torque converter indicate leakage, remove the converter and make the following check.

Assemble Rotunda Torque Converter Leak Test Kit 021-00047 or equivalent to the converter. Test the converter for leaks, following the direction supplied with the kit.



ROTUNDA TORQUE CONVERTER  
LEAK TEST KIT 021-00047

D4568-C

**Engine Idle Speed Check**

Refer to the Engine/Emissions Diagnosis manual\*.

NOTE: Whenever it is necessary to remove or replace any component affecting engine idle or requiring engine idle reset, then TV adjustment is required.

**IDLE SPEED ADJUSTMENT**

Idle Speed Change	
A decrease of 50 or more rpm	Adjust the throttle linkage
A increase of 50 or more rpm	Adjust the throttle linkage

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\* Can be purchased as a separate item.

## DIAGNOSIS AND TESTING (Continued)

CONDITION	POSSIBLE SOURCE	ACTION
Slow initial engagement	<ul style="list-style-type: none"> <li>• Improper fluid level</li> <li>• Damaged or improperly adjusted manual linkage</li> <li>• Contaminated fluid</li> <li>• Improper clutch and band application, or oil control pressure</li> <li>• Dirty valve body</li> </ul>	<ul style="list-style-type: none"> <li>• Add fluid as required.</li> <li>• Service or adjust linkage.</li> <li>• Change fluid and filter.</li> <li>• Perform control pressure test.</li> <li>• Clean, service, or replace valve body.</li> </ul>
Rough initial engagement in either forward or reverse	<ul style="list-style-type: none"> <li>• Improper fluid level</li> <li>• High engine idle</li> <li>• Automatic choke on (warm temperature)</li> <li>• Looseness in halfshafts, CV joints, or engine mounts</li> <li>• Improper clutch or band application, or oil control pressure</li> <li>• Sticky or dirty valve body</li> </ul>	<ul style="list-style-type: none"> <li>• Perform fluid check.</li> <li>• Adjust idle to specification.</li> <li>• Disengage choke.</li> <li>• Service as required.</li> <li>• Perform control pressure test.</li> <li>• Clean, service, or replace valve body.</li> </ul>
No drive in any gear	<ul style="list-style-type: none"> <li>• Improper fluid level</li> <li>• Damaged or improperly adjusted manual linkage</li> <li>• Improper clutch or band application, or oil control pressure</li> <li>• Internal leakage</li> <li>• Valve body loose</li> <li>• Damaged or worn clutches or band</li> <li>• Sticking or dirty valve body</li> <li>• Broken pump or turbine shaft</li> </ul>	<ul style="list-style-type: none"> <li>• Perform fluid check.</li> <li>• Service or adjust linkage.</li> <li>• Perform control pressure test.</li> <li>• Check and service as required.</li> <li>• Tighten to specification.</li> <li>• Perform air pressure test.</li> <li>• Clean, service, or replace valve body.</li> <li>• Service as required.</li> </ul>
No forward drive — reverse OK	<ul style="list-style-type: none"> <li>• Improper fluid level</li> <li>• Damaged or improperly adjusted manual linkage</li> <li>• Improper one-way clutch, or band application, or oil pressure control system</li> <li>• Valve body loose</li> <li>• Dirty or sticking valve body</li> <li>• Damaged or worn band or servo</li> </ul>	<ul style="list-style-type: none"> <li>• Perform fluid level check.</li> <li>• Service or adjust linkage.</li> <li>• Perform control pressure test.</li> <li>• Tighten to specification.</li> <li>• Clean, service or replace valve body.</li> <li>• Perform air pressure test.</li> </ul>
No drive, slips, or chatters in REVERSE — forward OK	<ul style="list-style-type: none"> <li>• Improper fluid level</li> <li>• Damaged or improperly adjusted manual linkage</li> <li>• Improper oil pressure control</li> <li>• Valve body loose</li> <li>• Dirty or sticking valve body.</li> <li>• Damaged or worn reverse clutch</li> </ul>	<ul style="list-style-type: none"> <li>• Perform fluid level check.</li> <li>• Service or adjust linkage.</li> <li>• Perform control pressure test.</li> <li>• Tighten to specification.</li> <li>• Clean, service, or replace valve body.</li> <li>• Perform air pressure test.</li> </ul>
Will not start in NEUTRAL or PARK	<ul style="list-style-type: none"> <li>• Neutral start switch improperly adjusted</li> <li>• Neutral start wire disconnected/damaged</li> <li>• Manual linkage improperly adjusted</li> </ul>	<ul style="list-style-type: none"> <li>• Service or adjust neutral start switch.</li> <li>• Replace/service.</li> <li>• Service or adjust linkage.</li> </ul>

**DIAGNOSIS AND TESTING (Continued)**

<b>CONDITION</b>	<b>POSSIBLE SOURCE</b>	<b>ACTION</b>
Slips or chatters in first gear in D	<ul style="list-style-type: none"> <li>● Improper fluid level</li> <li>● Damaged or worn band</li> </ul>	<ul style="list-style-type: none"> <li>● Perform fluid level check.</li> <li>● Service or replace band assembly.</li> </ul>
Slips or chatters in second gear	<ul style="list-style-type: none"> <li>● Improper fluid level</li> <li>● Internal leakage</li> <li>● Dirty or sticking valve body</li> <li>● Improper clutch application</li> <li>● Intermediate friction clutch</li> <li>● Polished, glazed band or drum</li> </ul>	<ul style="list-style-type: none"> <li>● Perform fluid level check.</li> <li>● Perform air pressure test.</li> <li>● Clean, service, or replace valve body.</li> <li>● Perform control pressure test.</li> <li>● Service clutch.</li> <li>● Replace or service as required.</li> </ul>
Starts up in 2nd or 3rd	<ul style="list-style-type: none"> <li>● Improper fluid level</li> <li>● Damaged or improperly adjusted manual linkage</li> <li>● Governor valve stuck</li> <li>● Improper band and/or clutch application, or oil pressure control system</li> <li>● Valve body loose</li> <li>● Dirty or sticking valve body</li> <li>● Cross leaks between valve body and case mating surface</li> </ul>	<ul style="list-style-type: none"> <li>● Perform fluid level check.</li> <li>● Service or adjust linkage.</li> <li>● Perform governor check. Replace or service governor.</li> <li>● Perform control pressure test.</li> <li>● Tighten to specification.</li> <li>● Clean, service, or replace valve body.</li> <li>● Replace valve body and/or case as required.</li> </ul>
Shift points incorrect	<ul style="list-style-type: none"> <li>● Improper fluid level</li> <li>● Damaged or worn governor</li> <li>● Improper clutch or band application, or oil pressure system</li> <li>● Dirty or sticking valve body</li> </ul>	<ul style="list-style-type: none"> <li>● Perform fluid level check.</li> <li>● Service or replace governor. Clean screen.</li> <li>● Perform shift test and control pressure test.</li> <li>● Clean, service, or replace valve body.</li> </ul>
No upshift at any speed in D	<ul style="list-style-type: none"> <li>● Improper fluid level</li> <li>● Damaged or worn governor</li> <li>● Dirty or sticking valve body</li> <li>● Improper band or clutch application, or oil pressure control system</li> </ul>	<ul style="list-style-type: none"> <li>● Perform fluid level check.</li> <li>● Service or replace governor. Clean screen.</li> <li>● Clean, service or replace valve body.</li> <li>● Perform control pressure test.</li> </ul>
Shifts 1-3 in D	<ul style="list-style-type: none"> <li>● Dirty or sticking valve body</li> <li>● Intermediate friction clutch</li> <li>● Improper clutch application, or oil pressure control system</li> </ul>	<ul style="list-style-type: none"> <li>● Clean, service or replace valve body.</li> <li>● Service.</li> <li>● Perform control pressure test.</li> </ul>

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**DIAGNOSIS AND TESTING (Continued)**

CONDITION	POSSIBLE SOURCE	ACTION
Engine over-speeds on 2-3 shift	<ul style="list-style-type: none"> <li>• Improper fluid level</li> <li>• Improper band or clutch application, or oil pressure control system</li> <li>• Damaged or worn direct clutch and/or servo</li> <li>• Dirty or sticking valve body</li> </ul>	<ul style="list-style-type: none"> <li>• Perform fluid level check.</li> <li>• Perform control pressure test.</li> <li>• Perform air pressure test. Service as required.</li> <li>• Clean, service, or replace valve body.</li> </ul>
Mushy 1-2 shift	<ul style="list-style-type: none"> <li>• Improper fluid level</li> <li>• Improper intermediate clutch application, or oil pressure control system</li> <li>• Damaged intermediate clutch</li> <li>• Dirty or sticking valve body</li> </ul>	<ul style="list-style-type: none"> <li>• Perform fluid level check.</li> <li>• Perform control pressure test.</li> <li>• Perform air pressure test. Service as required.</li> <li>• Clean, service or replace valve body.</li> </ul>
Rough 1-2 shift	<ul style="list-style-type: none"> <li>• Improper fluid level</li> <li>• Incorrect engine performance</li> <li>• Improper intermediate clutch application or oil pressure control system</li> <li>• Dirty or sticking valve body</li> </ul>	<ul style="list-style-type: none"> <li>• Perform fluid level check.</li> <li>• Tune and adjust engine idle.</li> <li>• Perform control pressure test.</li> <li>• Clean, service or replace valve body.</li> </ul>
Rough 2-3 shift (1-2 shift OK)	<ul style="list-style-type: none"> <li>• Improper fluid level</li> <li>• Incorrect engine performance</li> <li>• Improper band release or direct clutch application, or oil control pressure system</li> <li>• Damaged or worn servo release and direct clutch piston check ball</li> <li>• Dirty or sticking valve body</li> </ul>	<ul style="list-style-type: none"> <li>• Perform fluid level check.</li> <li>• Tune and adjust engine idle.</li> <li>• Perform control pressure test.</li> <li>• Air pressure test the servo apply and release and the direct clutch piston check ball. Service as required.</li> <li>• Clean, service, or replace valve body.</li> </ul>
Rough 3-2 shift at closed throttle in D	<ul style="list-style-type: none"> <li>• Improper fluid level</li> <li>• Incorrect engine idle or performance</li> <li>• Improper band or clutch application, or oil pressure control system</li> <li>• Improper governor operation</li> <li>• Dirty or sticking valve body</li> </ul>	<ul style="list-style-type: none"> <li>• Perform fluid level check.</li> <li>• Tune and adjust engine idle.</li> <li>• Perform control pressure test.</li> <li>• Perform governor test. Service as required.</li> <li>• Clean, service or replace valve body.</li> </ul>

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## DIAGNOSIS AND TESTING (Continued)

CONDITION	POSSIBLE SOURCE	ACTION
No forced downshifts	<ul style="list-style-type: none"> <li>• Improper fluid level</li> <li>• Improper clutch or band application, or oil pressure control system</li> <li>• Damaged internal TV lever.</li> <li>• Dirty or sticking valve body</li> <li>• Dirty or sticking governor</li> </ul>	<ul style="list-style-type: none"> <li>• Perform fluid level check.</li> <li>• Perform control pressure test.</li> <li>• Service internal TV lever.</li> <li>• Clean, service or replace valve body.</li> <li>• Clean or replace governor.</li> </ul>
Runaway engine on 3-2 or 3-1 downshift (1-2 shift OK)	<ul style="list-style-type: none"> <li>• Improper fluid level</li> <li>• Dirty or sticking valve body</li> <li>• Band out of adjustment</li> <li>• Improper band or clutch application, or oil pressure control system</li> <li>• Damaged or worn servo</li> <li>• Polished, glazed band or drum</li> </ul>	<ul style="list-style-type: none"> <li>• Perform fluid level check.</li> <li>• Clean, service or replace valve body.</li> <li>• Check and adjust servo rod travel.</li> <li>• Perform control pressure test.</li> <li>• Air pressure test check the servo. Service servo and/or seals.</li> <li>• Service or replace as required.</li> </ul>
No engine braking in manual first gear	<ul style="list-style-type: none"> <li>• Improper fluid level</li> <li>• Damaged or improperly adjusted manual linkage</li> <li>• Band or clutch out of adjustment</li> <li>• Oil pressure control system</li> <li>• Polished, glazed band or drum</li> <li>• Dirty or sticking valve body</li> </ul>	<ul style="list-style-type: none"> <li>• Perform fluid level check.</li> <li>• Check direct clutch and service as required.</li> <li>• Check servo rod travel.</li> <li>• Perform control pressure test.</li> <li>• Service or replace as required.</li> <li>• Clean, service or replace valve body.</li> </ul>
No engine braking in manual second gear	<ul style="list-style-type: none"> <li>• Improper fluid level</li> <li>• Damaged or improperly adjusted manual linkage</li> <li>• Improper band or clutch application, or oil pressure control system</li> <li>• Servo leaking</li> <li>• Polished, glazed band or drum</li> </ul>	<ul style="list-style-type: none"> <li>• Perform fluid level check.</li> <li>• Perform control pressure test.</li> <li>• Perform air pressure test of servo for leakage. Service as required.</li> <li>• Service or replace as required.</li> </ul>

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**DIAGNOSIS AND TESTING (Continued)**

CONDITION	POSSIBLE SOURCE	ACTION
<ul style="list-style-type: none"> <li>• Transaxle Noise* — Other Than Valve Resonance</li> </ul>	<ul style="list-style-type: none"> <li>• Improper fluid level.</li> <li>• Contaminated fluid.</li> </ul>	<ul style="list-style-type: none"> <li>• Perform fluid level check.</li> <li>• Change fluid and filter, flush convertor and cooler lines. Service.</li> </ul>
<ul style="list-style-type: none"> <li>• Noise Present During All Drive Ranges</li> </ul>	<ul style="list-style-type: none"> <li>• Damaged speedometer driven gear, CV joints, halfshaft or engine mounts (paying special attention to No. 4 engine mount.</li> </ul>	<ul style="list-style-type: none"> <li>• Remove speedometer driven gear and operate transaxle in each range. If noise continues, check CV joints, halfshafts and engine mounts for looseness. If noise stopped, replace speedometer gear. Remove oil pan to verify speedometer driven gear is not damaged.</li> </ul>
<ul style="list-style-type: none"> <li>• Noise Present During Initial Engagement</li> </ul>	<ul style="list-style-type: none"> <li>• Loose convertor to flywheel attaching nuts.</li> <li>• Damaged or missing convertor studs.</li> <li>• Damaged convertor.</li> <li>• Damaged oil pump.</li> </ul>	<ul style="list-style-type: none"> <li>• Tighten to specification.</li> <li>• Replace damaged or missing studs.</li> <li>• Perform convertor one-way clutch; end clearance and stator to impeller, interference checks. Service as required.</li> <li>• Service as required.</li> </ul>

\*Before removing a transaxle for gear noise concerns, make sure that the noise is in fact being caused by the transaxle. Perform the following tests before continuing to the next step in the chart:

1. Stop the vehicle. Apply the parking brake and leave the engine running.
2. Move the gear selector to neutral position.
3. Increase engine RPMs.

If the transaxle noise continues, then transaxle is not the probable cause of concern.

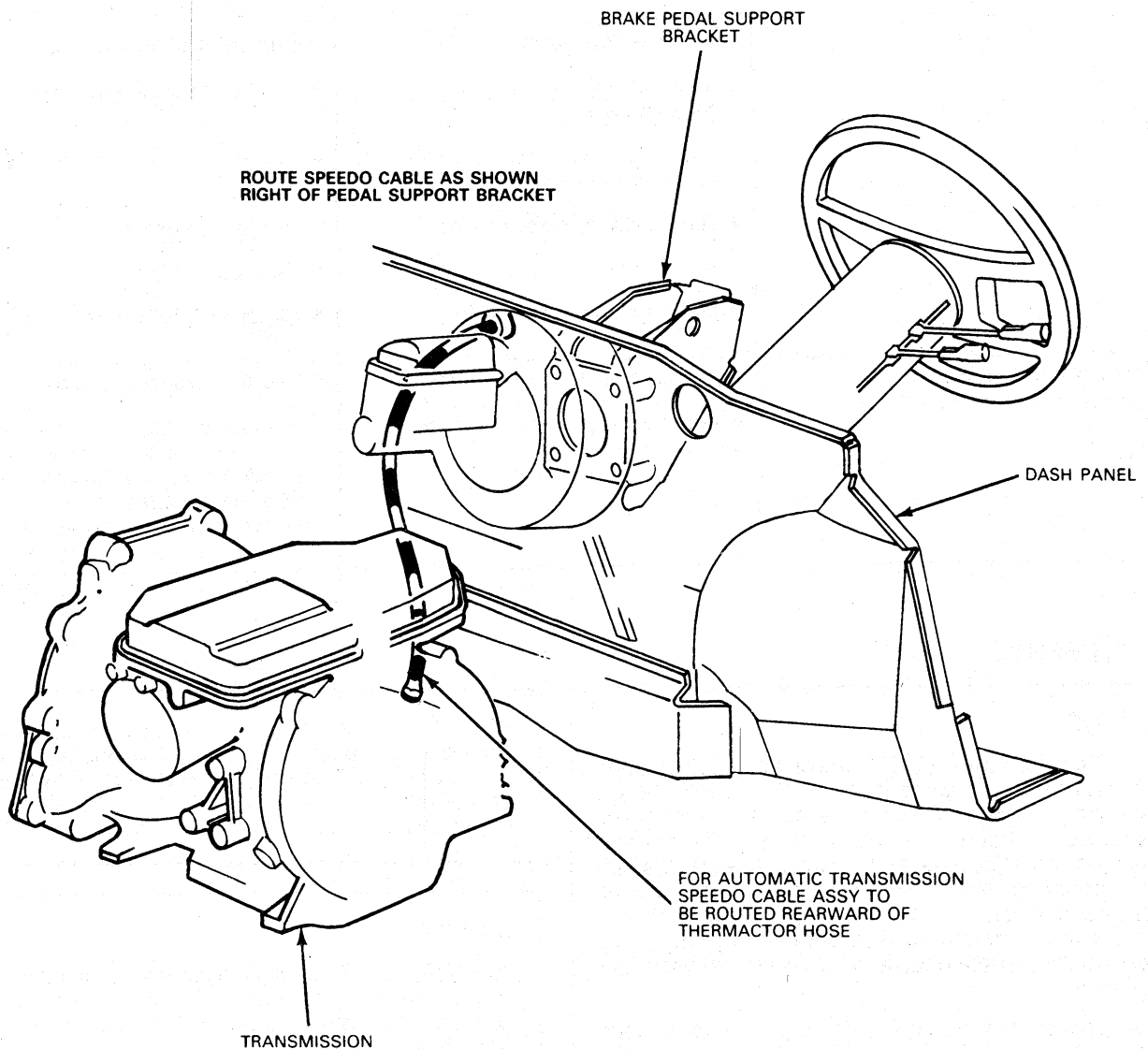
**CD6420-A**



## DIAGNOSIS AND TESTING (Continued)

CONDITION	POSSIBLE SOURCE	ACTION
• Noise Present In Low, Inter, and Reverse Only	• Damaged planetary gear.	• Service as required.
• Noise Present In Third Gear Only	• Damaged final drive gear.	• Service as required.

**NOTE:** Inherent transaxle gear noise may be isolated from the passenger compartment by installing a piece of 10 mm (3/18-inch) diameter fuel hose. Cut the hose in a spiral fashion and install over the speedometer cable from the dash panel to the speedometer gear retainer.



## DIAGNOSIS AND TESTING (Continued)

CONDITION	POSSIBLE SOURCE	ACTION
Transaxle noisy — valve resonance  <b>NOTE: Gauges may aggravate any hydraulic resonance. Remove gauge and check for resonance level.</b>	<ul style="list-style-type: none"> <li>• Improper fluid level</li> <li>• Improper band or clutch application, or oil pressure control system</li> <li>• Cooler lines grounding</li> <li>• Dirty or sticking valve body</li> <li>• Internal leakage or pump cavitation</li> </ul>	<ul style="list-style-type: none"> <li>• Perform fluid level check.</li> <li>• Perform control pressure test.</li> <li>• Free cooler lines.</li> <li>• Clean, service or replace valve body.</li> <li>• Service as required.</li> </ul>
Transaxle overheats	<ul style="list-style-type: none"> <li>• Excessive tow loads</li> <li>• Improper fluid level</li> <li>• Incorrect engine idle or performance</li> <li>• Improper clutch or band application, or oil pressure control system</li> <li>• Restriction in cooler or lines</li> <li>• Seized converter one-way clutch</li> <li>• Dirty or sticking valve body</li> </ul>	<ul style="list-style-type: none"> <li>• Check Owner's Manual for tow restriction.</li> <li>• Perform fluid level check.</li> <li>• Tune or adjust engine idle.</li> <li>• Perform control pressure test.</li> <li>• Service restriction.</li> <li>• Replace converter.</li> <li>• Clean, service or replace valve body.</li> </ul>
Transaxle fluid leaks	<ul style="list-style-type: none"> <li>• Improper fluid level</li> <li>• Leakage at gaskets, seals, etc.</li> </ul>	<ul style="list-style-type: none"> <li>• Perform fluid level check.</li> <li>• Remove all traces of lubrication on exposed surfaces of transaxle. Check the vent for free-breathing. Operate transaxle at normal temperatures and inspect for leakage. Service as required.</li> </ul>

CD3900-C

## ADJUSTMENTS

**2.5L CFI**

The Throttle Valve (TV) Control Linkage System consists of the coupling lever on the throttle body, TV linkage shaft assembly, TV bracket assembly, transaxle control rod assembly, external TV control lever on the transaxle and a linkage return spring. The coupling lever follows the motion of the carburetor throttle lever. The TV linkage shaft and control rod transmits motion between the coupling lever on the throttle body and TV control lever on the transaxle.

The control rod assembly is adjusted to proper length during initial assembly. The external TV control lever actuates the internal TV control mechanism which regulates the TV control pressure. The external TV control lever motion is controlled by stops internal to the transaxle at idle and beyond Wide Open Throttle (WOT). The linkage return spring must overcome the transaxle TV lever load (due to spring loading to WOT).

The TV control linkage is set to its proper length during initial assembly using the sliding trunnion block on the TV control rod assembly. Any required adjustment of the TV control linkage can be accomplished using this sliding trunnion block.

**All ATX**

At WOT, the TV control lever on the transaxle will not be wide open stop. The wide open throttle position must not be used as the reference point in adjusting linkage.

## ADJUSTMENTS (Continued)

### Shift Trouble Diagnosis Related to Throttle Linkage Adjustment

If there is a complaint of poor transaxle shift quality, the following diagnosis procedure should be followed:

- A. **Symptoms:** Excessively early and/or soft upshifts with or without slip-bump feel. No forced downshift (kickdown) function at appropriate speeds.

**Cause:** TV control linkage is set too short.

**Remedy:** Adjust linkage using Linkage Adjustment procedure.

- B. **Symptoms:** Extremely delayed and harsh upshifts and harsh idle engagement.

**Cause:** TV control linkage is set too long.

**Remedy:** Adjust linkage using Linkage Adjustment procedure.

- C. **Symptoms:** Harsh idle engagement after engine warm up. Shift clunk when throttle is backed off after full or heavy throttle acceleration. Harsh coasting downshifts (automatic 3-2, 2-1 shifts in D range). Delayed upshifts at light acceleration.

**Cause:** Interference due to hoses, wires, etc. prevents return of TV control rod or TV linkage shaft.

**Remedy:** Correct interference area. Check or reset linkage using the Linkage Adjustment procedure.

**Cause:** Excess friction due to binding of grommets prevents return of TV control linkage.

**Remedy:** Check for bent or twisted rods or levers causing misalignment of grommets. Service or replace damaged components. (Replace grommets if damaged). Reset TV control linkage using the Linkage Adjustment procedure.

- D. **Symptoms:** Erratic/delayed upshifts, possibly no kickdown, harsh engagements.

**Cause:** Clamping bolt on trunnion at upper end of TV control rod is loose.

**Remedy:** Reset TV control linkage using the Linkage Adjustment procedure.

- E. **Symptoms:** No upshifts and harsh engagements.

**Cause:** TV control rod disconnected. (Transaxle is at maximum TV pressure).

**Remedy:** Connect TV control rod. Replace grommet(s) if rod disconnect was due to damaged or worn grommet(s).

**Cause:** Linkage return spring broken or disconnected.

**Remedy:** Connect or replace spring.

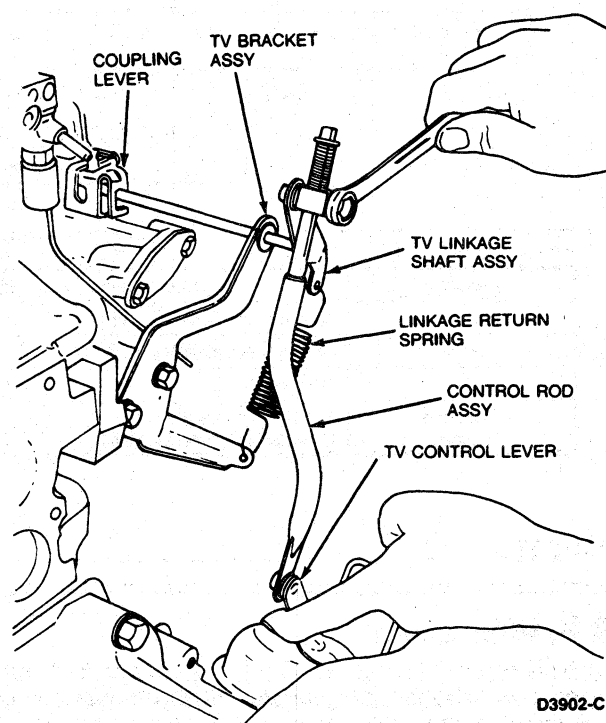
### Linkage Adjustment

The TV control linkage must be adjusted at the TV control rod assembly sliding trunnion block using the following procedures:

1. Operate engine until normal operating temperature is reached and all accessories are off. Ensure that the hot engine curb idle speed is to specification. Refer to the Engine/Emissions Diagnosis\* manual.

**NOTE:** The linkage cannot be properly set if the throttle lever is allowed to be on the choke fast idle cam.

**CAUTION:** The following steps involve working in proximity to the EGR system. Care must be taken to avoid contact with hot parts.



D3902-C

2. If the TV control rod assembly must be removed, refer to Section 24-60 for External TV Control Linkage Removal and Installation.

Loosen the bolt on the sliding trunnion block on the TV control rod assembly one turn minimum.

Remove any corrosion from the control rod and free-up the trunnion block so that it slides freely on the control rod.

3. With engine idling in PARK, rotate transaxle TV control lever up using one finger and a light force, 4.5 N (approximately 1 pound), to ensure that the TV control lever is against its internal idle stop. Without relaxing the force on the TV control lever, tighten the bolt on the trunnion block to 8-12 N·m (6-9 lb-ft).

\* Can be purchased as a separate item.

## ADJUSTMENTS (Continued)

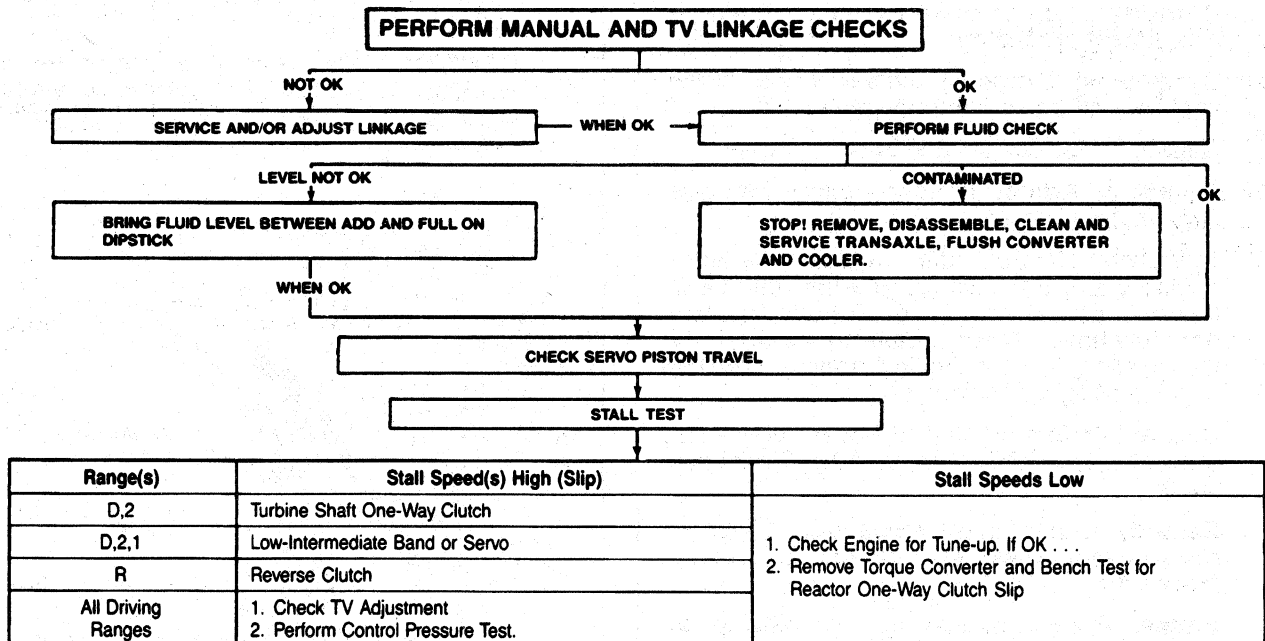
### Stall Test

Start the engine and allow it to reach its normal temperature. Apply both the parking and service brakes while making tests.

The stall test is made in DRIVE 2, 1 (First) or REVERSE at full throttle to check engine performance, converter clutch operation or installation, and the holding ability of the direct clutch, reverse clutch and low-intermediate band and the gear train one-way clutch.

**While making this test, do not hold the throttle open for more than five seconds at a time.**

After test, move the selector lever to NEUTRAL and run engine at 1000 rpm for about 15 seconds to cool the converter before making the next test. If the engine speed recorded by the tachometer exceeds the maximum limits given in Specifications, release the accelerator immediately because clutch or band slippage is indicated.



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### Governor Check

Accelerate vehicle to 48-64 km/h (30-40 mph) then back off throttle completely. If the governor is functioning properly, the transaxle will shift to third gear.

## ADJUSTMENTS (Continued)

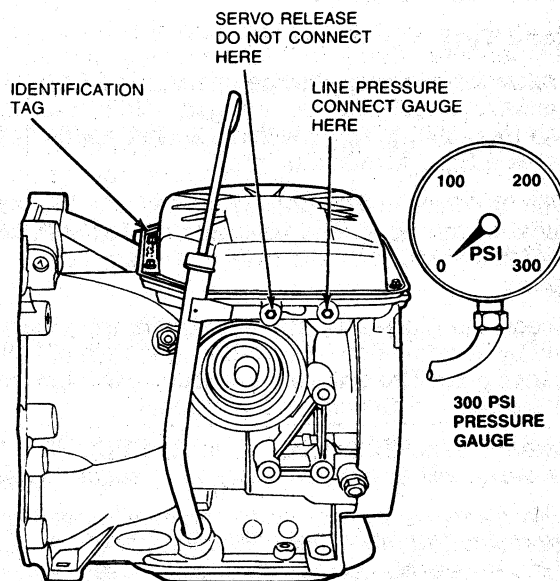
**Transaxle Fluid Cooler Flow Check**

The linkage, fluid and control pressure must be within specification before performing this flow check.

Remove the transaxle dipstick from the filler tube. Place a funnel in the transaxle filler tube. Raise the vehicle, remove the cooler return line from its fitting in the case. Attach a hose to the cooler return line and fasten the free end of the hose in the funnel installed in the filler tube. Start the engine and set idle speed at 1000 rpm with the transaxle in NEUTRAL.

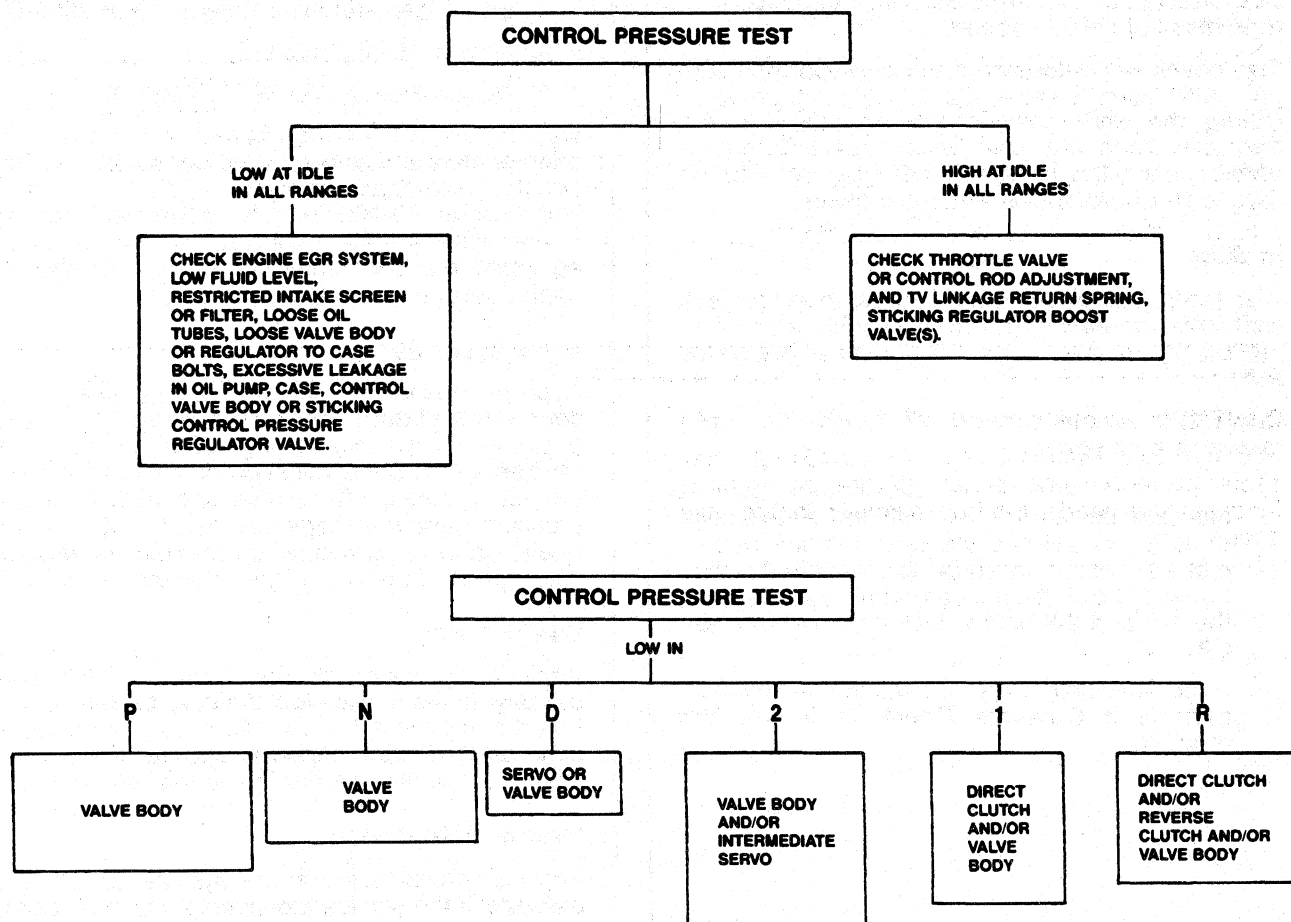
Observe the fluid flow at the funnel. When the flow is "solid" (air bleeding has been completed), the flow should be liberal. If there is not a liberal flow at 1000 rpm in NEUTRAL, low pump capacity, main circuit system leakage, or cooler system restriction is indicated.

To separate transaxle trouble from cooler system trouble, observe the flow at the transaxle case converter-out fitting.



CONTROL PRESSURE CHECK  
(GAUGE INSTALLATION)

D3904-F



CD3893-C

**ADJUSTMENTS (Continued)****Shift Point Checks****Road Test**

Check the minimum throttle upshifts in DRIVE. The transaxle should start in first gear, shift to second, and then shift to third, within the shift points in the Service Specifications manual.

With transaxle in third gear, depress the accelerator pedal to the floor. The transaxle should shift from third to second or third to first, depending on vehicle speed.

Check the closed throttle downshifts from third to first by coasting down from about 48 km/h (30 mph) in third gear. The shifts should occur within the limits in the Service Specifications manual.

When the selector lever is at 2 (SECOND), the transaxle will operate in first and in second gear.

With transaxle in third gear and road speed over approximately 48 km/h (30 mph), the transaxle shifts to second gear when selector lever is moved from DRIVE 3 (THIRD), to 1 (FIRST). The transaxle will shift into 1 (FIRST) when road speeds are less than 48 km/h (30 mph).

When the selector lever is moved from DRIVE (D) to SECOND (2), the transaxle will shift into Second (2), regardless of vehicle speed.

This check will determine if the governor pressure and shift control valve are functioning properly. During the shift point check operation, if the transaxle does not shift within specification, or certain gear ratios cannot be obtained, refer to the Diagnosis Charts to resolve the problem.

**In Shop**

A shift test can be performed in the shop to check shift valve operation, governor circuits, shift delay pressures, throttle boost and downshifts valve action.

**CAUTION: Never exceed 97 km/h (60 mph) speedometer speed.**

1. Place the transaxle in DRIVE and make a minimum throttle 1-2, 2-3 shift test. At this point of shift you will see the speedometer needle make a momentary surge and feel the driveline bump. If the shift points are within specification, the 1-2 and 2-3 shift valves and governor are OK.

If the shift points are not within specification, perform a Governor Check to isolate the problem.

**Air Pressure Checks**

A NO DRIVE condition can exist, even with the correct transaxle fluid pressure, because of inoperative clutches or band. Erratic shifts could be caused by a stuck governor valve. The inoperative units can be located through a series of checks by substituting air pressure for the fluid pressure to determine the location of the malfunction.

A NO DRIVE condition in Drive and 2 may be caused by an inoperative band or one-way clutch. When there is no drive in 1, the difficulty could be caused by improper functioning of the direct clutch or band and the one-way clutch. Failure to drive in reverse range could be caused by a malfunction of the reverse clutch or one-way clutch.

When you have a slip problem but do not know whether it is in the valve body or in the hydraulic system beyond the valve body, the air pressure tests can be very valuable.

To properly air test the automatic transaxle a main control to case gasket (Base No. -7D100-) and the following special service tools or equivalent will be required:

- Adapter Plate T82P-7006-B
- Adapter Plate Attaching Screws T82P-7006-C
- Air Nozzle TOOL-7000-DE
- Air Nozzle Rubber Tip TOOL-7000-DD

With the main control body removed, position the adapter plate and gasket on the transaxle. Install the adapter plate attaching screws. Tighten the screws to 9-11 N·m (80-100 lb-in). Note that each passage is identified on the plate. Using the air nozzle equipped with the rubber tip, apply air pressure to each passage in the following order.

**Band Apply Servo**

Apply air pressure to the servo apply passage in the service tool plate. The band should apply, however, because of the cushioning effect of the servo release spring the application of the band may not be felt or heard. The servo should hold the air pressure without leakage and a dull thud should be heard when air pressure is removed allowing the servo piston to return to the released position.

**Direct Clutch**

Apply air pressure to the forward clutch apply passage in the service tool plate. A dull thud can be heard or movement of the piston can be felt on the case as the clutch piston is applied. If the clutch seal(s) are leaking, a hissing sound will be heard.

**Intermediate Clutch**

Apply air pressure to the intermediate clutch apply passage in the service tool plate. A dull thud can be heard or movement of the piston can be felt on the case as the clutch piston is applied. If the clutch seal(s) are leaking, a hissing sound will be heard.

**ADJUSTMENTS (Continued)****Reverse Clutch**

Apply air pressure to the reverse clutch apply passage in the service tool plate. A dull thud can be heard or movement of the piston can be felt on the case as the clutch piston is applied. If the clutch seal(s) are leaking a hissing sound will be heard.

**Converter In**

This passage can only be checked for blockage. If the passage holds air pressure remove the service tool plate and check for an obstruction or damage.

**Control Pressure to Governor**

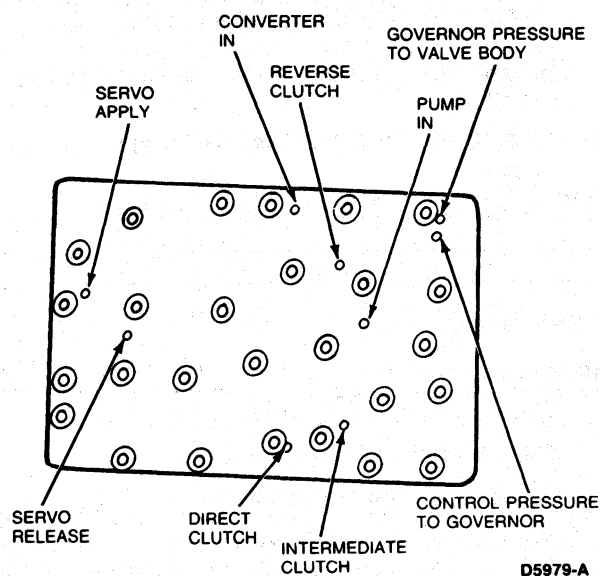
Remove the governor cover and while applying air pressure to the passage in the service tool plate watch for movement of the governor valve.

**Governor to Control Pressure**

This passage can only be checked for blockage. If the passage holds air pressure remove the service tool plate and check for an obstruction or damage.

**Pump In (Bench Test)**

With the transaxle removed from the vehicle and the converter removed, the rotating pump gears should be heard when air pressure is applied to this passage. This check is normally performed during the assembly of an overhauled transaxle.

**REMOVAL AND INSTALLATION****Transaxle**

Before beginning the Removal procedure, perform the following preliminary steps:

- Position vehicle on a hoist. Refer to the Pre-Delivery manual, Section 50-04.
- Raise the hood.
- Position fender covers.
- Disconnect battery ground cable.

**Removal and Installation**

1. Remove air cleaner assembly.
2. Position engine control wiring assembly away from transaxle converter housing area.
3. Disconnect throttle valve linkage and manual lever cable at the respective levers.

**CAUTION: Failure to disconnect linkage during transaxle removal, and allowing the transaxle to hang will damage the TV camshaft joint (located under the transaxle cover).**

4. Remove power steering hose brackets.
5. Remove two upper transaxle-to-engine attaching bolts.
6. Install Engine Lifting Bracket D81L-6001-D or equivalent to RH rear area of cylinder with a bolt (M10x 1.5 x 20).
7. Install a second engine lifting bracket to LH front area of cylinder with a bolt (M10x 1.5 x 20).
8. Install two Engine Support Bars D79P-6000-A or equivalent. NOTE: An engine support bar may be fabricated from a length of 4 x 4 wood cut to approximately 1.45m (57 inches) in length.
9. Place 4 x 4 or one of the engine support bars across vehicle in front of each of shock towers.
10. Place other support bar across vehicle approximately between alternator and valve cover. Attach chains from each support bar to previously installed engine lifting brackets.
11. Raise vehicle and remove wheels.
12. Remove catalytic converter inlet pipe.
13. Disconnect engine exhaust air hose assembly by disconnecting one 8mm screw.
14. Remove each tie rod end from its spindle.

**REMOVAL AND INSTALLATION (Continued)**

15. Remove bolts and nuts attaching lower ball joints to struts, separate and remove.
16. Remove lower control arm from each spindle.
17. Remove stabilizer bar retaining nuts and disconnect stabilizer bar.
18. Remove nuts securing rack-and-pinion to sub-frame. Disconnect and remove auxiliary cooler from sub-frame.
19. Position rack-and-pinion away from sub-frame and secure with a wire.
20. Remove bolts retaining RH front axle support and bearing assembly.
21. Remove halfshaft and link shaft assembly out of RH side of transaxle.
22. Disengage LH halfshaft from differential side gear using Differential Rotator T81P-4026-A or equivalent.
23. Pull halfshaft out of transaxle.  
**NOTE:** Support and secure halfshaft by suspending from an underbody component with a piece of wire. **DO NOT ALLOW HALFSHAFTS TO HANG UNSUPPORTED.**
24. Install transaxle differential Seal Plugs T81P-1177-B or equivalent.
25. Remove front support insulator.
26. Position LH front splash shield aside.
27. Position work bench or shop table to support sub-frame after it is disconnected.
28. Lower vehicle to bench table surface. Position blocks or support for sub-frame as required.
29. Remove sub-frame retaining bolts and remove sub-frame. Disconnect neutral start switch wire assembly.
30. Raise vehicle.
31. Disconnect speedometer cable and neutral start switch wire assembly.
32. Remove shift cable bracket bolts and bracket from transaxle.
33. Disconnect oil cooler lines using Cooler Line Disconnect Tool T86P-77265-AA or equivalent.
34. Remove starter support bracket and disconnect starter cable.
35. Remove starter attaching bolts and starter.
36. Remove dust cover from torque converter housing.
37. Remove torque converter-to-flywheel attaching nuts.

38. Position a transmission jack under transaxle and secure transaxle to jack.
39. Remove remaining transaxle-to-engine attaching bolts.
40. Before transaxle can be lowered out of vehicle, torque converter studs must be clear of flywheel. Insert a screwdriver between flywheel and converter and carefully move transaxle and converter away from engine.
41. Lower transaxle out of vehicle.
42. Before installing transaxle, oil cooler and lines **MUST** be cleaned using Torque Converter Cleaner Rotunda 014-00028 or equivalent.

To install the transaxle, reverse the removal procedure except for the following:

1. Install new circlips on LH and RH CV joint steel shafts.
2. Carefully install halfshafts in transaxle aligning splines of CV joint with splines of differential.
3. Attach lower ball joint to steering knuckle. Install new bolt and nut. Tighten nut to 50-60 N·m (37-44 lb-ft). **DO NOT TIGHTEN THE BOLT.**
4. When installing transaxle and converter assembly to engine, verify that converter-to-transaxle engagement is maintained (1/2 in.  $\pm$  1/16 in. from engine mounting surface to front of converter pilot). Prevent converter from moving forward and partially disengaging during installation.
5. **READJUST** TV linkage and manual linkage as outlined.
6. Check transaxle fluid level as outlined.

**Valve Body****Removal**

1. Open hood and set parking brake.
2. Remove battery and battery tray.
3. Remove air cleaner assembly.
4. Remove transaxle dipstick.
5. Remove valve body cover bolts and valve body cover, with gasket.
6. Remove valve body bolts and valve body, with gasket.



**REMOVAL AND INSTALLATION (Continued)****Installation**

1. Install two Guide Pins T80L-77100-A, or equivalent.
2. Install valve body to case gasket.
3. Install valve body. One alignment pin must temporarily be removed to allow the attachment of the manual valve to the "Z" link. After manual valve is attached to its linkage, reinstall alignment pin.  
  
NOTE: Ensure the roller on the end of the throttle valve plunger has engaged the cam on the end of the throttle lever shaft.
4. Connect throttle valve control spring.
5. Remove alignment pins.
6. Install 27 valve body retaining bolts, detent spring, and oil pressure regulator exhaust plate.
7. Tighten attaching bolts to 8-11 N·m (6-8 lb-ft).
8. Install a new valve body cover gasket on case.
9. Install valve body cover.
10. Install valve body cover bolts. Ensure transaxle identification tag is installed in its original position.
11. Tighten attaching bolts to 9-12 N·m (7-9 lb-ft).
12. Attach neutral start switch connector.
13. Connect fan motor and water temperature sending unit wiring.
14. Install battery tray and battery.
15. Install air cleaner assembly.
16. Start engine, cycle transaxle through all ranges. Check fluid level and fill to recommended level if necessary, with Motorcraft Ford type "H" Automatic Transmission Fluid (ESP-M2C166-H) or equivalent transmission fluid.
17. Check for fluid leaks.
18. Close hood and release parking brake.

6. Connect battery ground cable.
7. Start engine in both PARK and NEUTRAL.
8. Close hood and release parking brake.

**Governor****Removal**

1. Open hood and set parking brake.
2. Disconnect battery ground cable.
3. Remove air cleaner.
4. Using a long screwdriver, remove governor cover retaining clip.
5. Remove governor cover.
6. Remove governor.

**Installation**

1. Install governor.  
NOTE: Slide in carefully, allow gear teeth to mesh. **Do not force in.**
2. Install a new seal on governor cover and position on case.
3. Using a long screwdriver, tap governor cover retaining clip in place.
4. Install air cleaner.
5. Connect battery ground cable.
6. Start engine, check for leaks, check transaxle fluid level and fill if necessary to recommended level with Motorcraft Ford type "H" Automatic Transmission Fluid (ESP-M2C166-H) or equivalent transmission fluid.
7. Close hood and release parking brake.

**Neutral Start Switch****Removal**

1. Open hood and set parking brake.
2. Disconnect battery ground cable.
3. Disconnect neutral start switch connector.
4. Remove two neutral start switch attaching bolts.
5. Remove neutral start switch.

**Installation**

1. Install neutral start switch on manual shaft.
2. Loosely install two neutral start switch attaching bolts and washers.
3. Insert a No. 43 drill (.089 inch) through hole provided in switch.
4. Tighten attaching bolts to 9-12 N·m (7-9 lb-ft) and remove drill.
5. Connect neutral start switch connector.

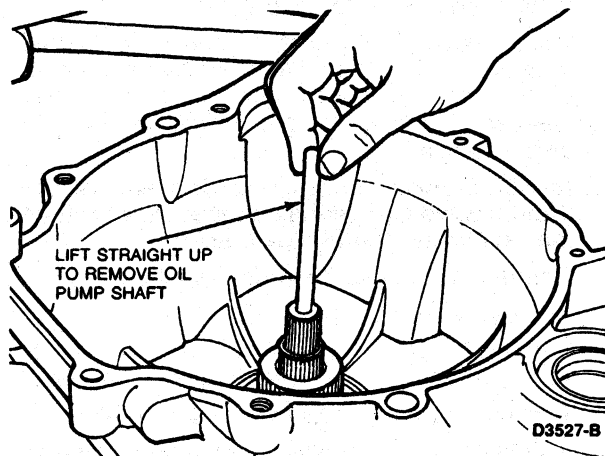
**Servo****Removal**

1. Open hood and set parking brake.
2. Disconnect battery ground cable.
3. Unplug fan motor and water temperature sending unit wiring.
4. Unplug FM capacitor wiring, if so equipped.
5. Remove two fan shroud to radiator attaching nuts.
6. Remove fan and fan shroud assembly.
7. Remove filler tube to case attaching bolt.
8. Remove filler tube and dipstick. Some fluid may leak when filler tube is removed from case.
9. Remove from LH front (No. 1) mount the lower LH (facing front of vehicle) mount to case attaching bolt.
10. Remove servo cover and snap ring using Servo Installation Tool T81P-70027-A or equivalent. Some fluid will leak from case when servo cover is removed.

**REMOVAL AND INSTALLATION (Continued)****Installation**

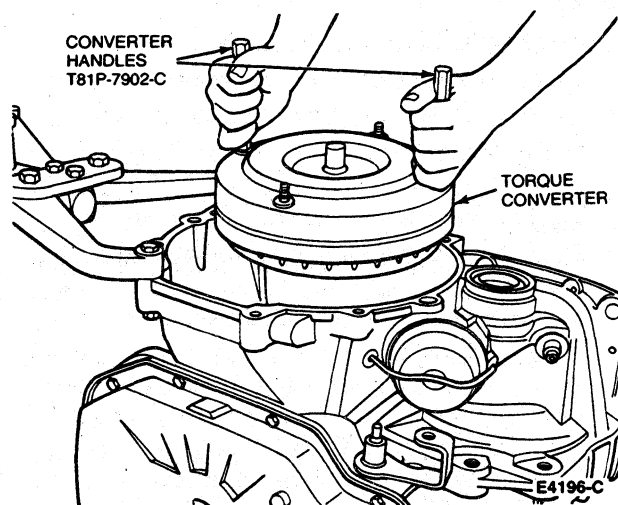
1. Install servo cover and snap ring using Servo Installation Tool T81P-70027-A or equivalent.
2. Install mount to case attaching bolt in LH front (No. 1) mount.
3. Install filler tube.
4. Install filler tube to case attaching bolt. Tighten bolt to 9-12 N·m (7-9 lb-ft).
5. Install fan and fan shroud assembly.
6. Install two fan shroud to radiator attaching nuts.
7. Connect FM capacitor wiring, if so equipped.
8. Connect fan motor and water temperature sending unit wiring.
9. Connect battery ground cable.
10. Start engine, cycle transaxle through all ranges, check fluid level and fill if necessary to recommended level with Motorcraft Ford Type "H" Automatic Transmission Fluid (ESP-M2C166-H) or equivalent transmission fluid.
11. Check for fluid leaks.
12. Close hood and release parking brake.

2. Remove the pump driveshaft.

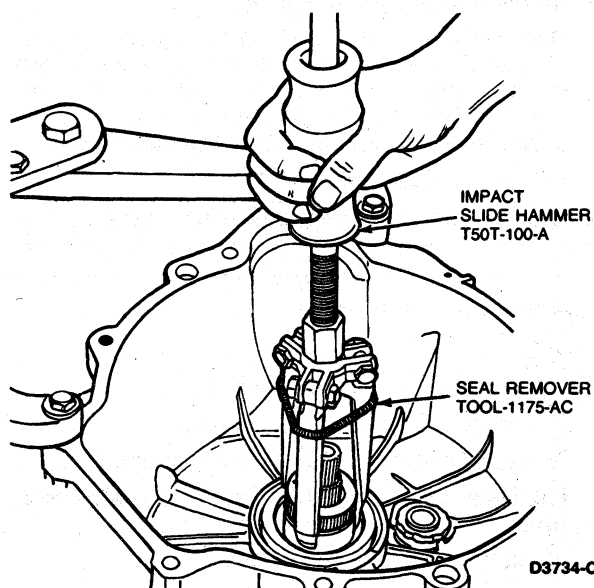
**Converter Hub Seal****Removal**

1. Install Converter Handles T81P-7902-C or equivalent and lift the converter out of the transaxle.

NOTE: The torque converter is relatively heavy. Be prepared to handle the weight.

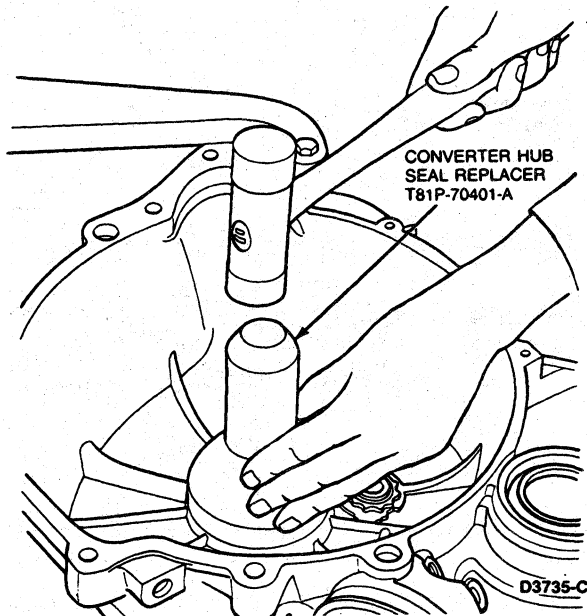


3. Remove the converter hub seal using Impact Slide Hammer T50T-100-A and Seal Remover Tool-1175-AC or equivalent.

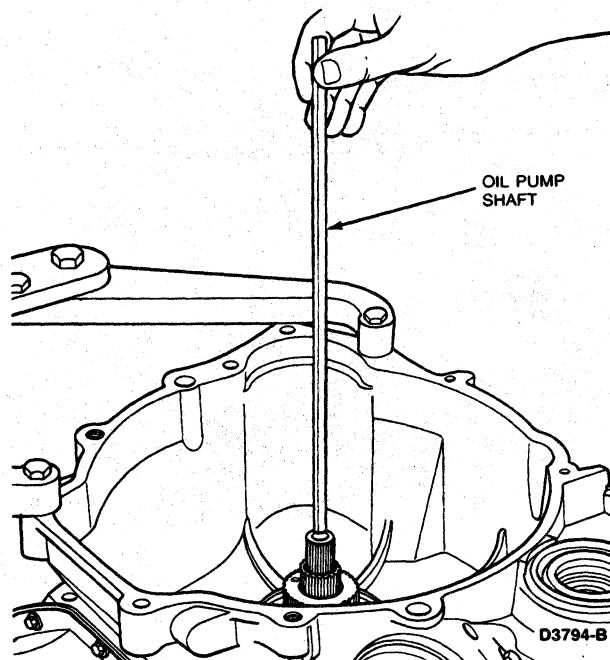


**REMOVAL AND INSTALLATION (Continued)****Installation**

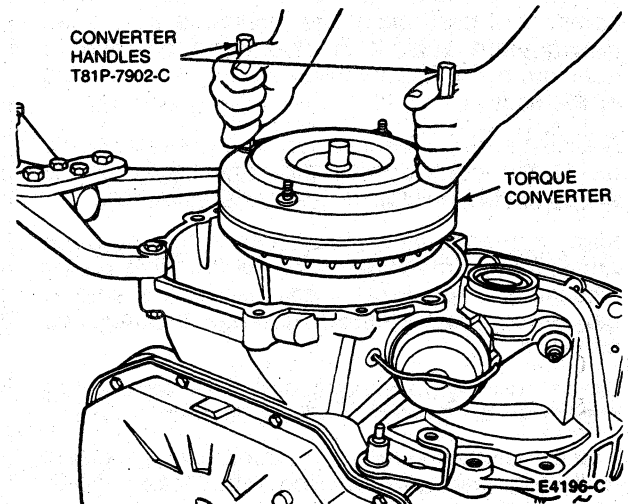
1. Install the seal using Converter Hub Seal Replacer T81P-70401-A or equivalent.



2. Install the pump driveshaft.



3. Install the torque converter using Converter Handles T81P-7902-C or equivalent.

**Flywheel****Removal and Installation**

1. Remove pressure plate and disc. Refer to Section 16-02.
2. Remove flywheel retaining bolts.
3. Carefully remove flywheel from vehicle.
4. To install, reverse Steps 1, 2, and 3.

**DISASSEMBLY AND ASSEMBLY**

**NOTE:** Before beginning the transaxle overhaul, review the following guidelines. These general rules are provided to emphasize the need for attention to detail and care when servicing an automatic transaxle.

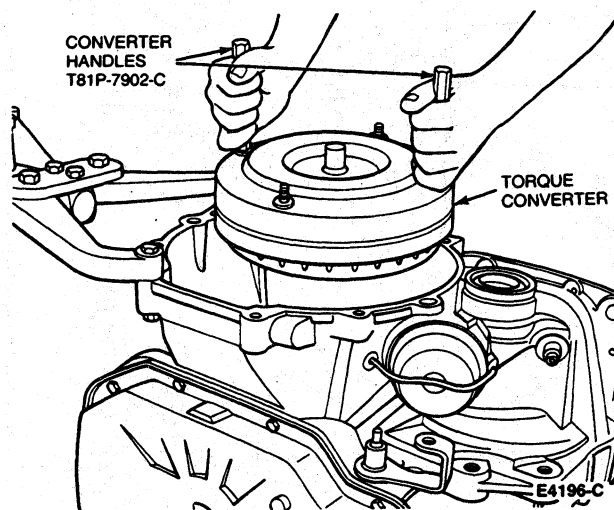
- Refer to Cleaning and Inspection for procedures detailing the cleaning and inspection of individual components.
- Thorough cleaning of the transaxle exterior will reduce the possibility that damaging contaminants might enter the subassemblies during disassembly and assembly.

**DISASSEMBLY AND ASSEMBLY (Continued)**

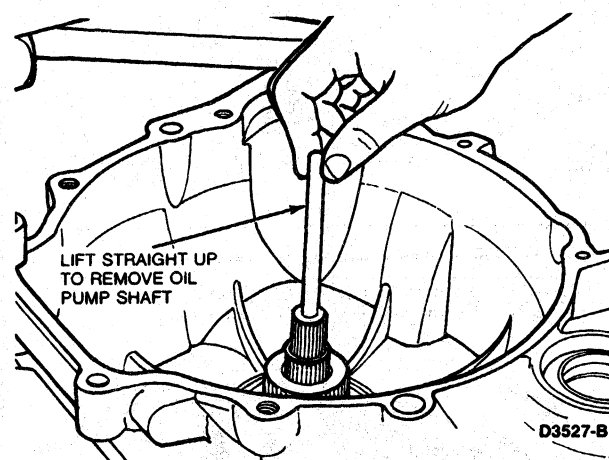
- All fasteners must be tightened to the torque indicated in the text. In addition to appearing in the text, the necessary torques can be found in Specifications.
- When building up subassemblies each component part should be lubricated with clean transmission fluid. It is also good practice to lubricate the subassemblies as they are installed in the case.
- Needle bearings, thrust washers and seals should be lightly coated with petroleum jelly during subassembly buildup or transaxle assembly.
- Many components and surfaces in the transaxle are precision machined. Careful handling during disassembly, cleaning, inspection and assembly can prevent unnecessary damage to machined surfaces.
- When building up subassemblies or assembling the transaxle, always use new gasket and seals.
- The transaxle service area should be kept clean, well organized and supplied with clean lint-free shop cloths.
- Whenever a seal is removed from a piston, shaft or servo, note the type of seal and when applicable, the direction of the sealing lip.
- Always use the specified transmission oil when lubricating seals or other components prior to assembly (refer to Specifications for the proper oil).

2. Install Converter Handles T81P-7902-C or equivalent and lift converter out of transaxle.

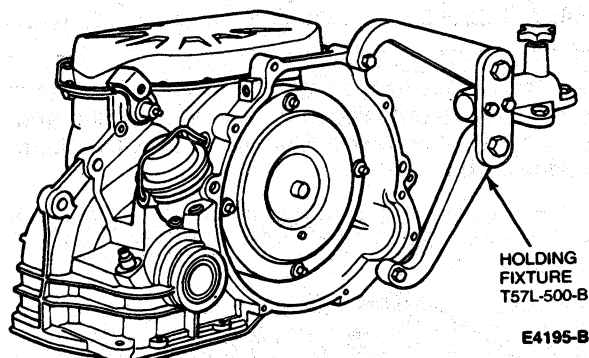
NOTE: The torque converter is relatively heavy. Be prepared to handle the weight.



3. Remove oil pump driveshaft.

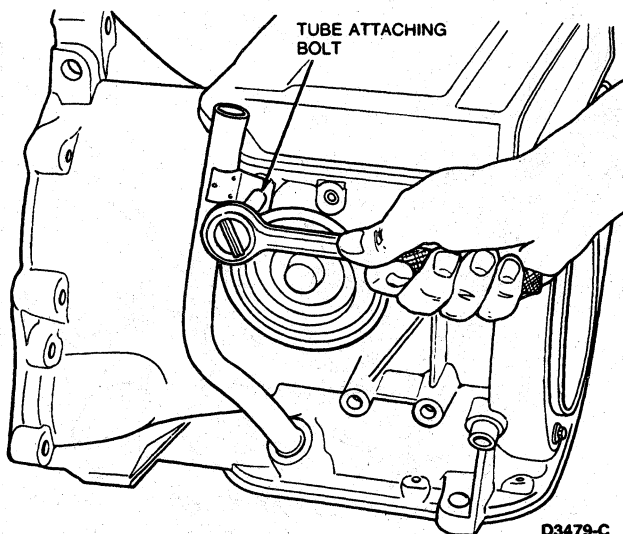
**Transaxle****Disassembly**

1. Mount transaxle in Holding Fixture T57L-500-B or equivalent.

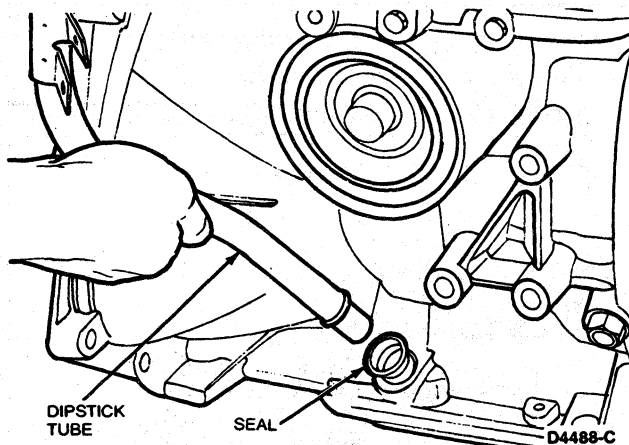


## DISASSEMBLY AND ASSEMBLY (Continued)

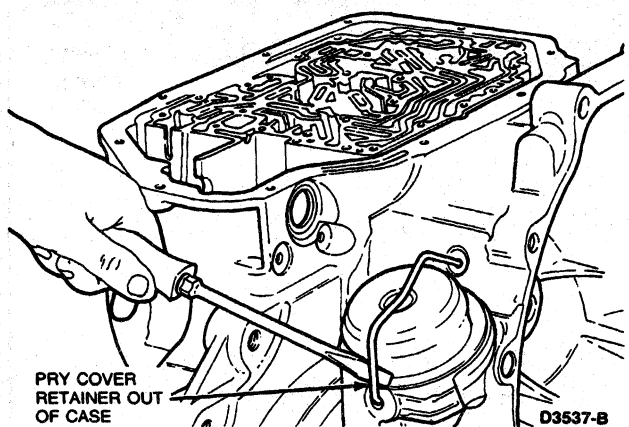
4. Remove converter turbine sleeve.
5. Remove fluid level dipstick tube attaching bolt and remove tube from case.



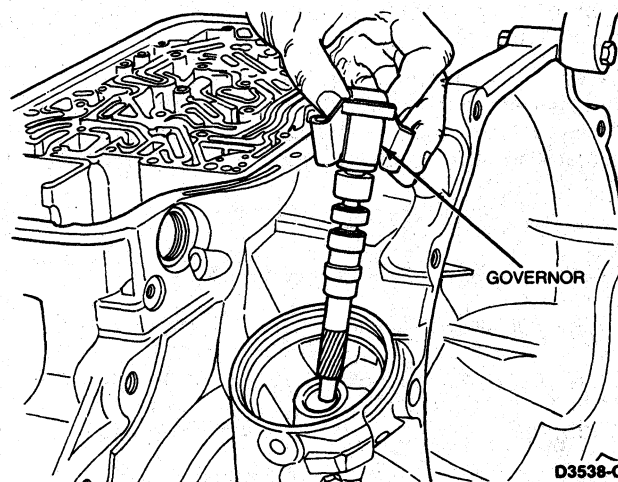
Remove seal from case and discard.



6. Remove governor cover by prying retainer out of case. Then pry cover out of case.



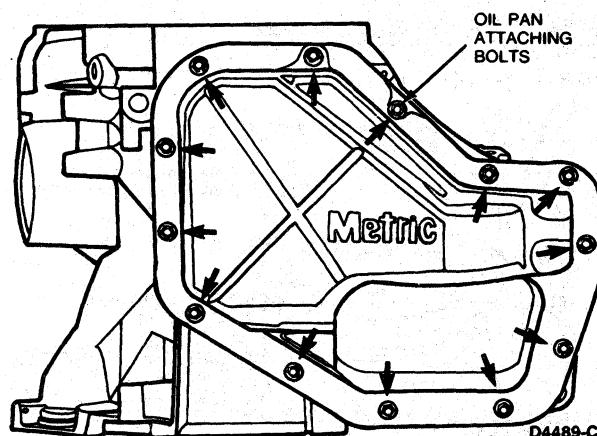
7. Remove governor.



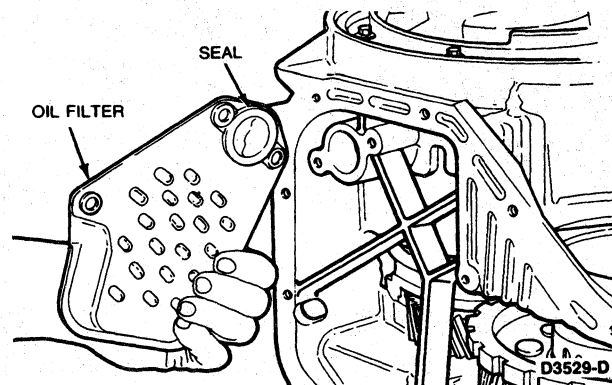
8. Remove 13 oil pan attaching bolts.

9. Remove oil pan.

Discard gasket.

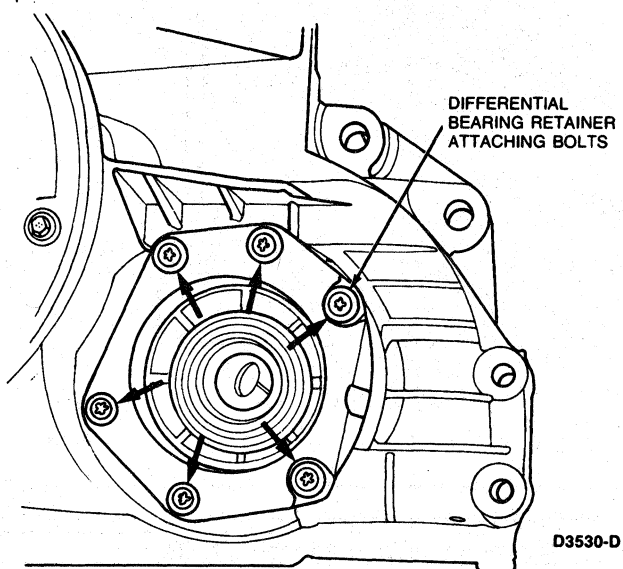


10. Remove three oil filter attaching bolts and remove filter. Discard seal. Thoroughly clean filter at this time.

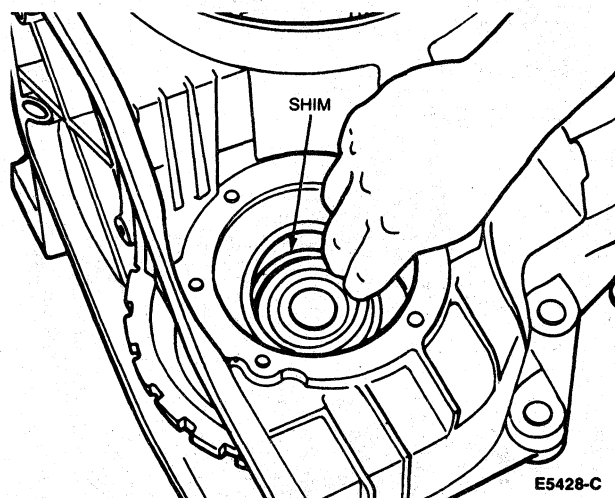


**DISASSEMBLY AND ASSEMBLY (Continued)**

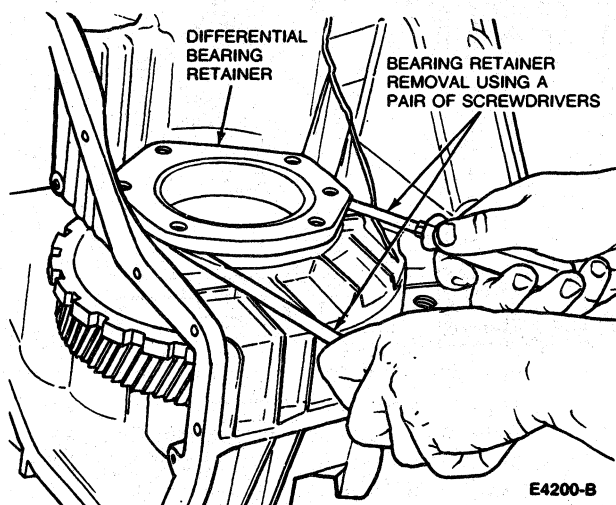
11. Remove six differential bearing retainer attaching bolts.



13. Remove differential bearing spacer shims.

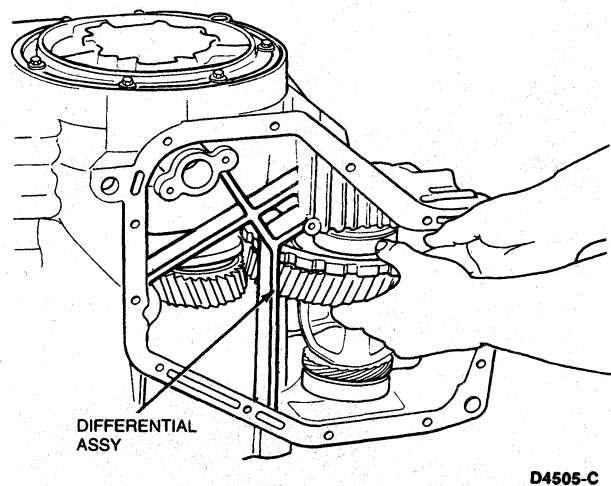


12. Remove differential bearing retainer.



14. Remove differential assembly.

NOTE: For differential service, refer to Section 15-20.



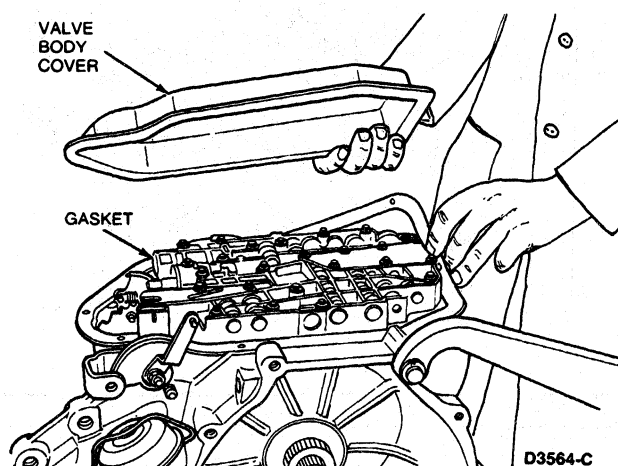
**DISASSEMBLY AND ASSEMBLY (Continued)**

15. Remove 10 valve body cover attaching bolts.

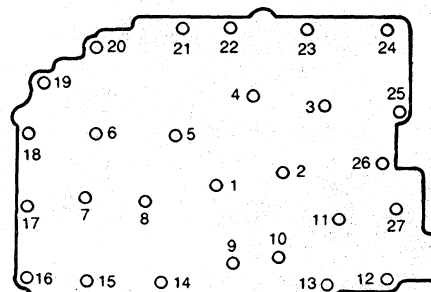
NOTE: The transaxle identification tag is attached to the case by a valve body attaching bolt. This tag must be installed in its original position during assembly.

16. Remove valve body cover.

Discard gasket.



18. Loosen the 27 valve body attaching bolts.



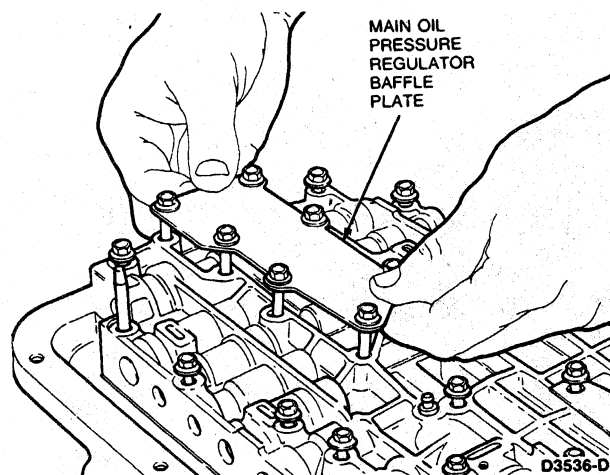
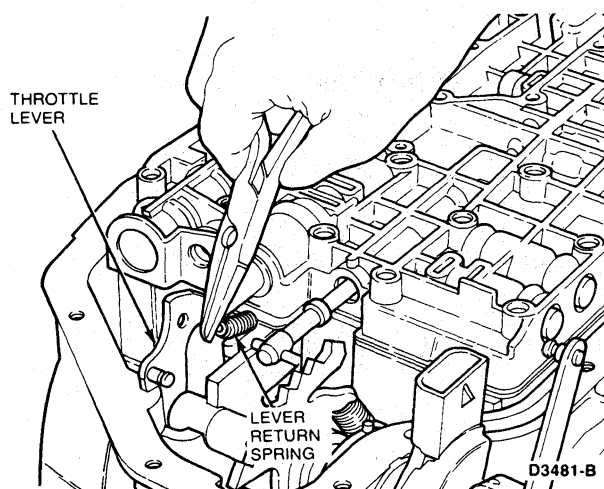
FROM PUMP SIDE OF CASE

D3483-B

19. Remove main oil pressure regulator baffle plate.

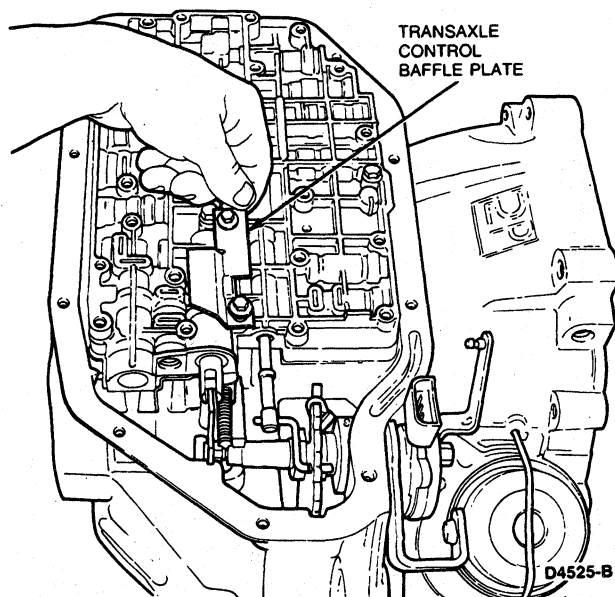
NOTE: Because the seven baffle attaching bolts are longer on the main oil pressure regulator plate, keep them separate from the other valve body attaching bolts.

17. Disconnect throttle lever return spring.

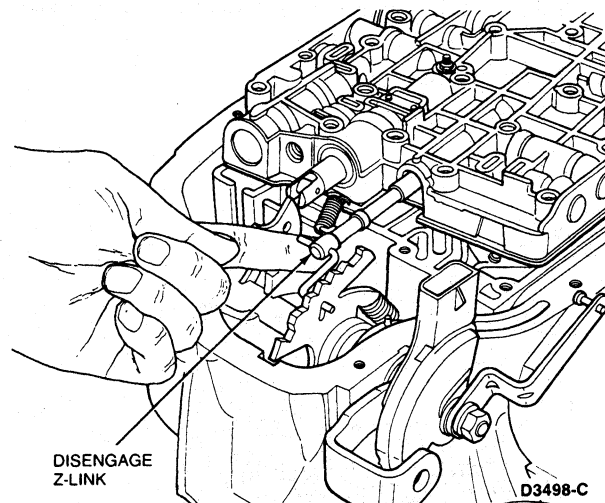


**DISASSEMBLY AND ASSEMBLY (Continued)**

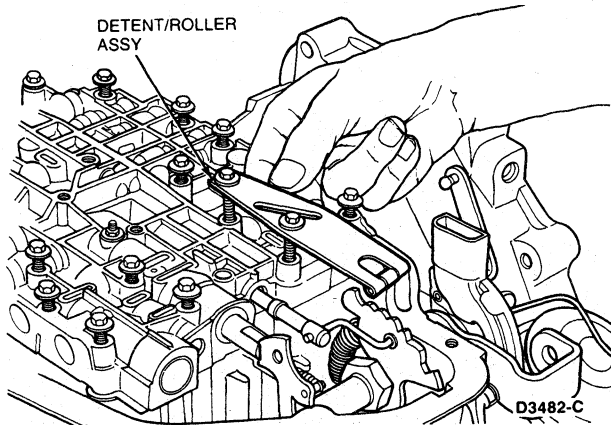
20. Remove transaxle control baffle plate.



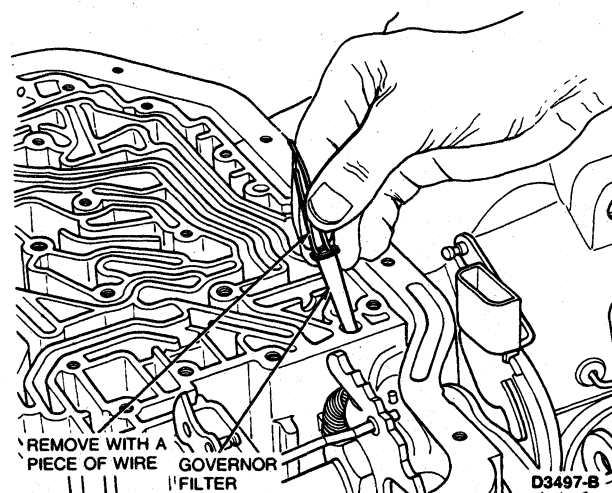
22. Disengage Z-link from manual valve and remove valve body. Discard gasket.



21. Remove detent spring and roller assembly.



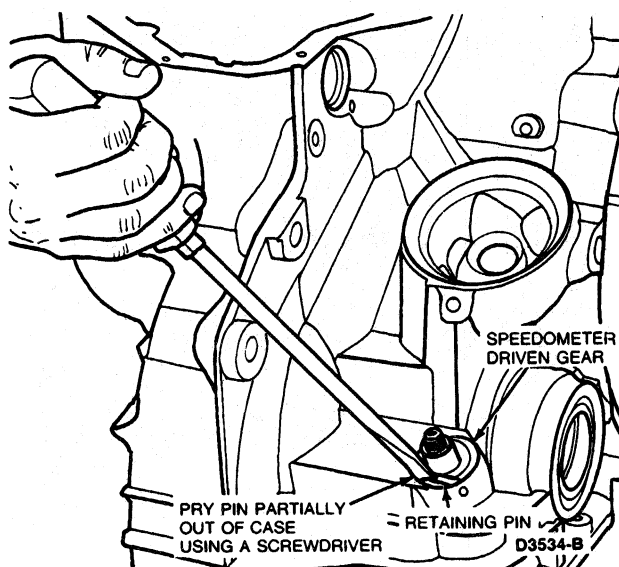
23. With valve body removed, lift governor filter from the case. A piece of wire can be used to lift filter from case bore.



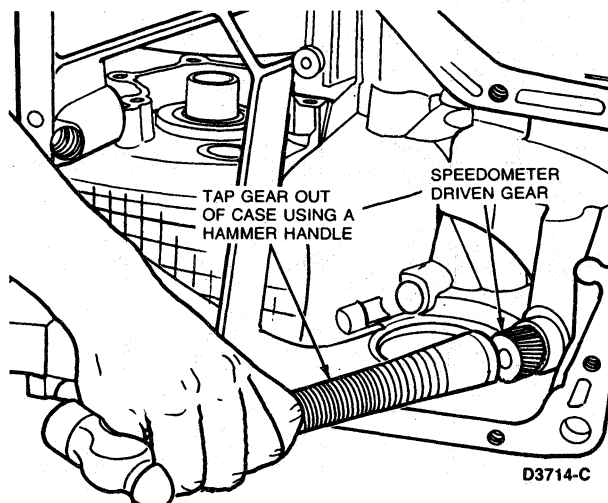


## DISASSEMBLY AND ASSEMBLY (Continued)

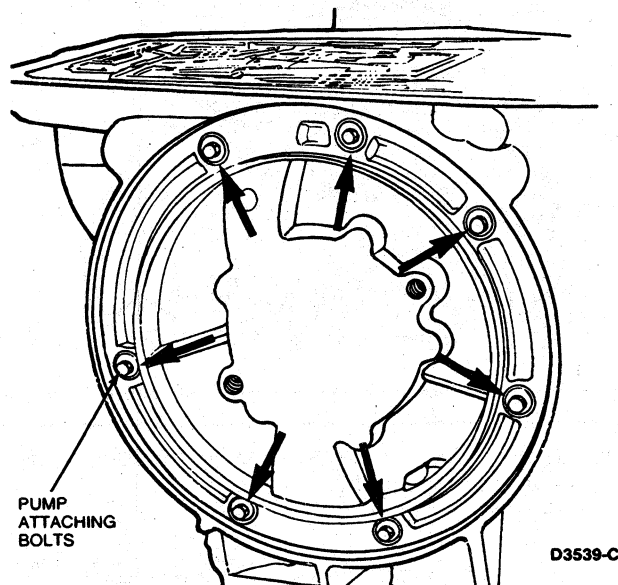
24. Partially pry speedometer driven gear retaining pin out of case using a screwdriver. Remove pin from case using sidecutters.



25. Remove speedometer driven gear from case using a hammer handle.

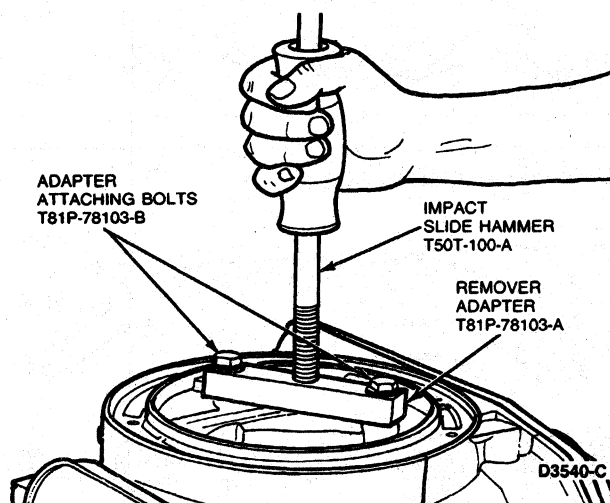


26. Remove and discard the seven pump attaching bolts and washers.



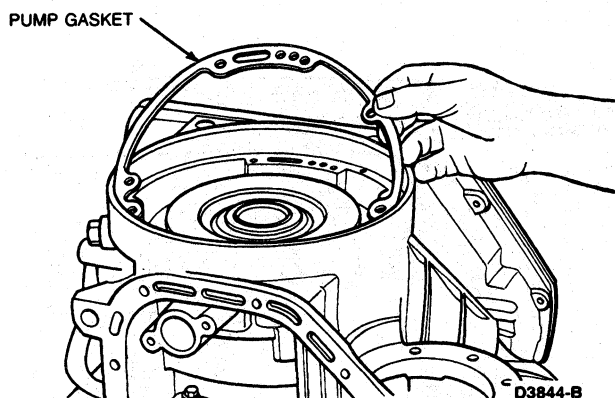
27. Remove pump body using Impact Slide Hammer T50T-100-A, Adapter T81P-78103-A and Adapter Attaching Bolts T81P-78103-B or equivalent.

NOTE: Ensure selective thrust washer under pump body is also removed.

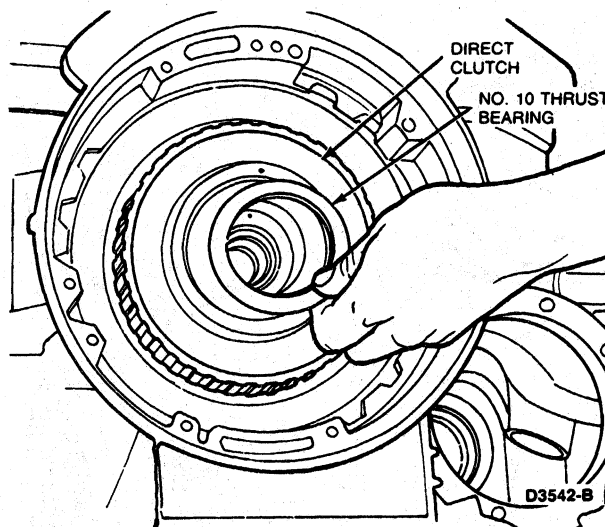


## DISASSEMBLY AND ASSEMBLY (Continued)

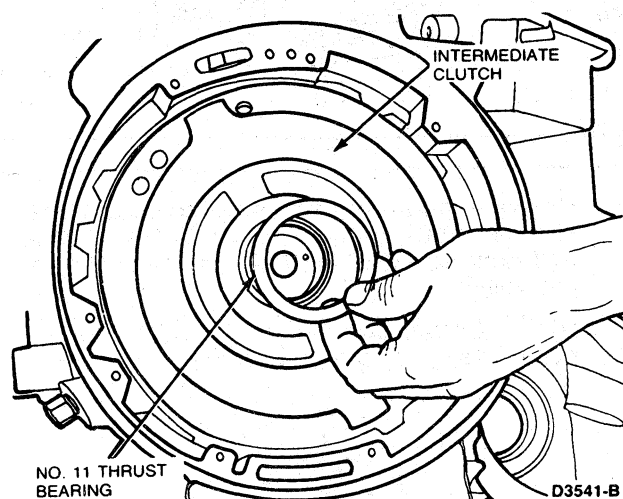
28. Remove and discard pump gasket.



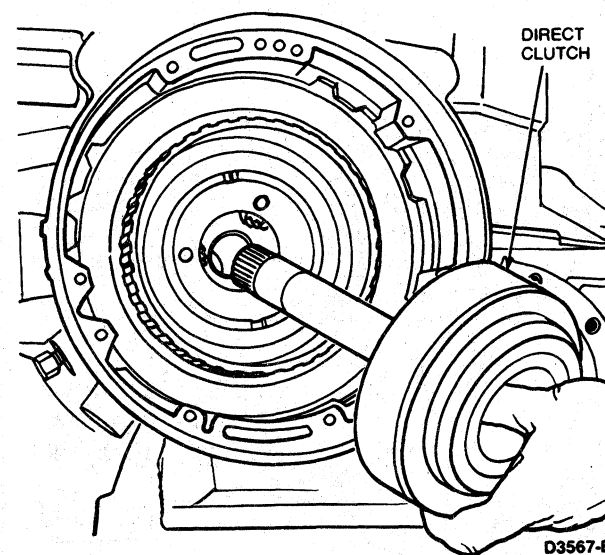
31. Remove No. 10 thrust bearing (needle) from direct clutch.



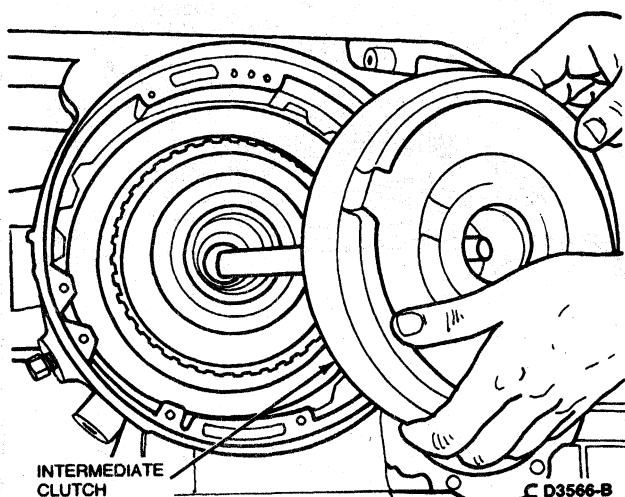
29. Remove No. 11 thrust bearing (needle) from intermediate clutch.



32. Remove direct clutch.

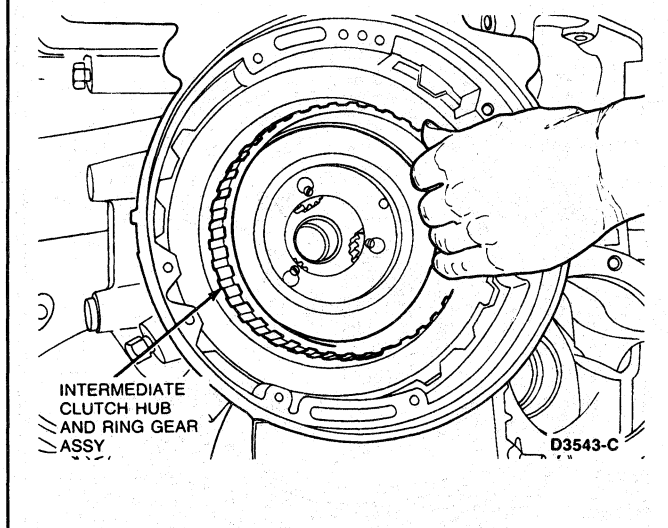


30. Remove intermediate clutch.

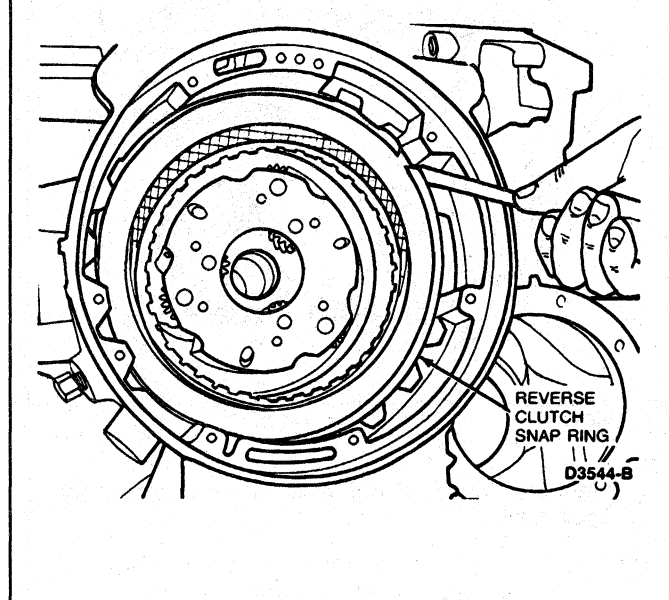


**DISASSEMBLY AND ASSEMBLY (Continued)**

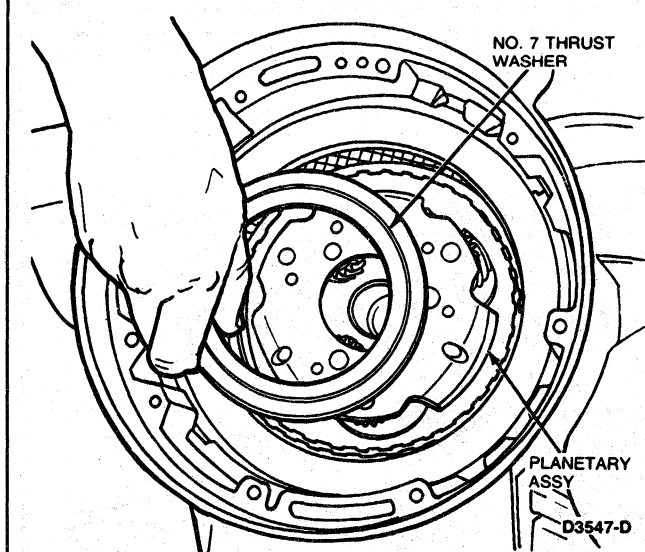
33. Remove intermediate clutch hub and ring gear assembly.



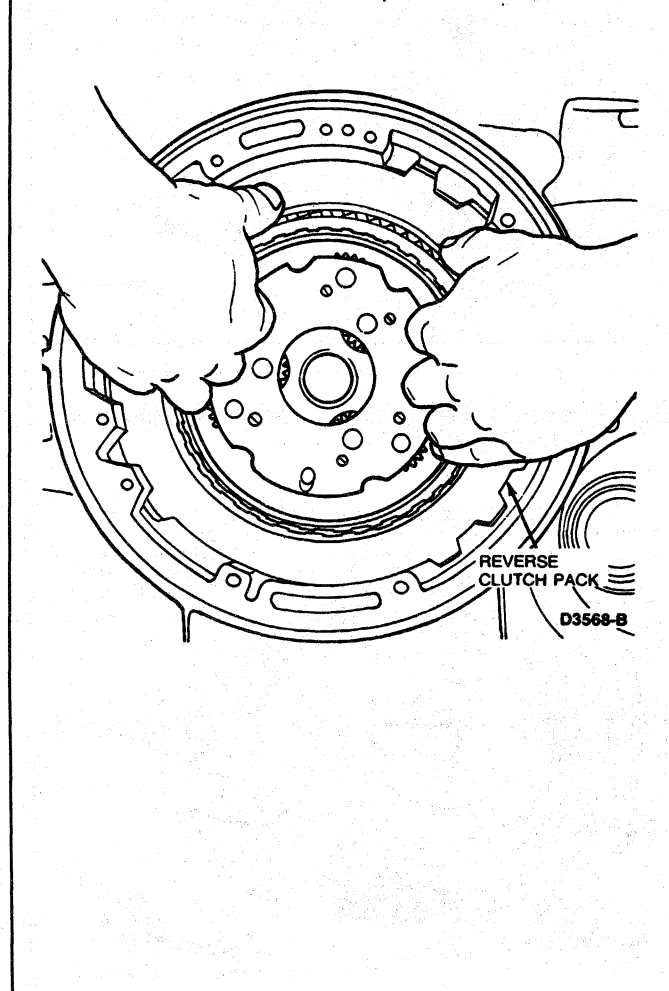
35. Remove reverse clutch snap ring.



34. Remove No. 7 thrust washer from planetary assembly.

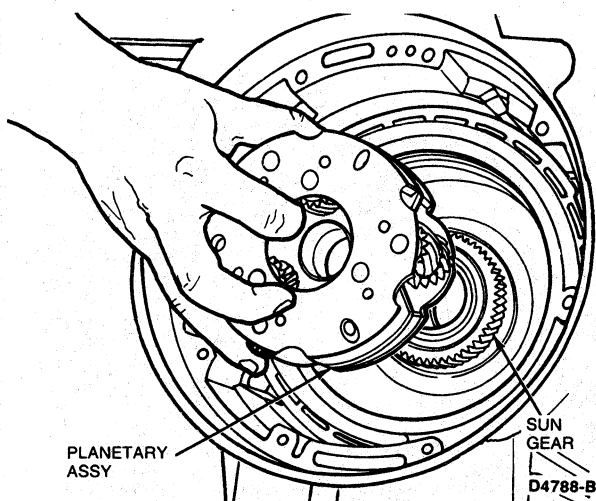


36. Remove reverse clutch pack.

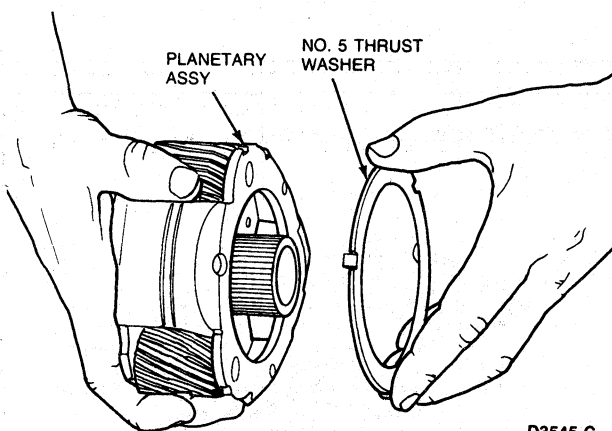


## DISASSEMBLY AND ASSEMBLY (Continued)

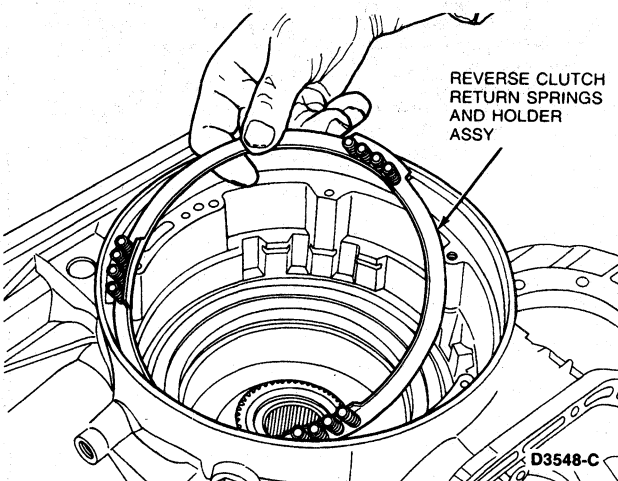
37. Remove planetary assembly.



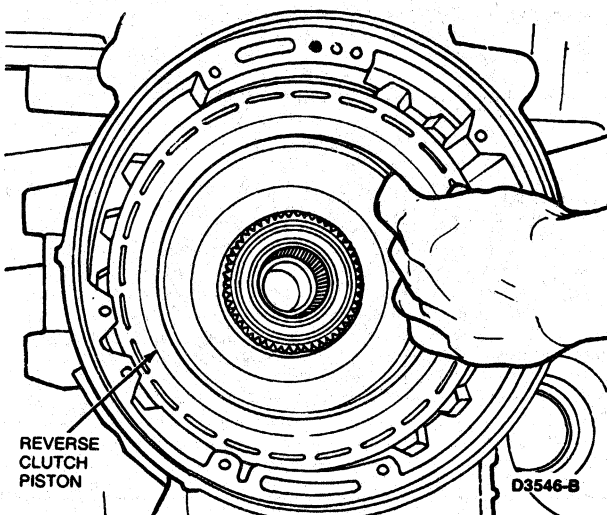
Remove No. 5 thrust washer from planetary assembly.



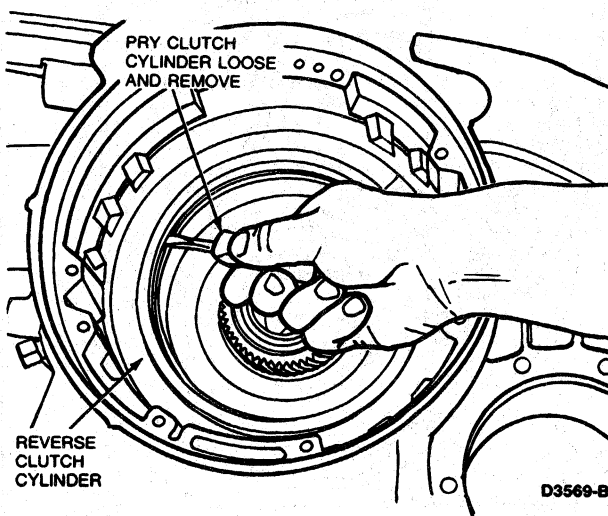
38. Remove reverse clutch return springs and holder assembly.



39. Remove reverse clutch piston.



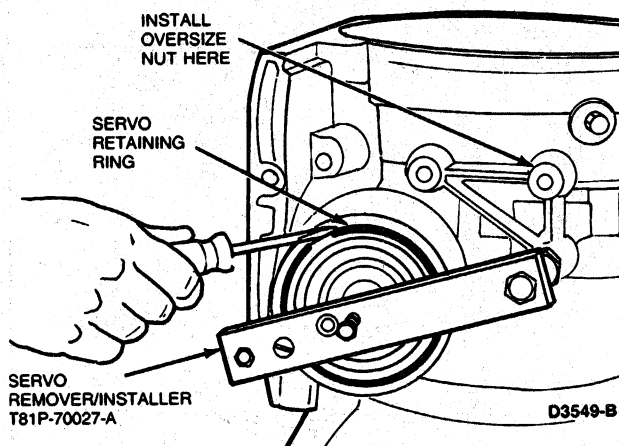
40. Pry reverse clutch cylinder up to loosen, and remove from case.



**DISASSEMBLY AND ASSEMBLY (Continued)**

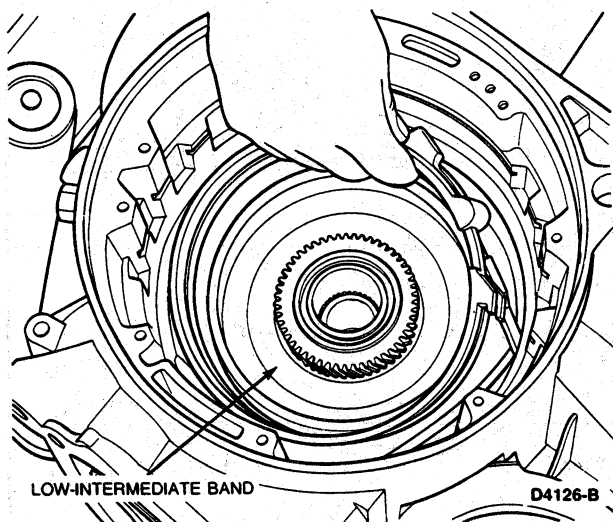
41. Install Servo Remover/Installer T81P-70027-A or equivalent and remove servo retaining ring.

NOTE: An oversize nut will have to be installed under the rear spacer. The nut will compensate for the motor mount thickness.

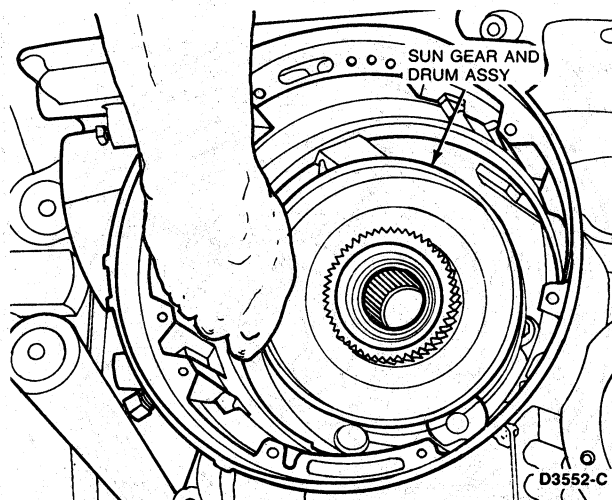


42. Back center screw out until spring pressure is removed from servo.  
Remove tool and servo.

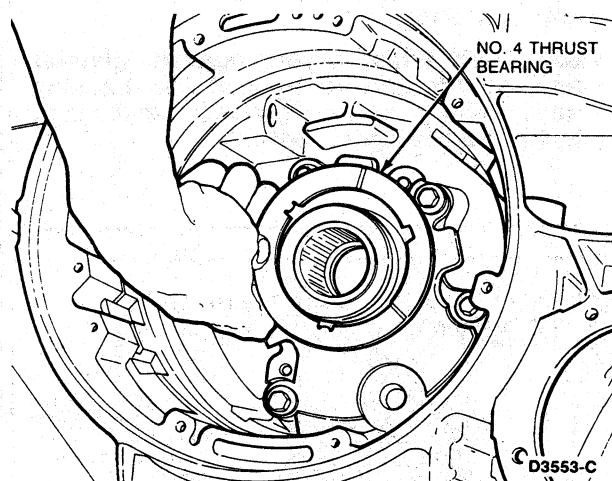
43. Remove low-intermediate band.



44. Remove sun gear and drum assembly.

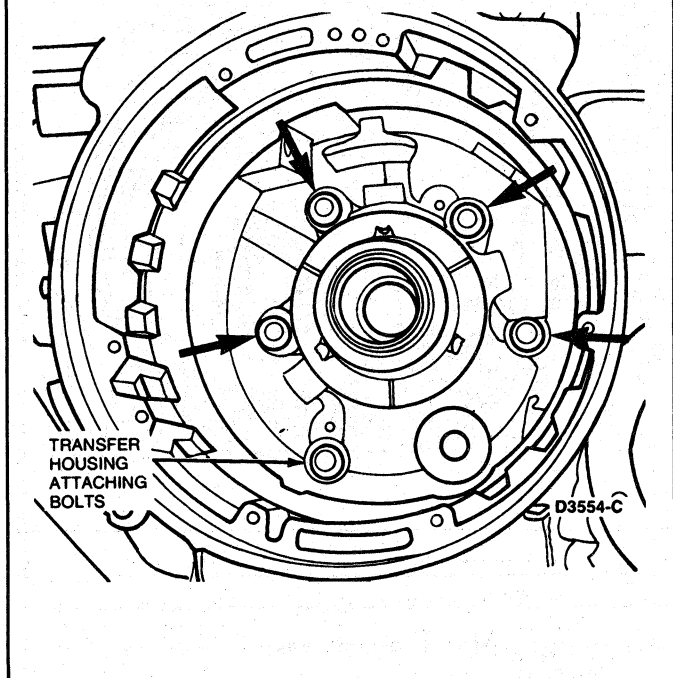


45. Remove No. 4 thrust washer from transfer housing.



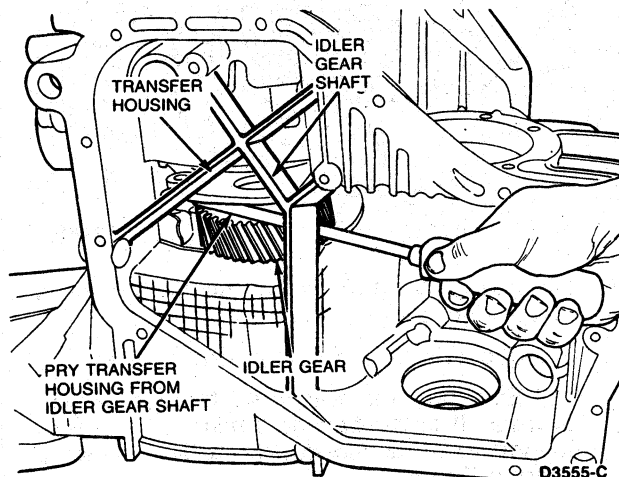
## DISASSEMBLY AND ASSEMBLY (Continued)

46. Remove and discard the five transfer housing attaching bolts.

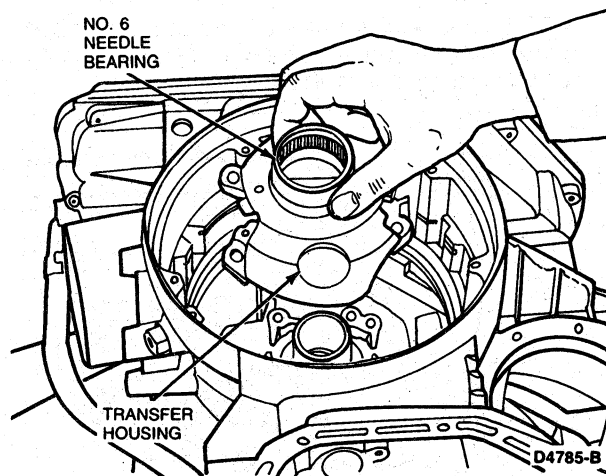


47. Using a screwdriver, pry transfer housing from idler gear shaft.

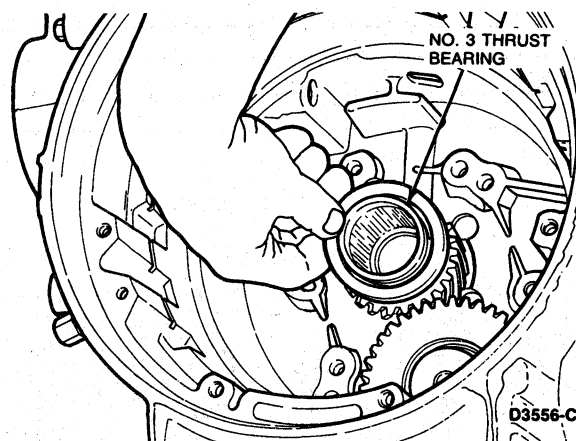
**CAUTION:** When prying against transfer housing lift upward against the housing only. Prying downward can result in damage to the transfer gear teeth.



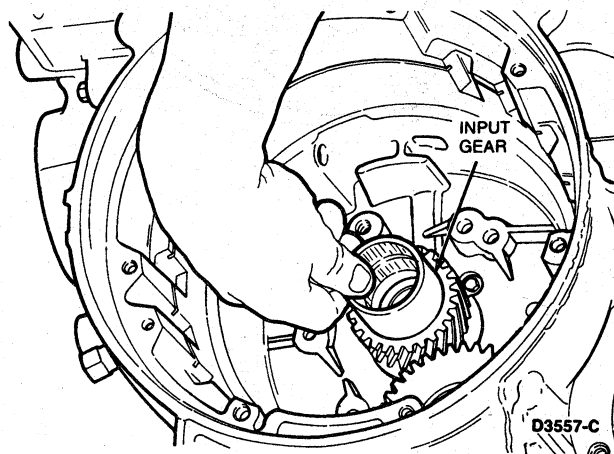
48. Remove transfer housing.



49. Remove No. 3 thrust bearing (needle type) from input gear.

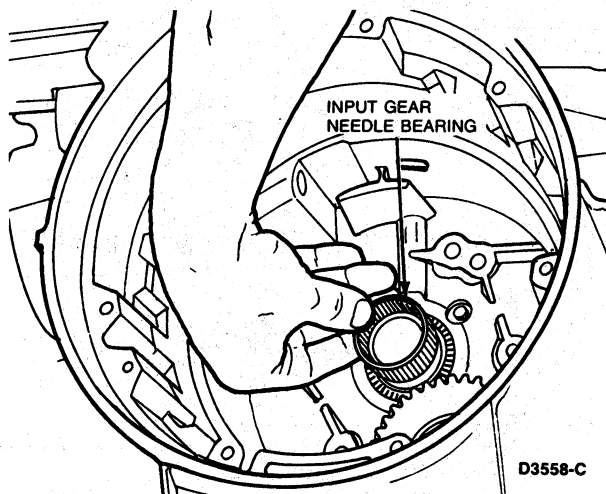


50. Remove input gear.

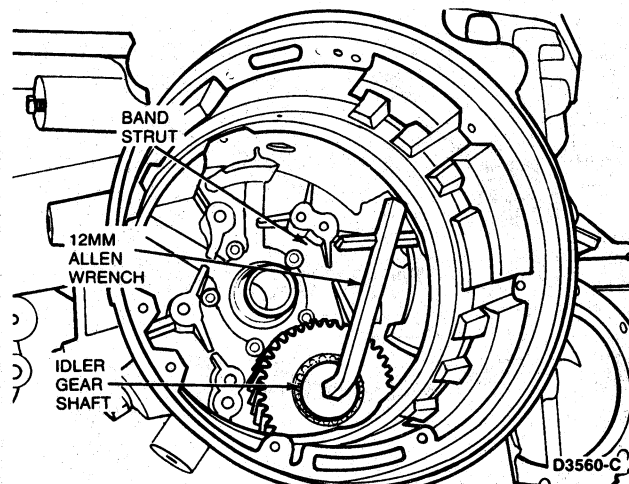


**DISASSEMBLY AND ASSEMBLY (Continued)**

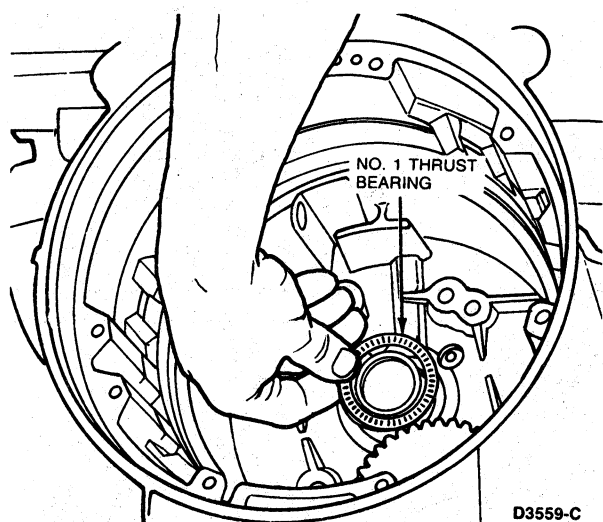
51. Remove input gear caged needle bearing (No. 2 bearing).



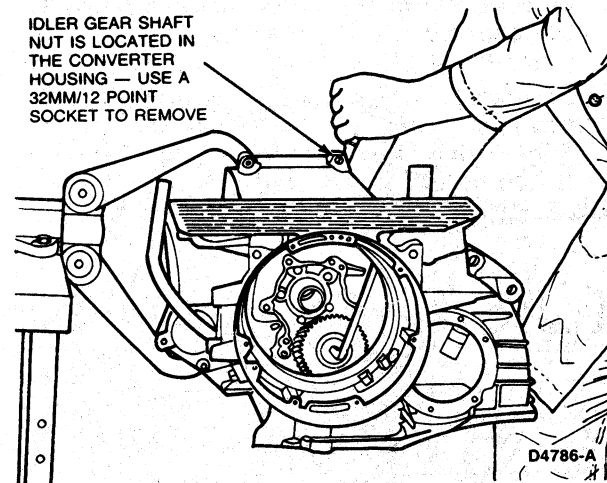
53. Position a 12mm Allen wrench in idler gear shaft and allow wrench to catch on side of case.



52. Remove No. 1 thrust bearing (needle type).



54. With Allen wrench holding idler gear shaft, remove nut from shaft using a 32mm/12 point socket.



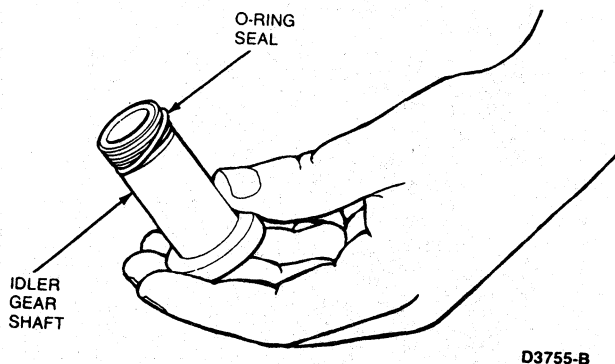
55. Tap idler gear shaft with a hammer handle to loosen O-ring seal.

Remove idler gear and shaft from case.

NOTE: Inspect the reactor support for damage or wear. If inspection determines the reactor support to be unserviceable, refer to Reactor Support Removal.

**DISASSEMBLY AND ASSEMBLY (Continued)****Assembly**

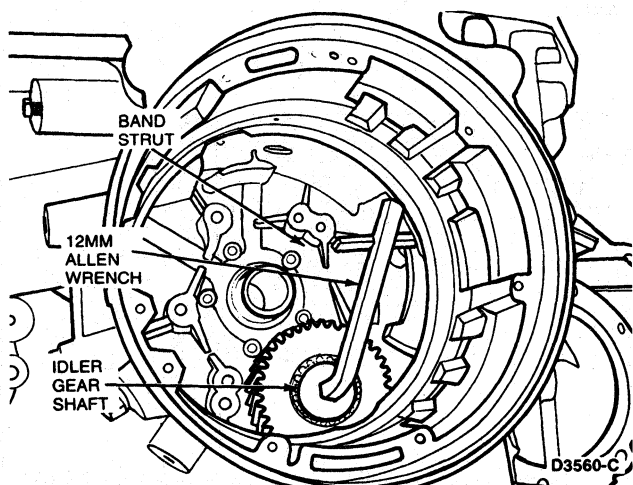
1. Clean threads of idler gear shaft and install a new O-ring.



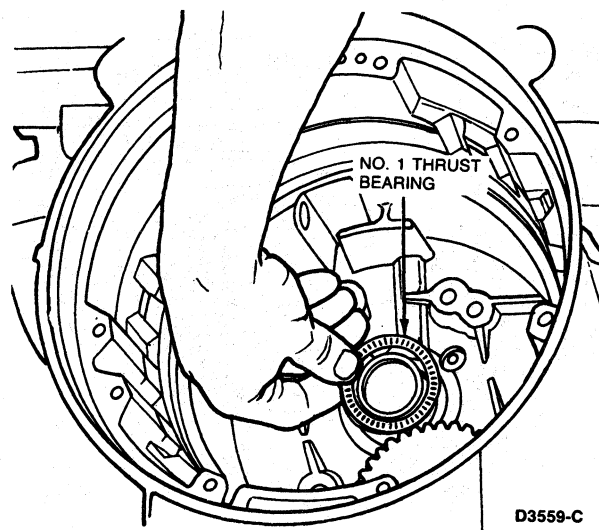
2. Position idler gear and shaft assembly in case.

Install a 12mm Allen wrench in idler gear shaft and bring it around until it catches on the band anchor strut.

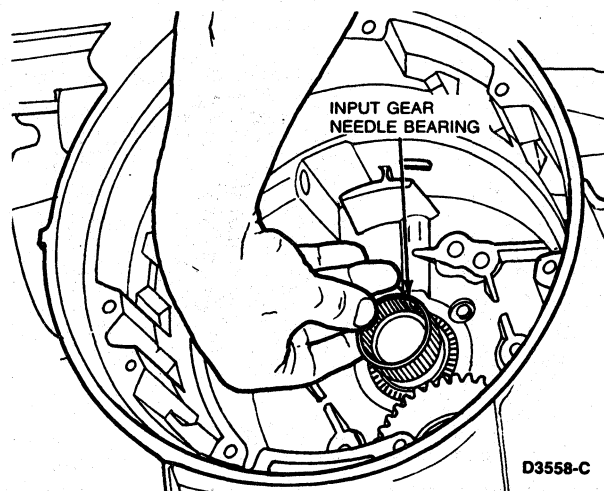
Apply Threadlock and Sealer E0AZ-19554-A or equivalent, to attaching nut. Install and tighten to 108-136 N·m (80-100 lb-ft) using a 32mm, 12 point socket.



3. Install No. 1 thrust bearing (needle type).



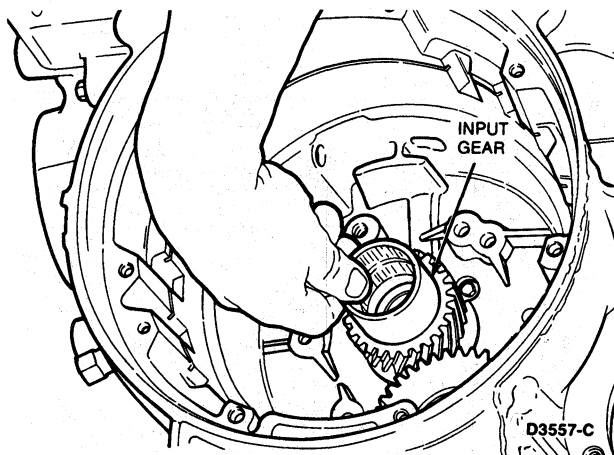
4. Install input gear caged needle bearing (No. 2 bearing).



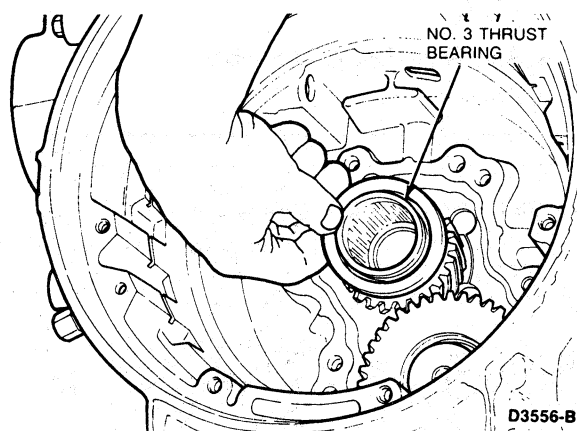


**DISASSEMBLY AND ASSEMBLY (Continued)**

5. Install input gear.



6. Install the No. 3 thrust bearing (needle type) on input gear.

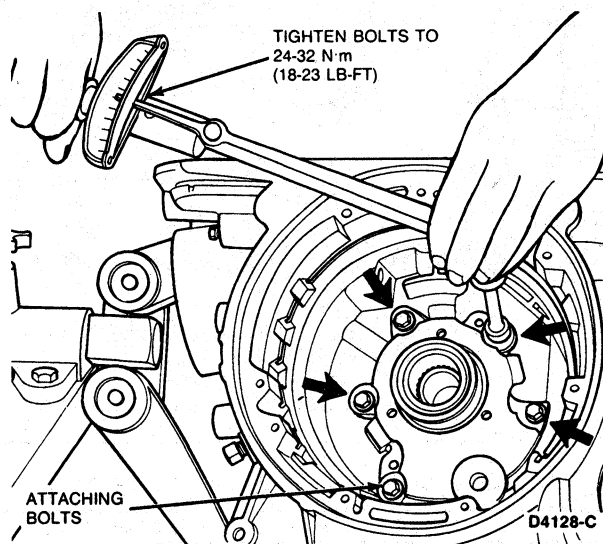


7. Position transfer housing in case. Ensure it is firmly seated on alignment dowels.

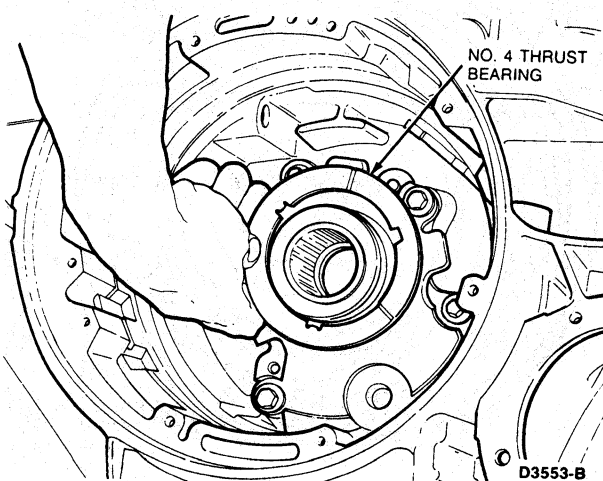
NOTE: The transmission case and transfer housing are matched parts. If one is damaged, both must be replaced.

8. Install new transfer housing attaching bolts and tighten to 18-23 N·m (24-32 lb-ft).

NOTE: Before installing transfer housing, ensure the band strut is rotated into its operating position.

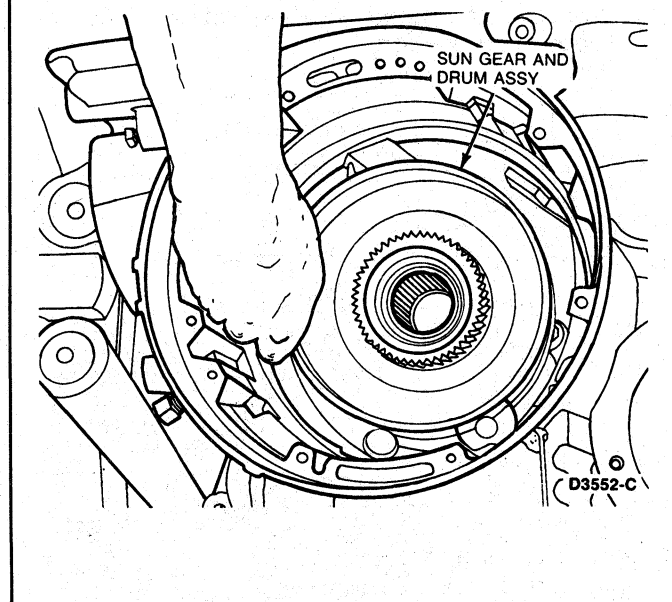


9. Install the No. 4 thrust washer on transfer housing.

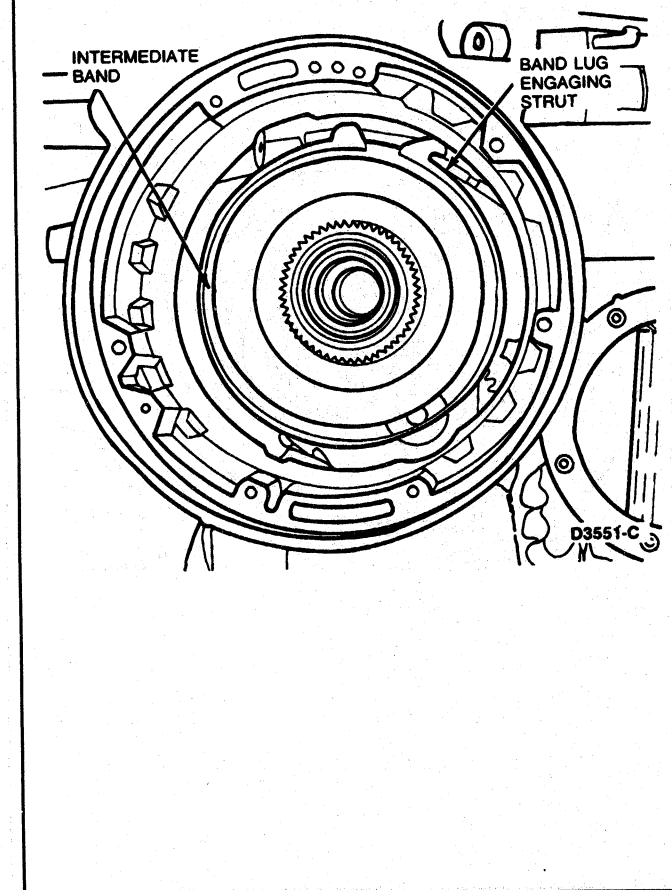


## DISASSEMBLY AND ASSEMBLY (Continued)

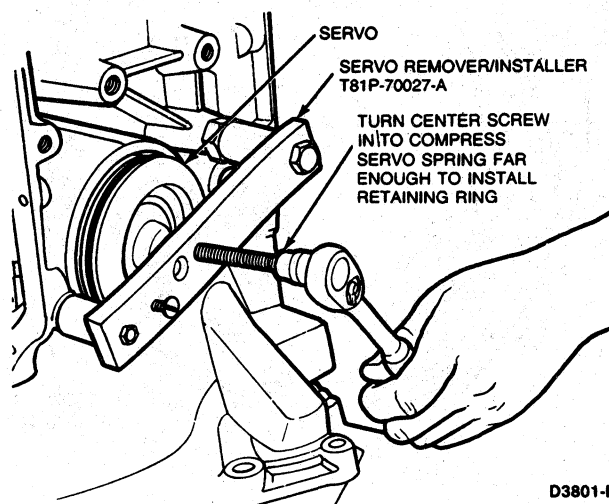
10. Install sun gear and drum assembly.



11. Install intermediate band. Ensure band lug engages strut.



12. Position servo piston in case and install Remover/Installer T81P-70027-A or equivalent. Compress piston spring far enough to allow installation of retaining ring.

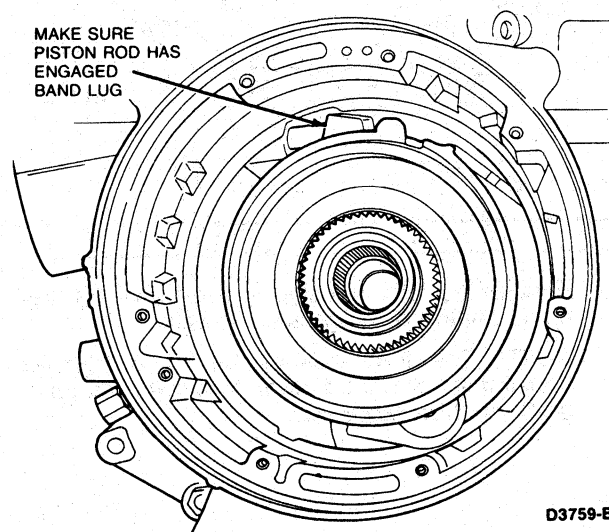


NOTE: If a component(s) listed below has been replaced, refer to the Servo Rod Selection procedure before installing the servo piston:

- Case
- Band
- Servo Rod
- Sun Gear/Drum Assembly
- Anchor Strut

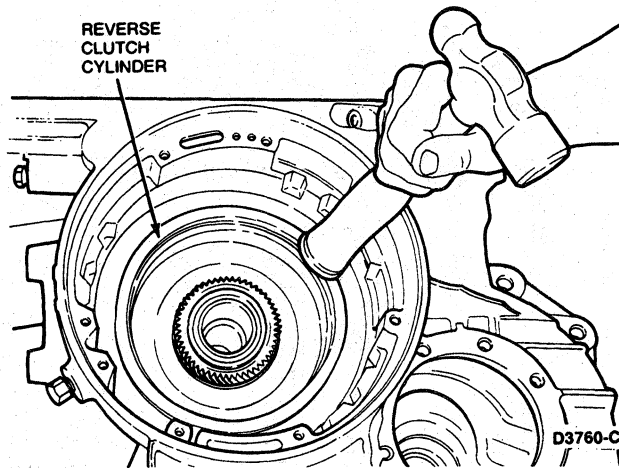
13. Install servo retaining ring.

Before removing tool, ensure piston rod has engaged band lug.

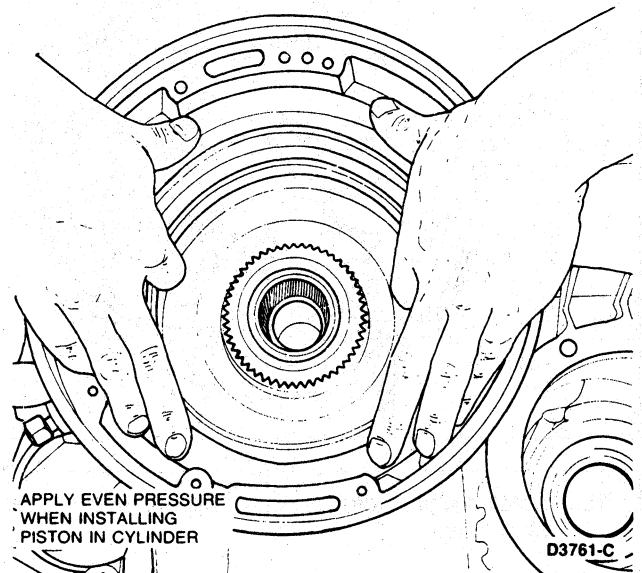


**DISASSEMBLY AND ASSEMBLY (Continued)**

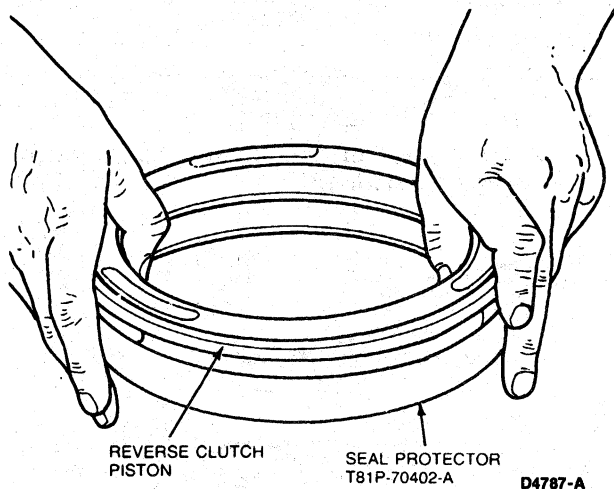
14. Position reverse clutch cylinder in case.  
Tap cylinder into case using a hammer needle.



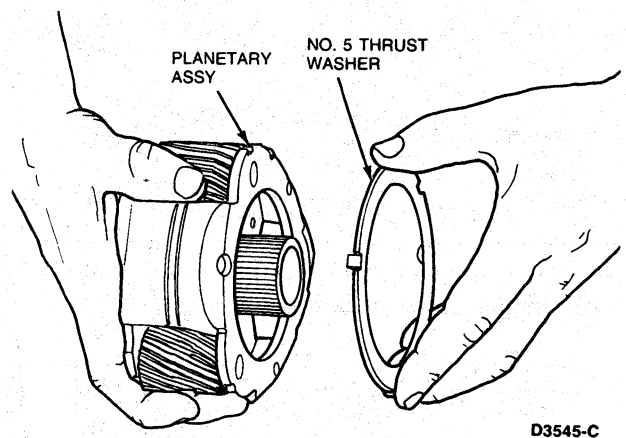
16. Install reverse clutch piston in clutch cylinder using Seal Protector T81P-70402-A or equivalent.



15. Install reverse clutch piston into Seal Protector T81P-70402-A or equivalent.

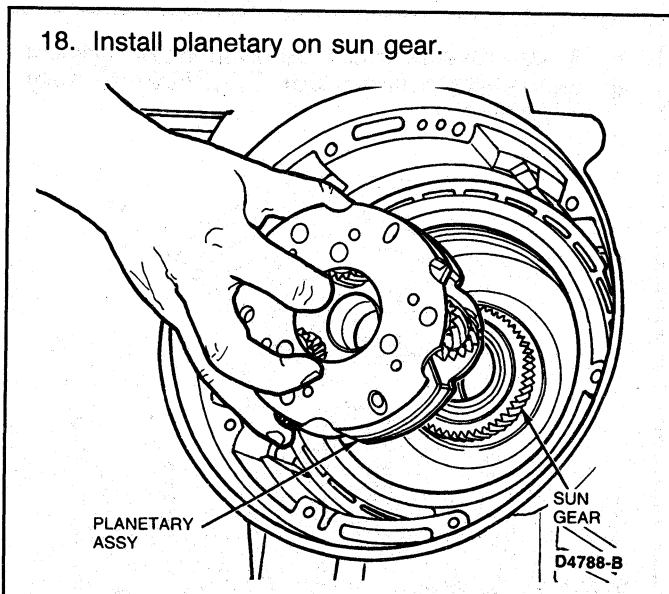


17. Install the No. 5 thrust washer on planetary assembly. Petroleum jelly can be used to hold washer in position.

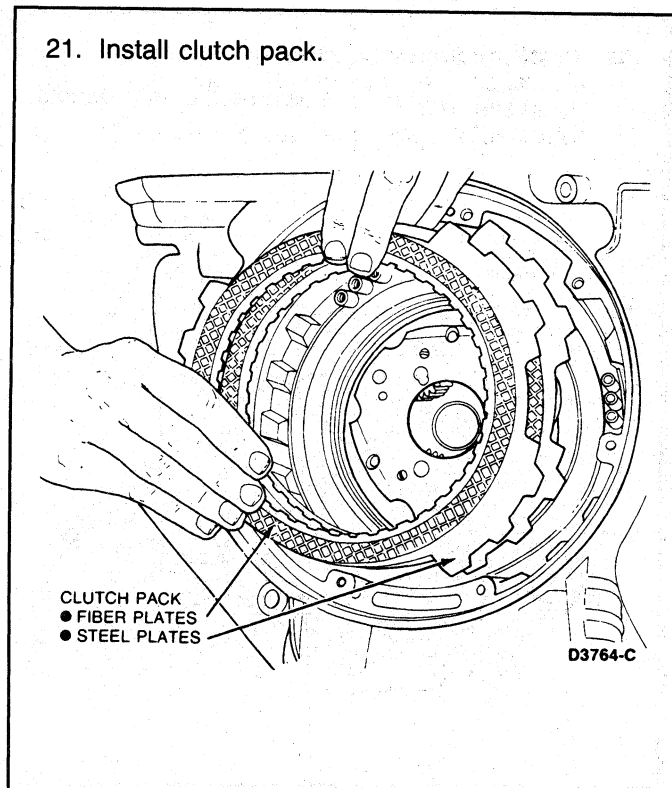


**DISASSEMBLY AND ASSEMBLY (Continued)**

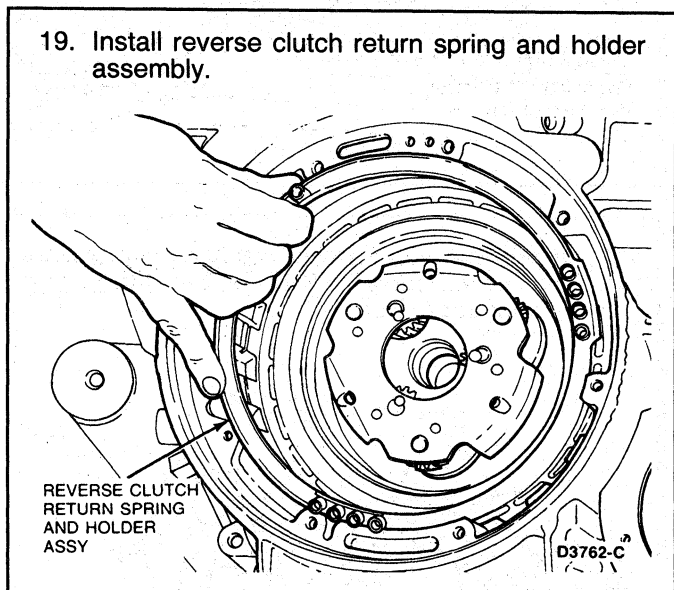
18. Install planetary on sun gear.



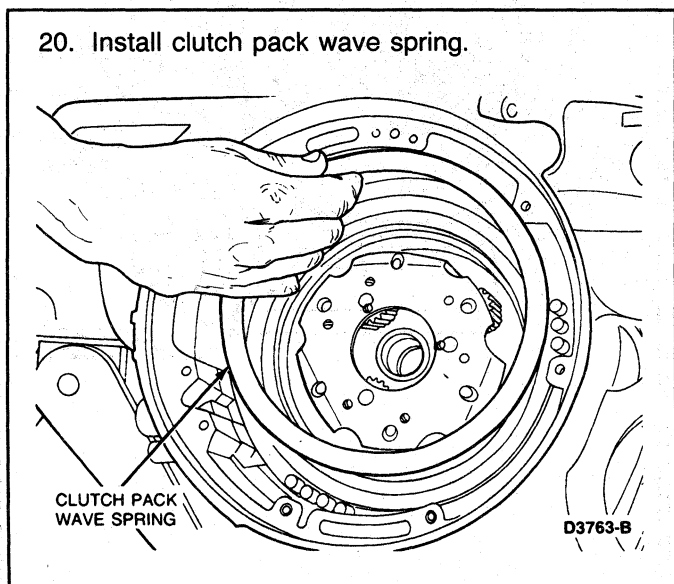
21. Install clutch pack.



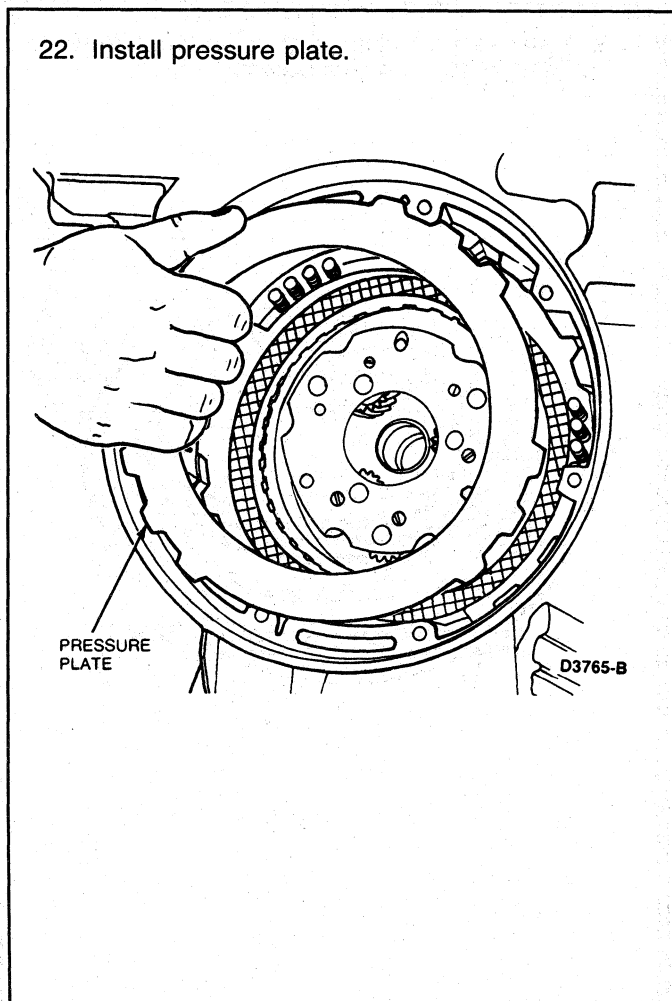
19. Install reverse clutch return spring and holder assembly.



20. Install clutch pack wave spring.

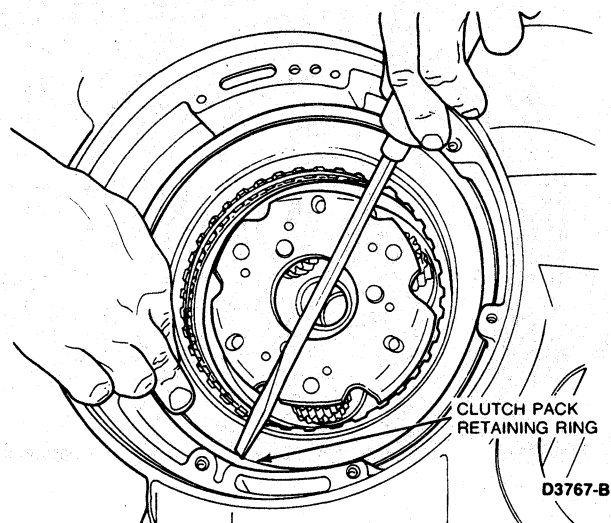


22. Install pressure plate.

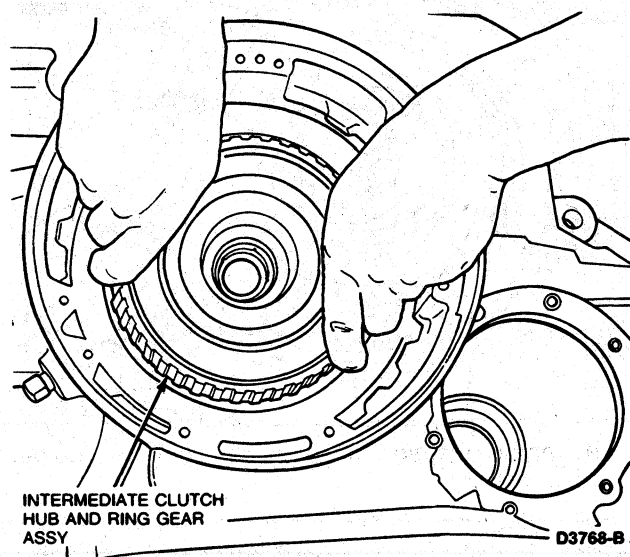


**DISASSEMBLY AND ASSEMBLY (Continued)**

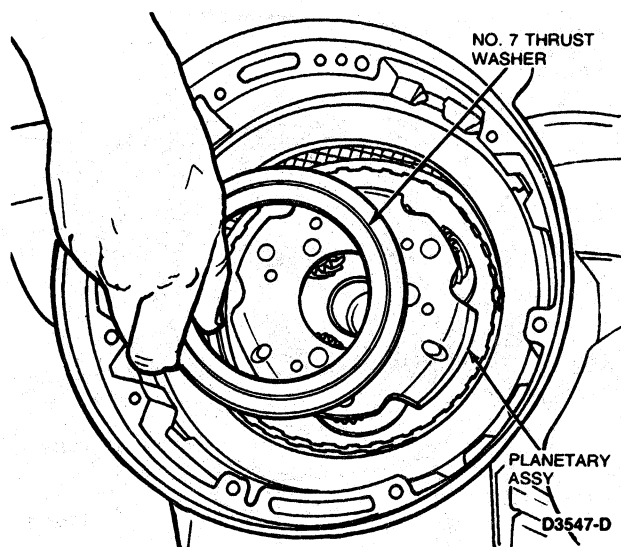
23. Install clutch pack retaining ring and check clearance between clutch retaining ring and pressure plate. Refer to Subassemblies, Intermediate Clutch, Assembly, Step 10.



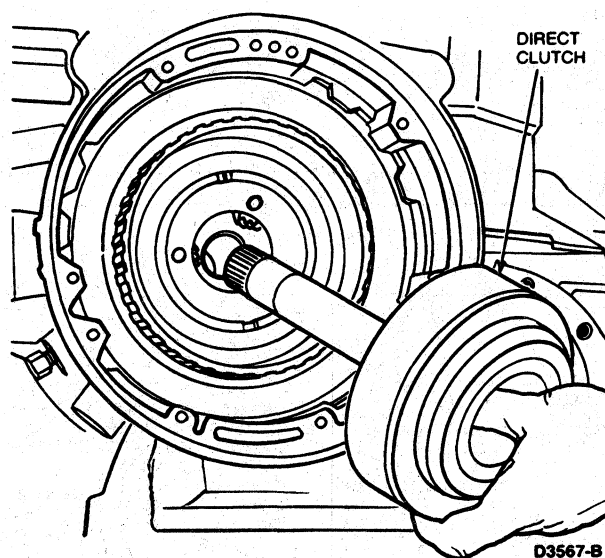
25. Install intermediate clutch hub and ring gear assembly. Rotate back and forth to fully engage.



24. Install No. 7 thrust washer on planetary assembly.

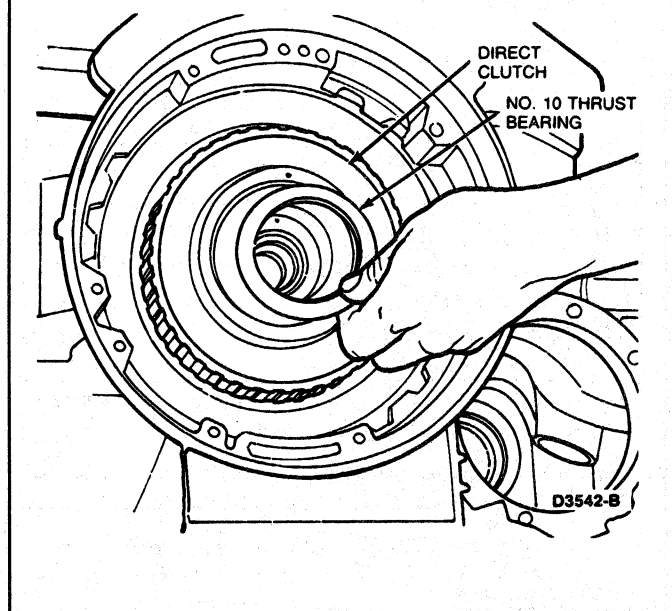


26. Install direct clutch.

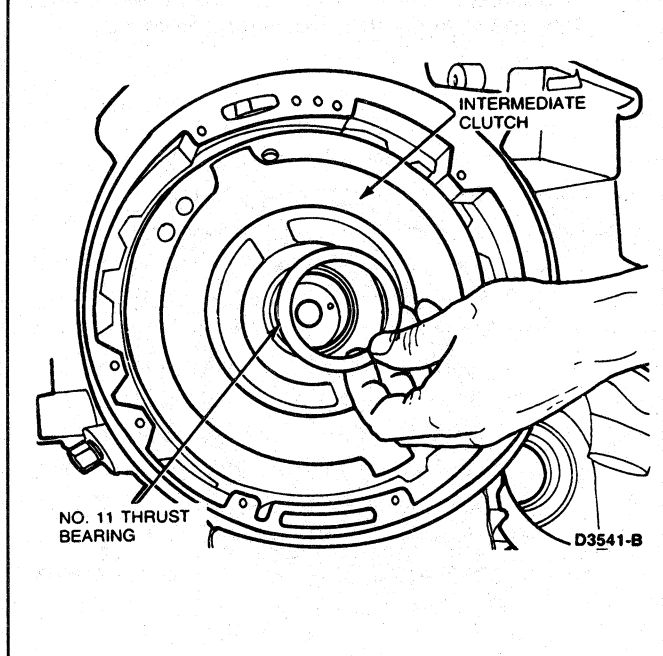


**DISASSEMBLY AND ASSEMBLY (Continued)**

27. Install No. 10 thrust bearing (needle type).

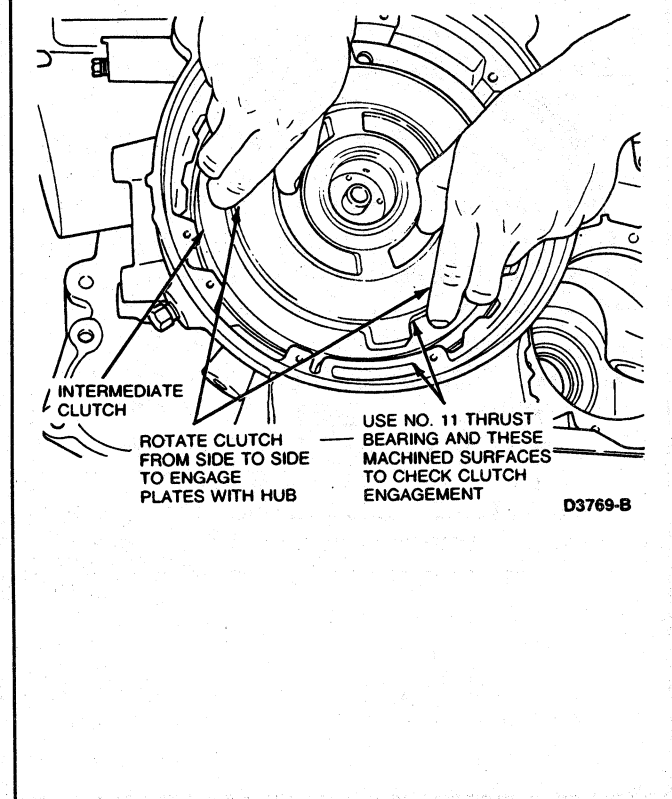


29. Install No. 11 thrust bearing (needle type).

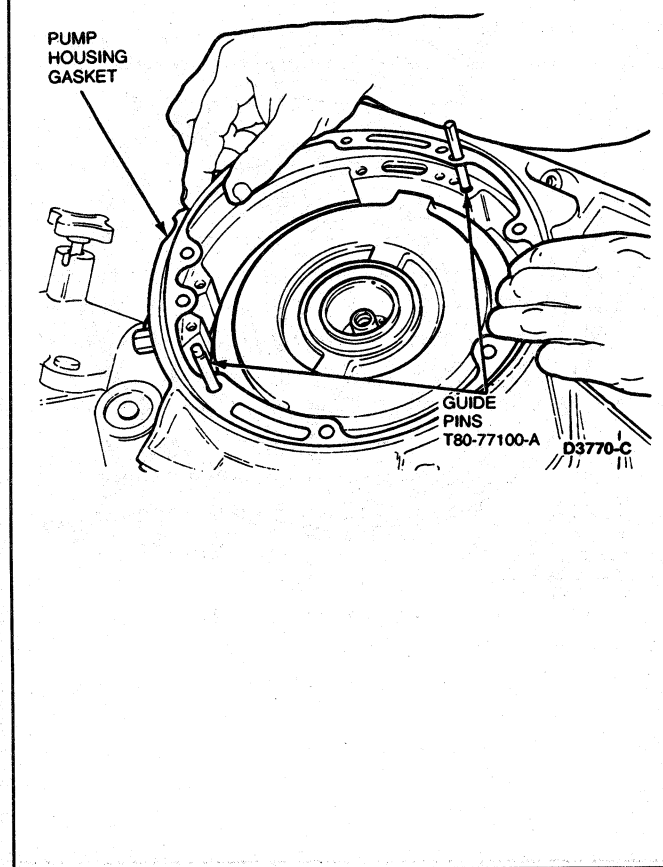


28. Install intermediate clutch.

To check clutch for proper engagement, use No. 11 thrust bearing. Position bearing on one of machined tabs and push it up against case. If bearing is flush with or slightly below machined pump housing surface, the clutch is fully engaged.



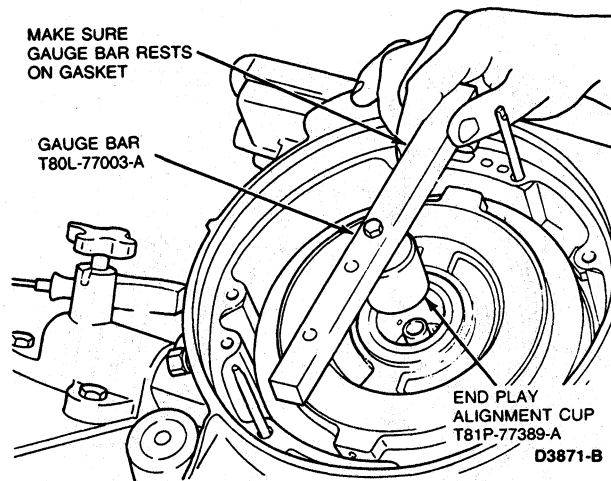
30. Install Guide Pins T80L-77100-A or equivalent, and pump housing gasket.



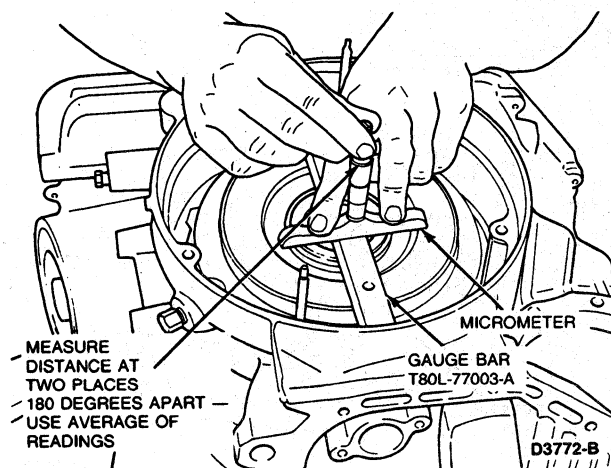
**DISASSEMBLY AND ASSEMBLY (Continued)**

31. If necessary, bolt End Play Alignment Cup T81P-77389-A to Gauge Bar T80L-77003-A or equivalent.

Position assembled tool in the intermediate clutch.



32. Using a micrometer, measure the distance from the top of the gauge bar to the top of the No. 11 thrust bearing. Make the measurement at two places 180 degrees apart and use average.



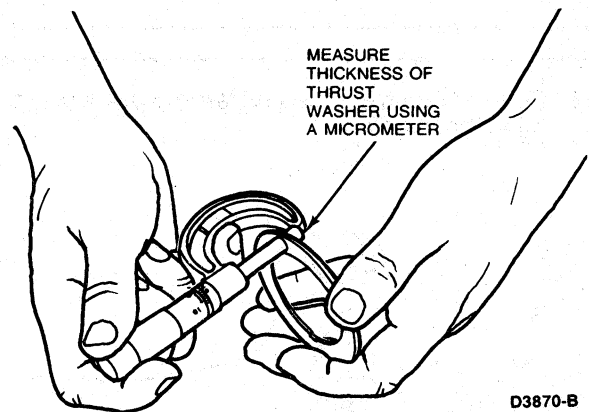
From the micrometer reading, choose the correct thickness from the Thrust Washer Selection Chart.

**THRUST WASHER SELECTION CHART**

For This Reading	Use This Washer Part ID
2.00-1.77mm (0.079-0.070 inch)	AA
2.20-2.00mm (0.087-0.079 inch)	BA
2.41-2.20mm (0.095-0.087 inch)	CA
1.77-1.46mm (0.070-0.057 inch)	EA

CD3890-C

**NOTE:** If the thrust washer thickness is not known, measure its thickness using a micrometer.



Then identify the washer using the Thrust Washer Thickness Chart.

**THRUST WASHER THICKNESS CHART**

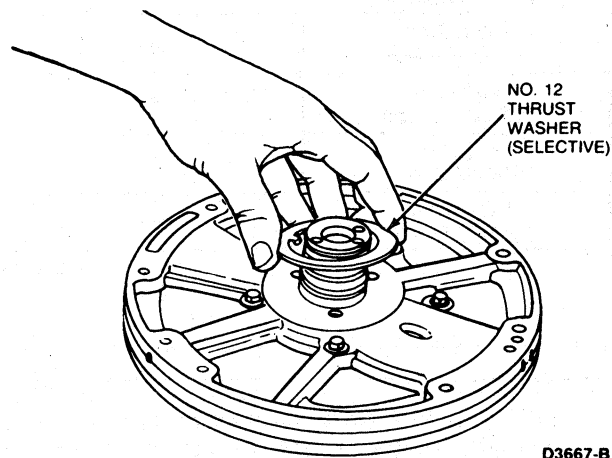
Thickness		ID
MM	Inch	
1.40-1.45	(.055-.057)	AA
1.60-1.65	(.063-.065)	BA
1.80-1.85	(.071-.073)	CA
1.15-1.20	(.045-.047)	EA

CD3891-B

## DISASSEMBLY AND ASSEMBLY (Continued)

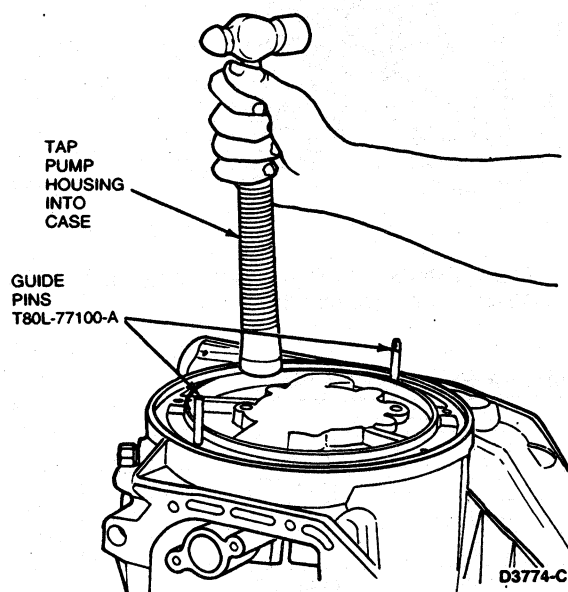
33. Install correct selective thrust washer (No. 12) on pump.

NOTE: Petroleum jelly can be used to hold washer in position.



D3667-B

34. Position pump in case and tap into place using a hammer handle.

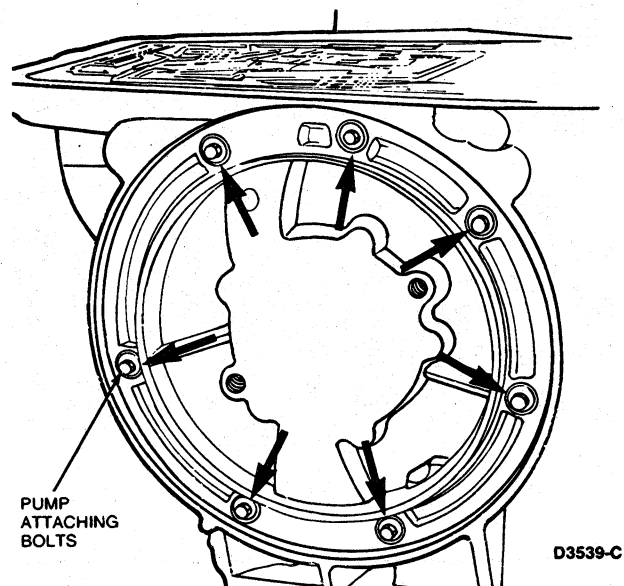


D3774-C

35. Remove alignment pins and install seven new pump attaching bolts and sealing washers.

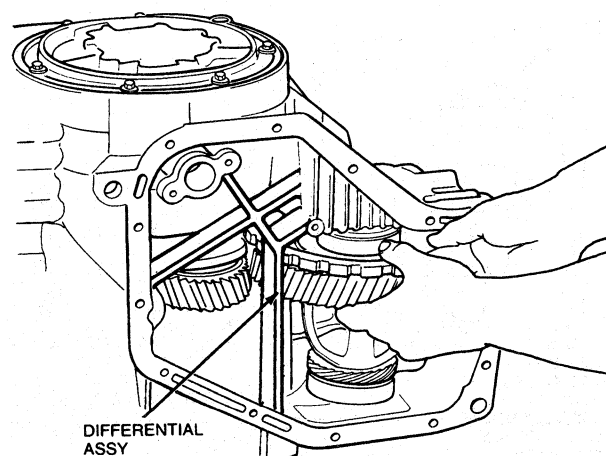
**CAUTION: The washers provide the bolt seal and must not be substituted. Failure to use the sealing washers may result in a transaxle fluid leak.**

Tighten bolts to 9-12 N·m (7-9 lb-ft).



D3539-C

36. Install differential assembly.

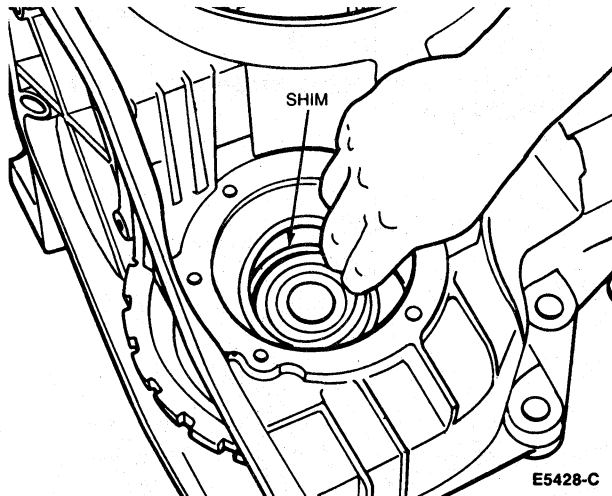


D4505-C

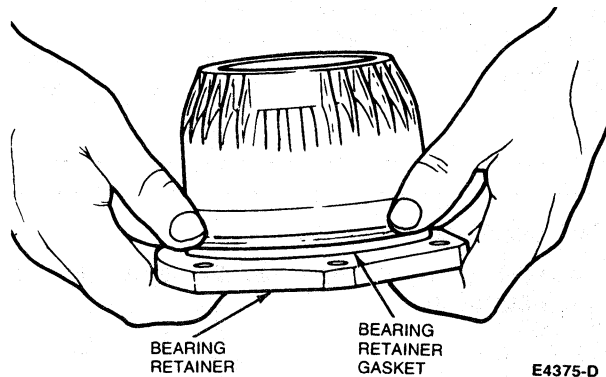


## DISASSEMBLY AND ASSEMBLY (Continued)

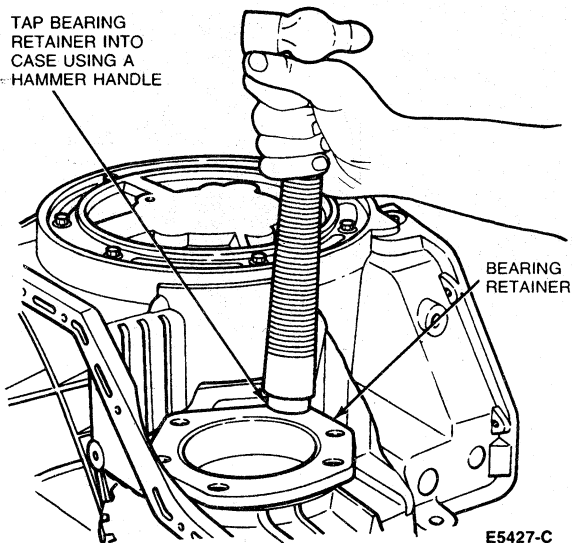
37. Install differential bearing spacer shim.



38. Install a new gasket on differential retainer.



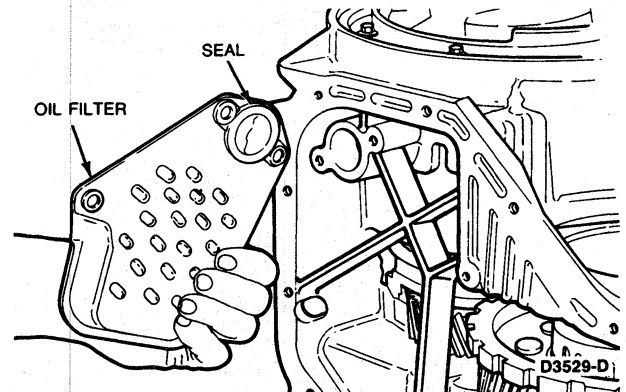
Position retainer in case. Tap retainer into case using a hammer handle.



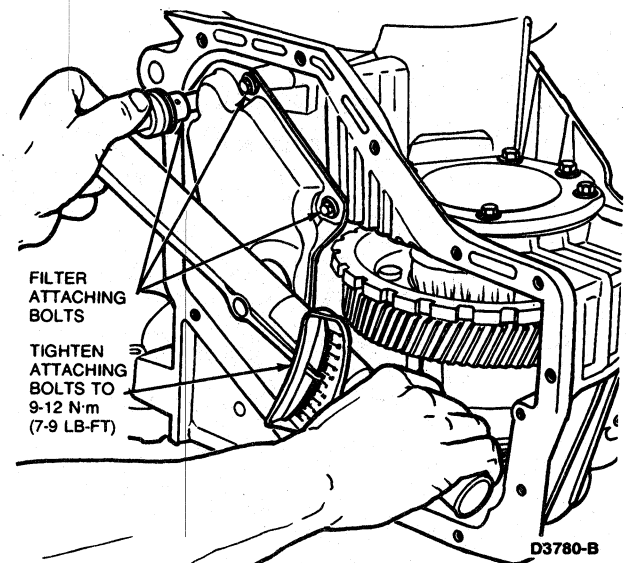
39. Apply Thread-Lock Sealer E0AZ-19554-A or equivalent to threads of bearing retainer attaching bolts.

Install bolts. Tighten to 20-26 N·m (15-19 lb-ft).

40. Position a new seal on filter and install filter.



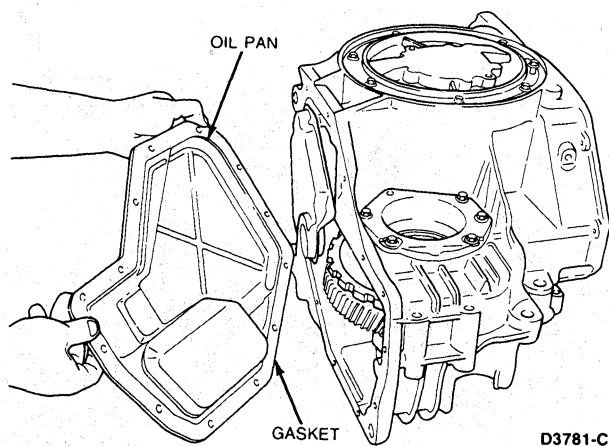
Apply Threadlock and Sealer E0AZ-19554-A or equivalent to filter bolts and install filter attaching bolts. Tighten bolts to 9-12 N·m (7-9 lb-ft).



**DISASSEMBLY AND ASSEMBLY (Continued)**

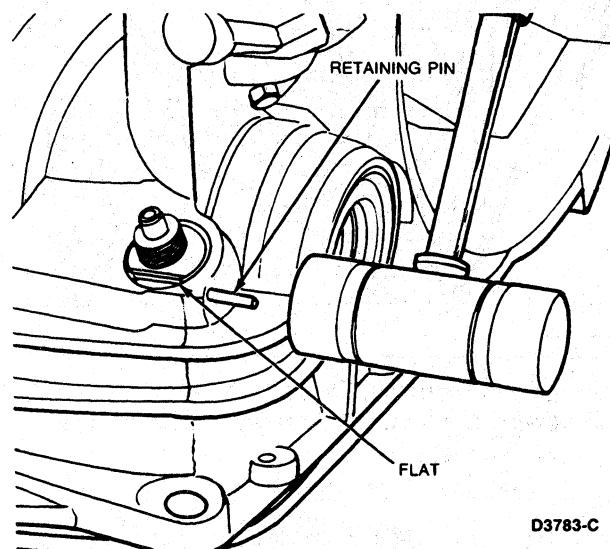
41. Install oil pan using a new gasket.

Install oil pan attaching bolts. Tighten bolts to 20-26 N·m (15-19 lb-ft).

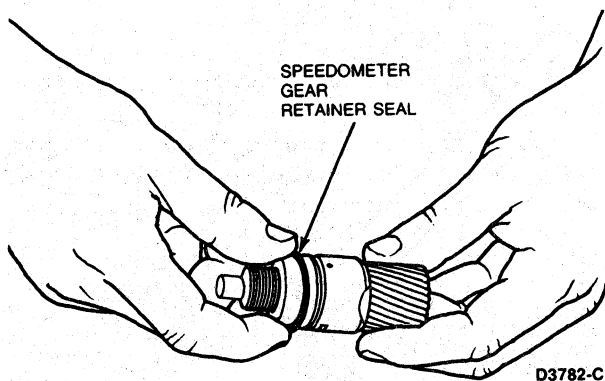


43. Install speedometer gear retainer in case and tap into position using a plastic tipped hammer. With speedometer retainer seated, tap retaining pin into case.

NOTE: Ensure flat is properly aligned before installing pin.

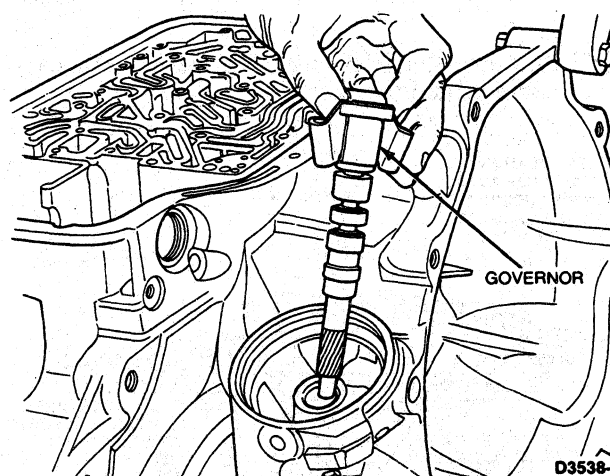


42. Install a new seal on speedometer gear retainer.



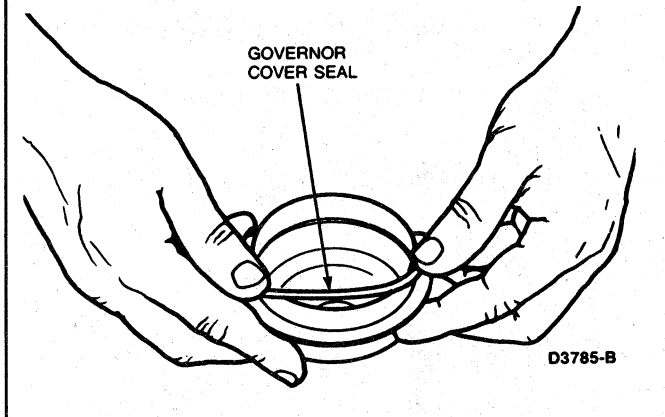
44. Install governor.

NOTE: Inspect governor for wear prior to installation.

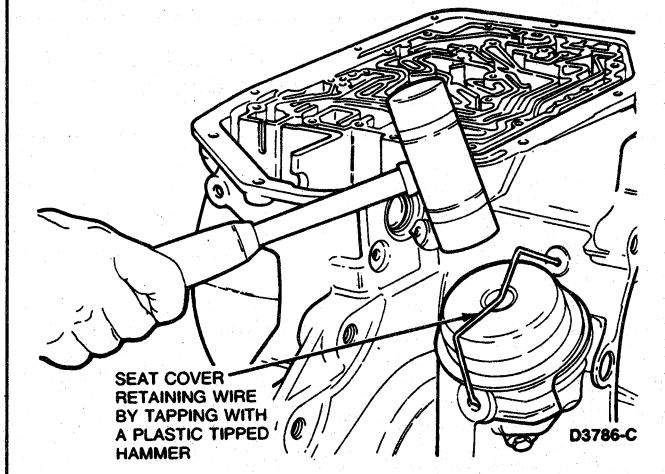


**DISASSEMBLY AND ASSEMBLY (Continued)**

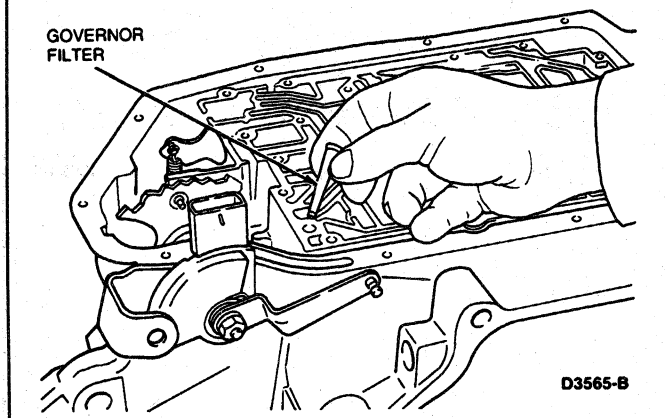
45. Install a new seal on governor cover and position cover on case.



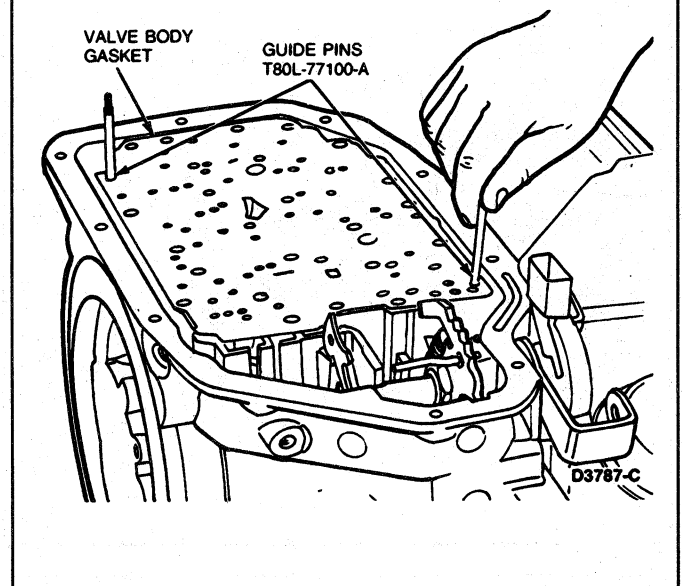
46. Tap governor cover with a plastic tipped hammer to seat in case.  
 NOTE: Tap near outer edge to avoid cracking plastic cover.
47. Install cover retaining wire.



48. Install governor filter.  
 Ensure filter is clean before installing.



49. Position valve body gasket on case and install Guide Pins T80L-77100-A or equivalent to hold gasket in position.



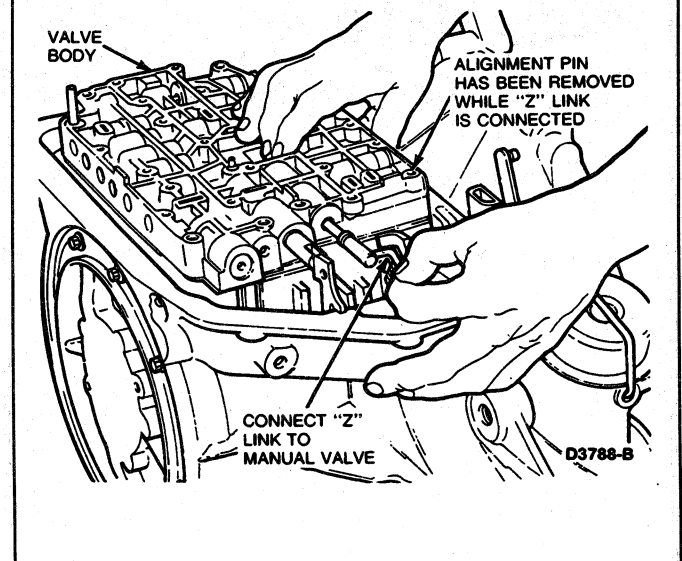
50. Install valve body.

Connect throttle valve control spring to separator plate. The spring stretches from inner lever cam to separator plate.

Install Z-link in manual valve while positioning valve body on case.

NOTE: One alignment pin has to be removed to allow the Z-link to be installed in the manual valve.

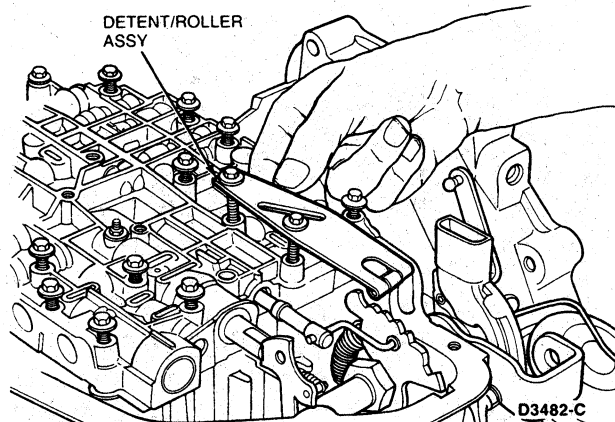
Ensure roller on end of throttle valve plunger has engaged cam on the end of throttle lever shaft.



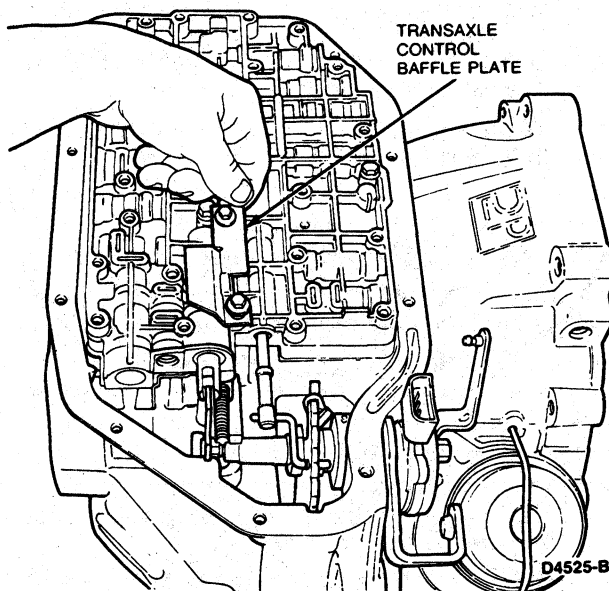
**DISASSEMBLY AND ASSEMBLY (Continued)**

51. Install alignment pin removed in Step 50.

52. Install detent spring and roller assembly.

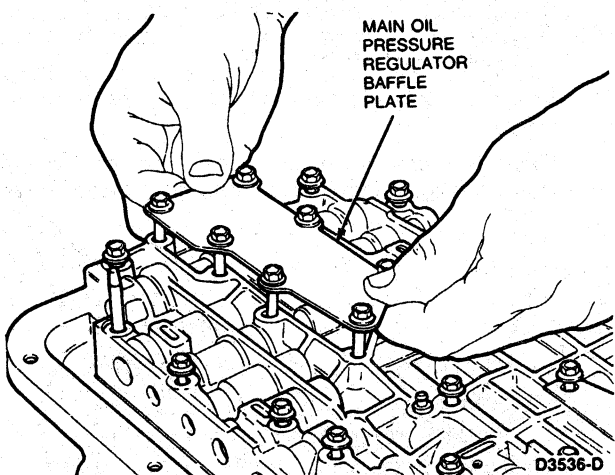


54. Install transaxle control baffle plate.

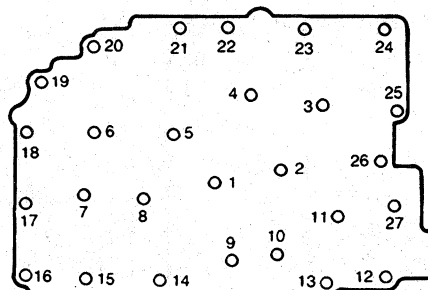


53. Install main oil pressure regulator baffle plate.

**NOTE:** The main oil pressure regulator plate uses longer attaching bolts.



55. Tighten valve body attaching bolts to 8-11 N·m (72-96 lb-in) in the sequence shown.



FROM PUMP SIDE OF CASE

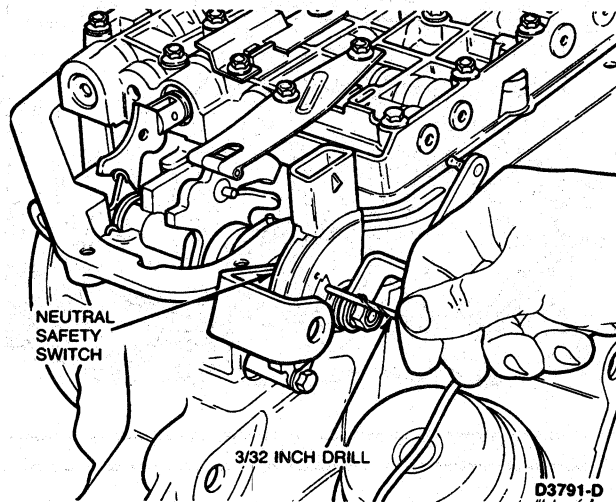
D3483-B

**DISASSEMBLY AND ASSEMBLY (Continued)**

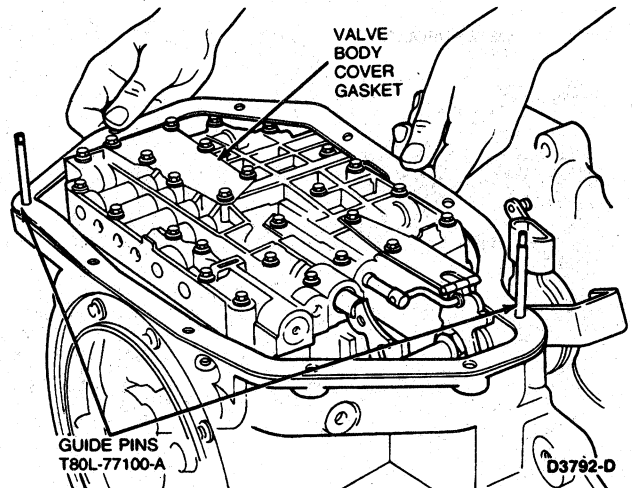
56. If necessary, loosen neutral safety switch attaching bolts.

With manual valve in neutral position, insert a No. 43 drill (.089 inch) through neutral safety switch. Push drill through switch until it seats against case.

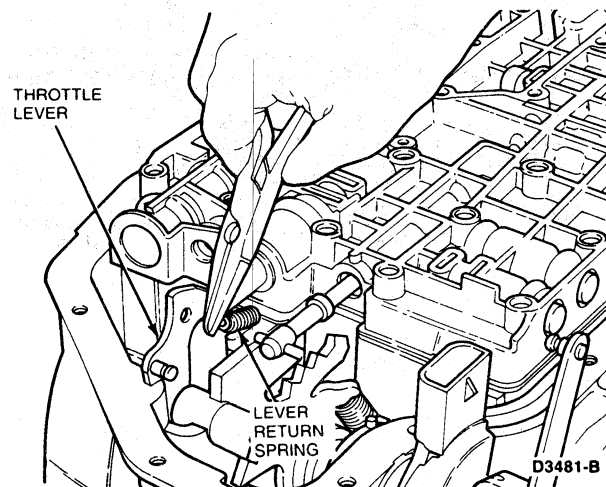
Tighten switch attaching bolts to 9-12 N·m (7-9 lb-ft) and remove drill.



58. Install Guide Pins T80L-77100-A or equivalent and a new valve body cover gasket.



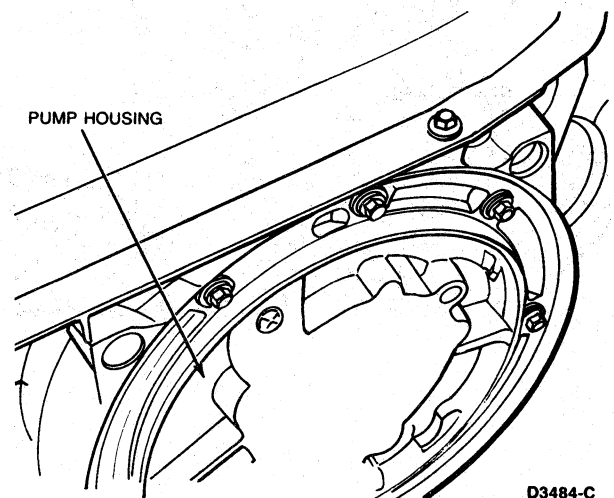
57. Connect throttle lever return spring to spring anchor on throttle lever.



59. Install valve body cover and cover attaching bolts.

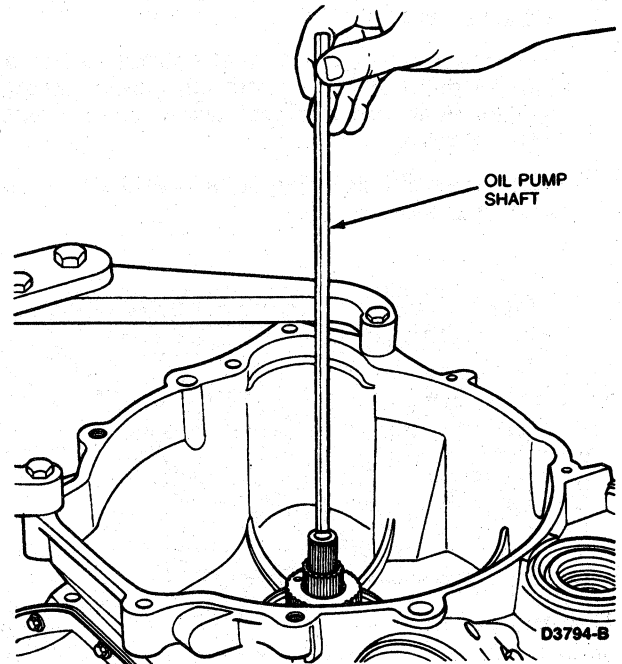
NOTE: Ensure transmission identification tag is installed in its original position.

60. Tighten valve body cover attaching bolts to 9-12 N·m (7-9 lb-ft).



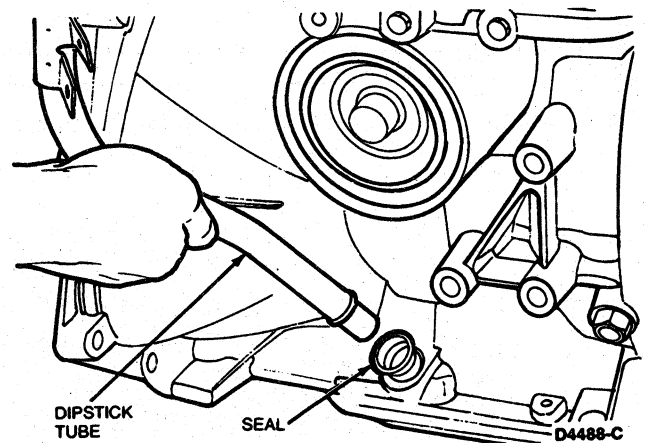
**DISASSEMBLY AND ASSEMBLY (Continued)**

61. Install oil pump shaft.



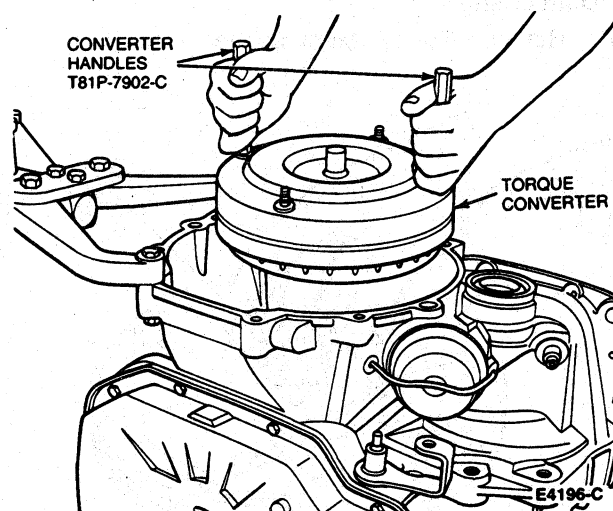
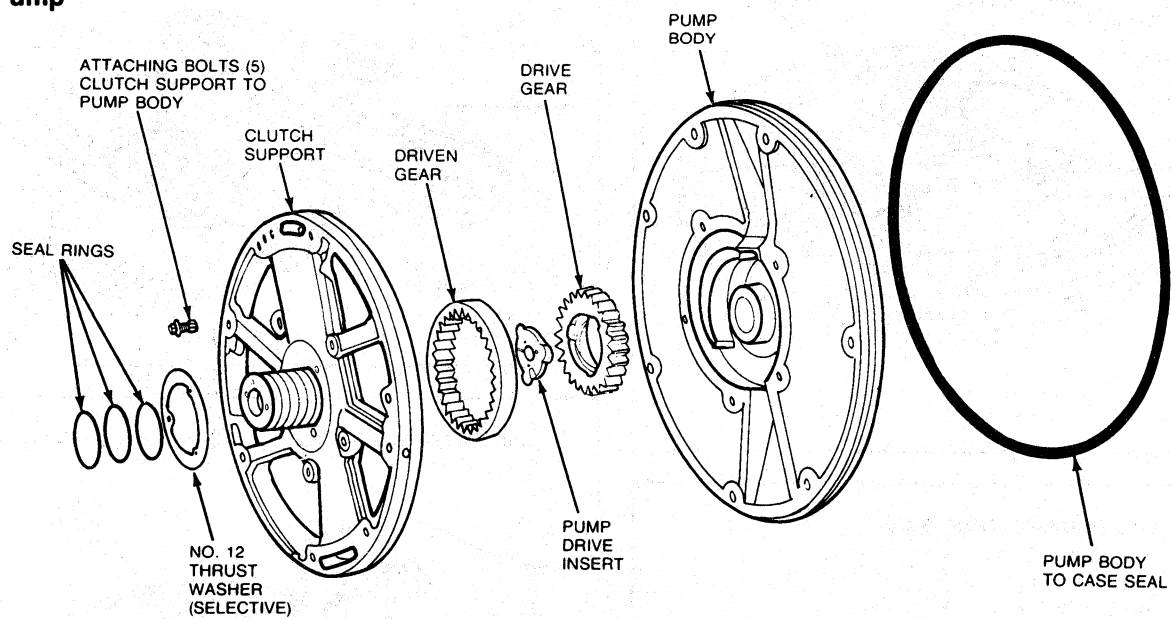
62. Install a new seal on fluid level dipstick tube and install tube in case.

Tighten tube attaching bolts to 9-12 N·m (7-9 lb-ft).



**DISASSEMBLY AND ASSEMBLY (Continued)**

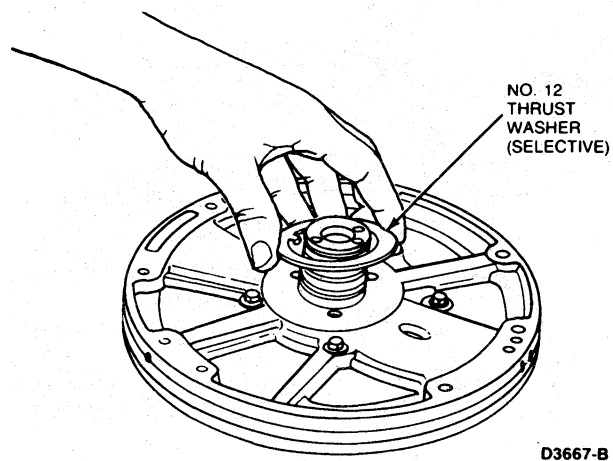
63. Install torque converter using Converter Handles T81P-7902-C or equivalent.

**Subassemblies****Pump****Sub-Assemblies****Pump**

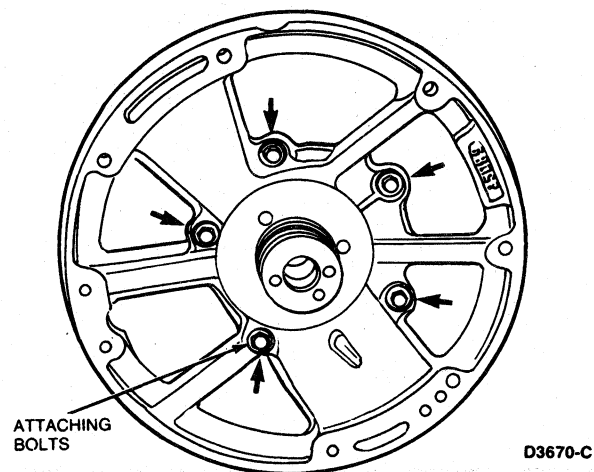
D3666-B

**DISASSEMBLY AND ASSEMBLY (Continued)****Disassembly**

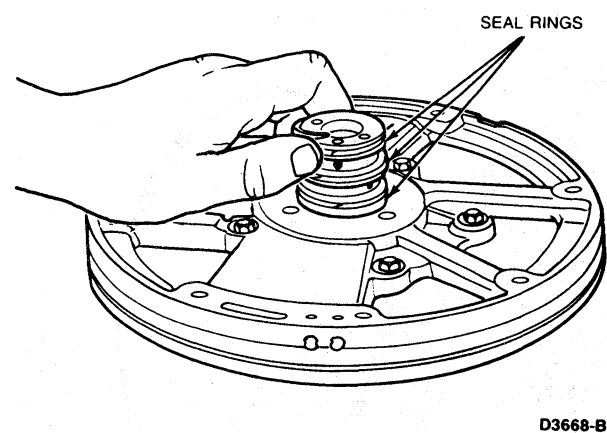
1. Remove No. 12 thrust washer (selective).



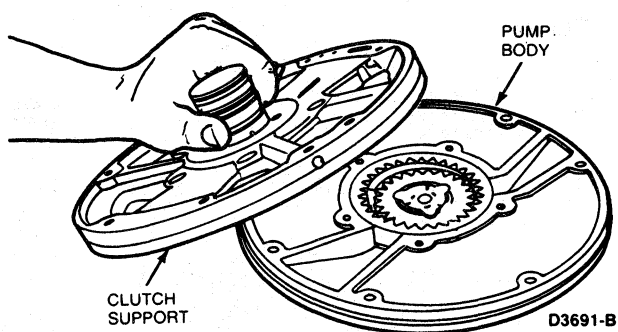
4. Remove five clutch support-to-pump body attaching bolts.



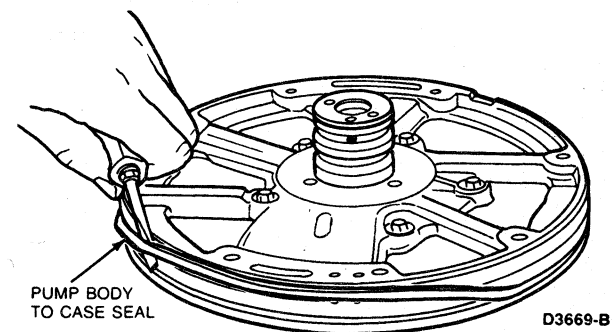
2. Remove seal rings from clutch support.



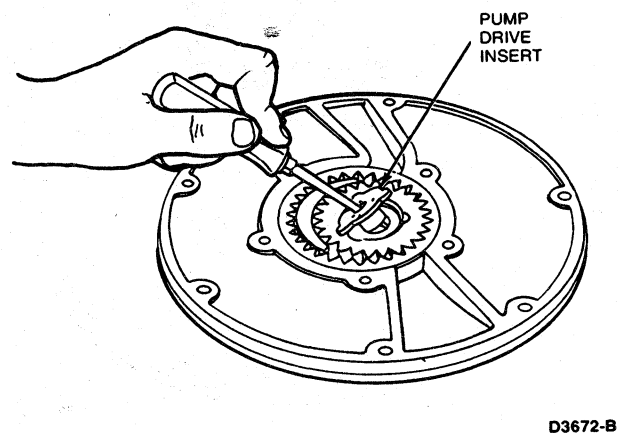
5. Remove clutch support from pump body.



3. Remove pump-to-case seal.



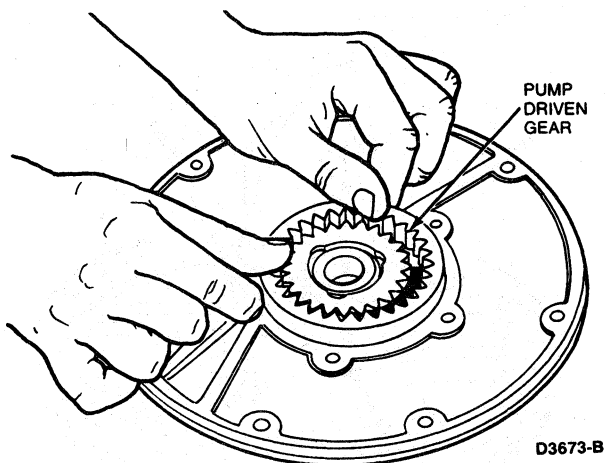
6. Remove insert from pump drive gear.



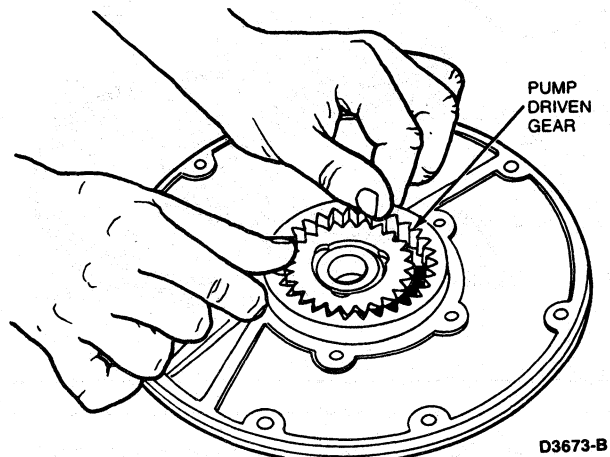


**DISASSEMBLY AND ASSEMBLY (Continued)**

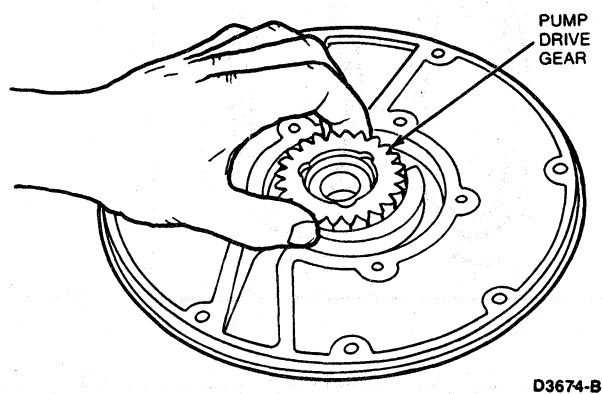
7. Remove pump driven gear.



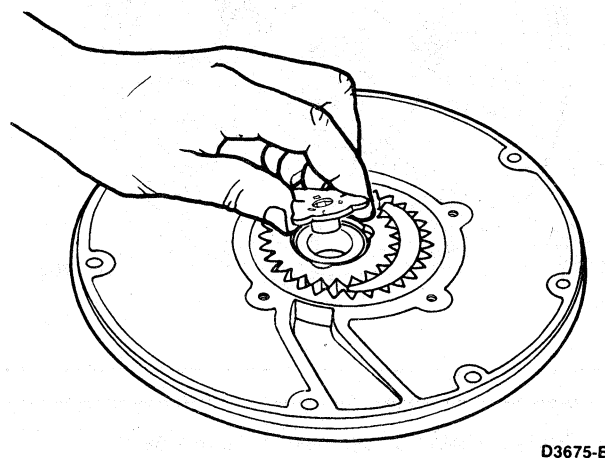
2. Install pump driven gear.



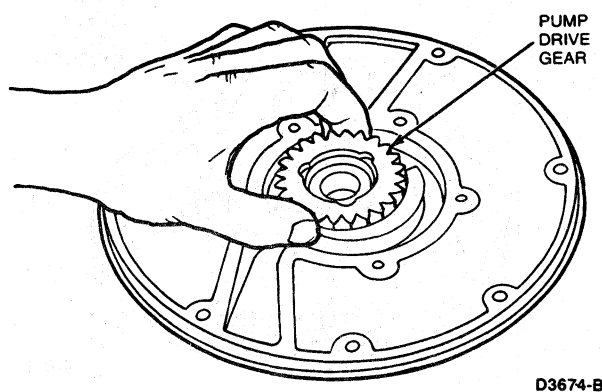
8. Remove pump drive gear.



3. Install pump drive insert.

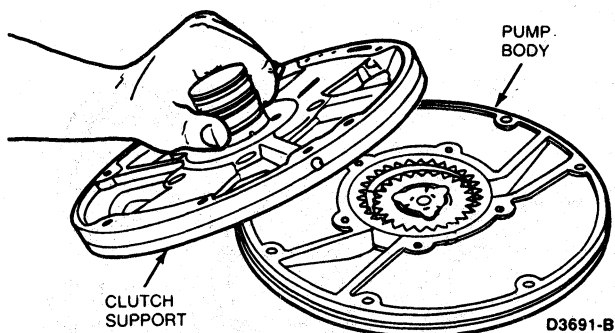
**Assembly**

1. Install pump drive gear.

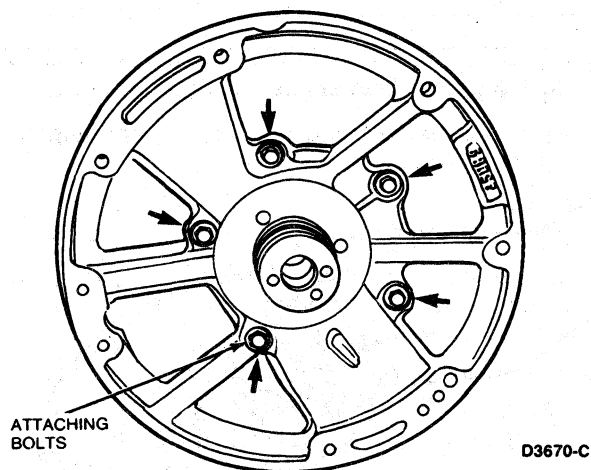


**DISASSEMBLY AND ASSEMBLY (Continued)**

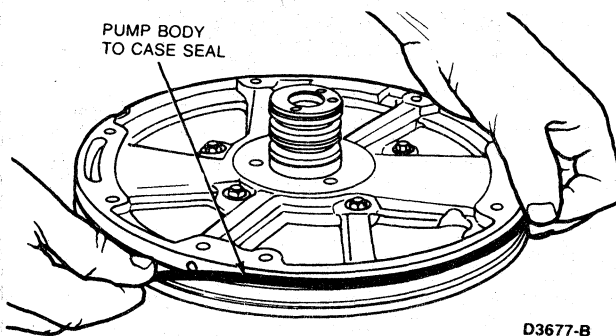
4. Position clutch support on pump body.



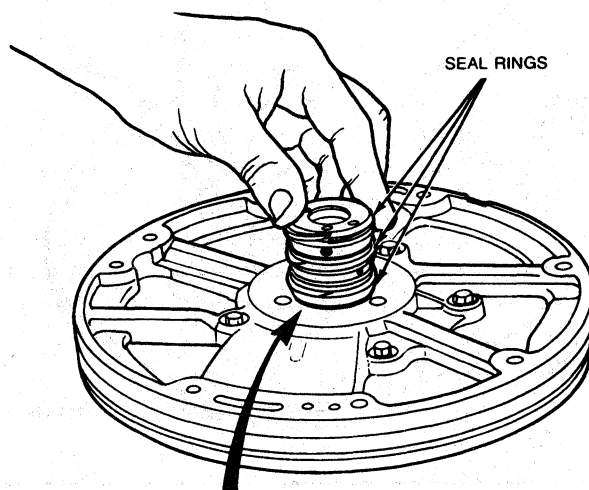
5. Install five clutch support-to-pump body attaching bolts. Tighten bolts to 8-11 N·m (6-8 lb-ft).



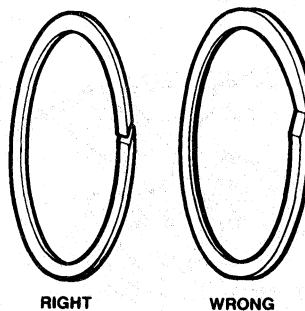
6. Install a new pump body to case seal.



7. Install seal rings.

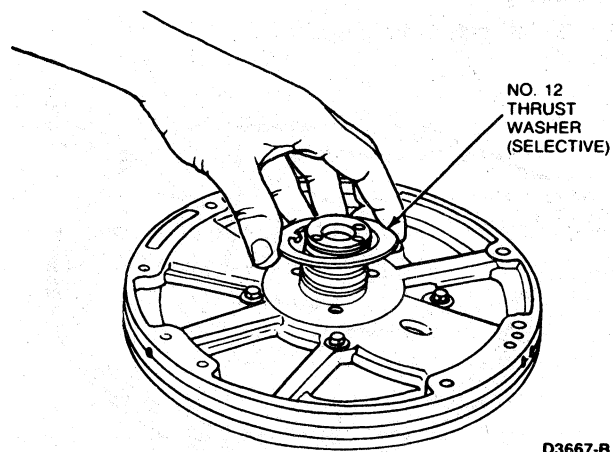


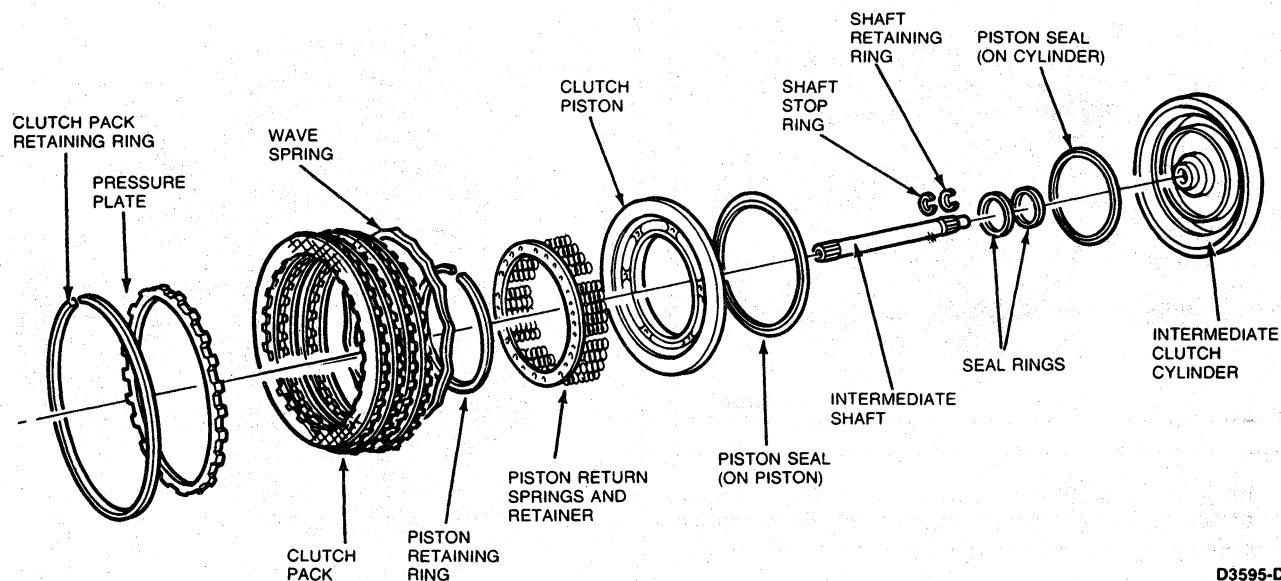
NOTE: SCARF CUT SEALS  
MUST OVERLAP AS SHOWN



D3678-B

8. Install the No. 12 thrust washer (selective).

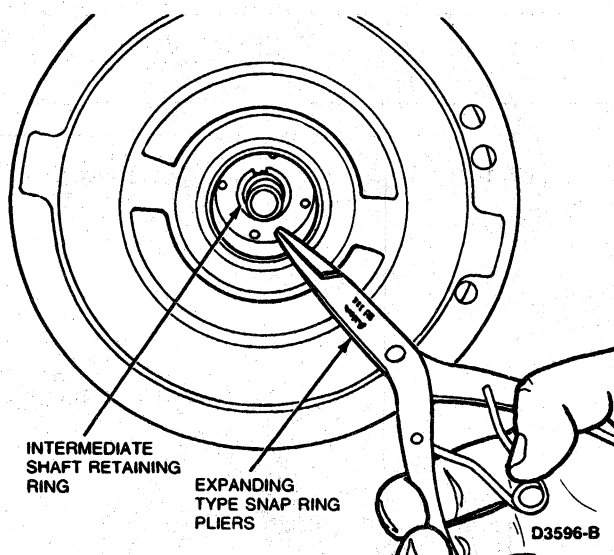


**DISASSEMBLY AND ASSEMBLY (Continued)****Intermediate Clutch**

D3595-D

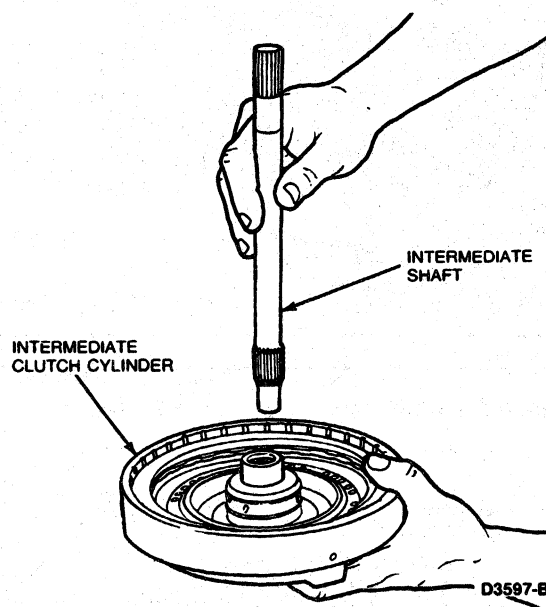
**Disassembly**

1. Using expanding type snap ring pliers, remove intermediate shaft retaining ring.



D3596-B

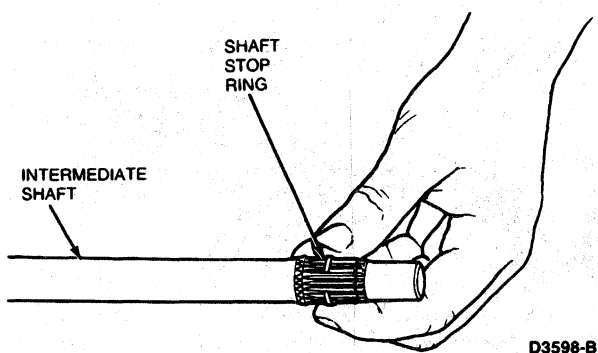
2. Remove intermediate shaft from intermediate clutch cylinder.



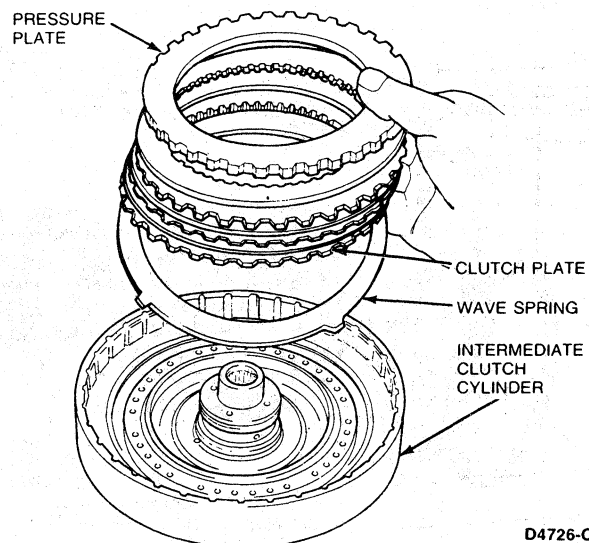
D3597-B

**DISASSEMBLY AND ASSEMBLY (Continued)**

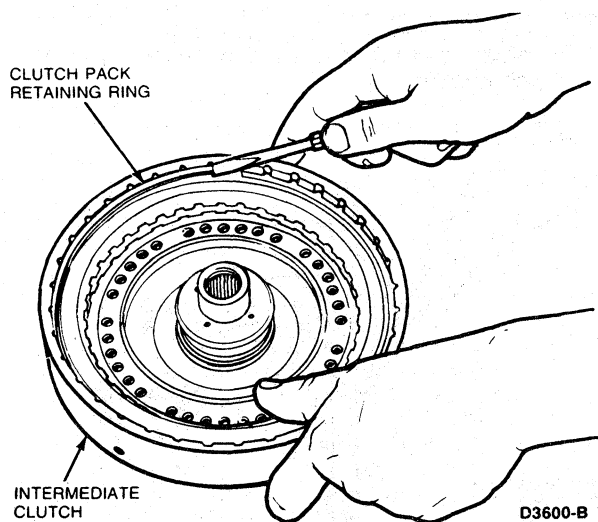
3. Inspect intermediate shaft stop ring. Remove ring if damaged.



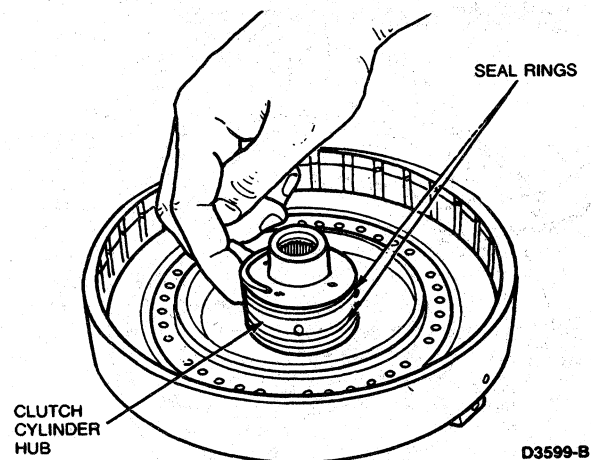
5. Remove pressure plate, clutch pack and wave spring.



4. Remove clutch pack retaining ring.

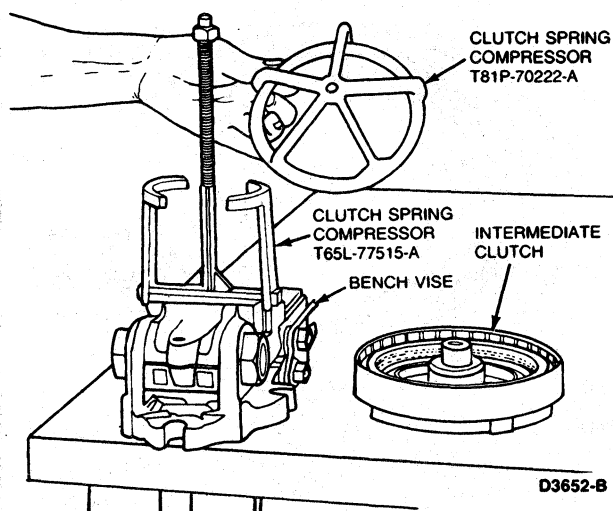


6. Remove seal rings from clutch cylinder hub.

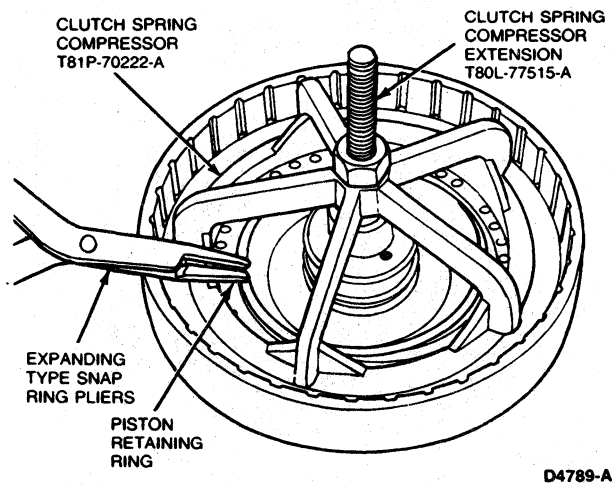
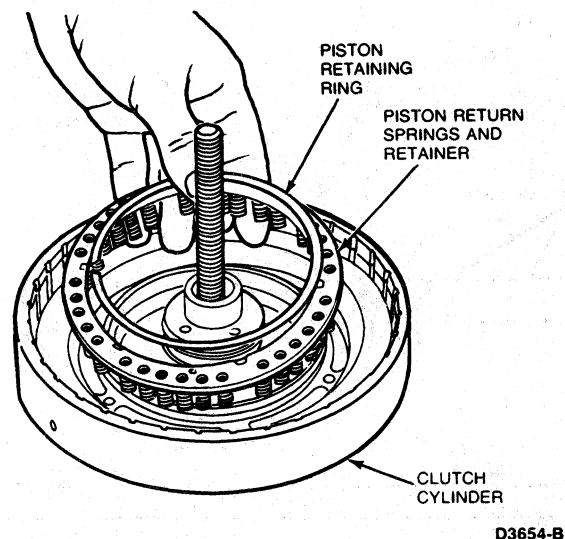


**DISASSEMBLY AND ASSEMBLY (Continued)**

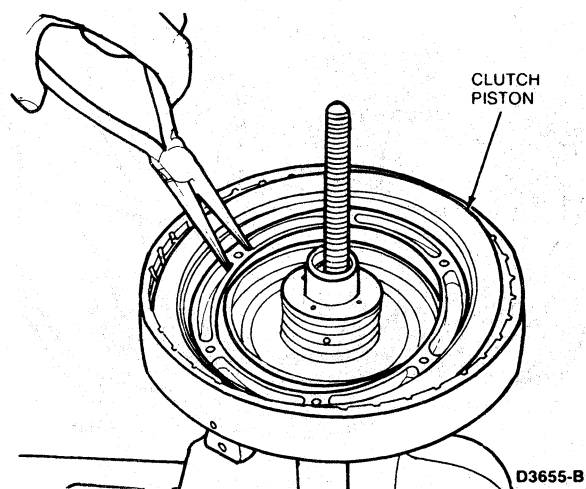
7. Remove piston retaining ring using a bench vise and special tools shown.



8. Remove retaining ring and piston return spring retainer.

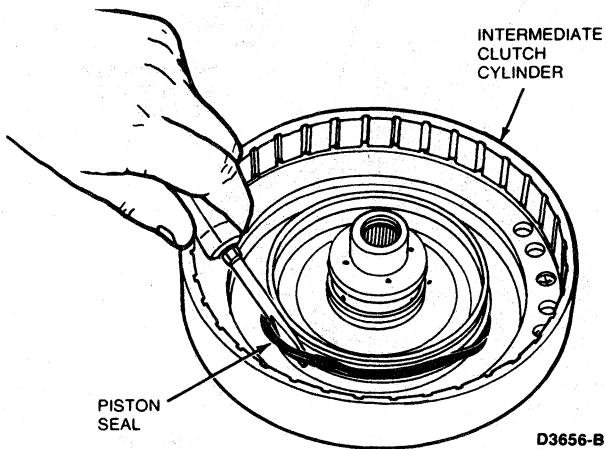


9. Remove clutch piston using pliers.

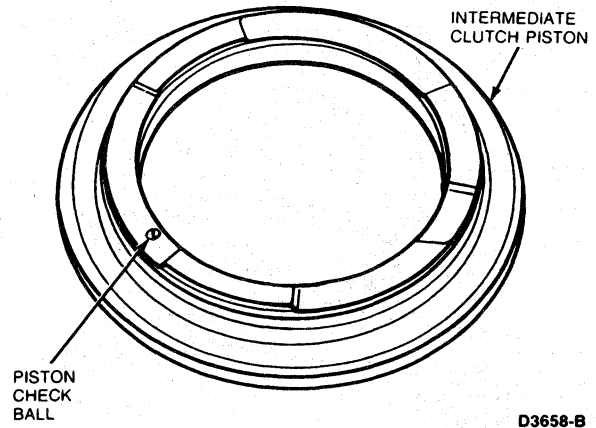


**DISASSEMBLY AND ASSEMBLY (Continued)**

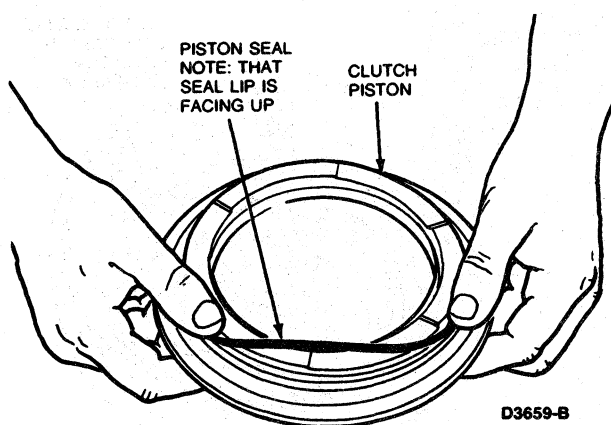
10. Remove piston seal from intermediate clutch cylinder.

**Assembly**

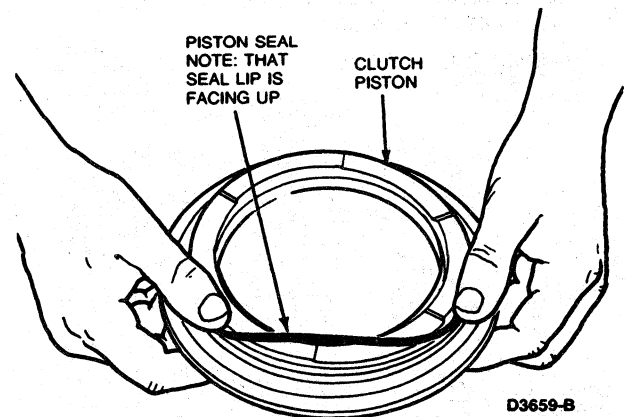
1. Inspect piston check ball. Ensure ball is present and free in cage.



11. Remove seal from clutch piston.

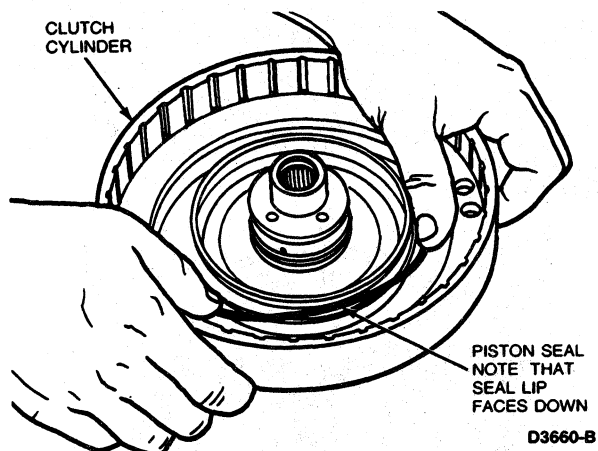


2. Install seal on piston.

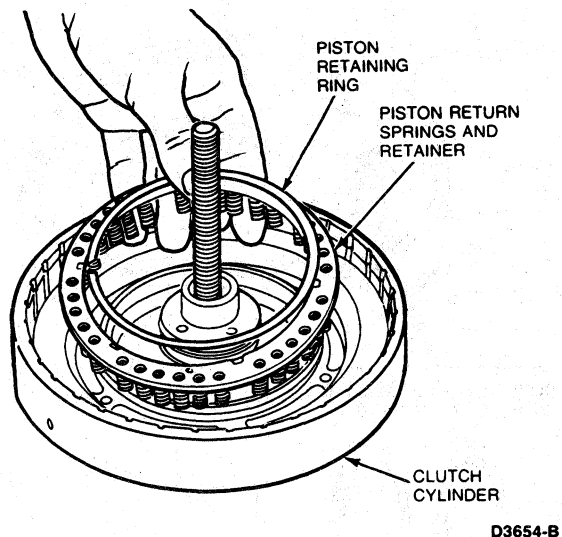


## DISASSEMBLY AND ASSEMBLY (Continued)

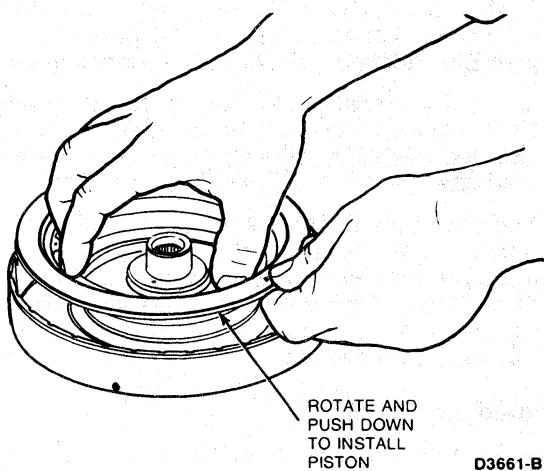
3. Install piston seal in clutch cylinder.



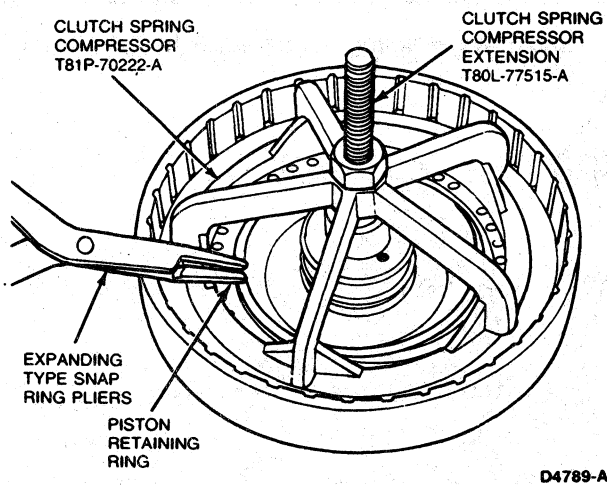
5. Position piston return spring retainer and piston retaining ring.



4. Apply a light film of petroleum jelly to piston seals, clutch cylinder seal area and the clutch piston inner seal area.  
Install clutch piston.

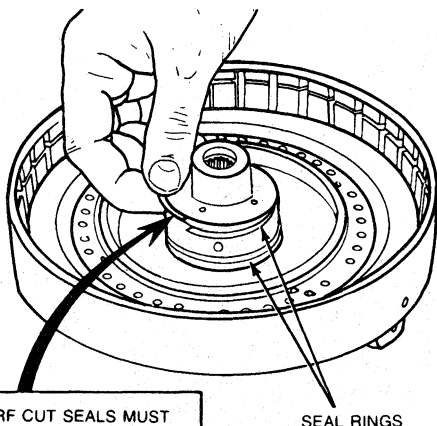


6. Install Clutch Spring Compressor T81P-70222-A or equivalent and install piston retaining ring.

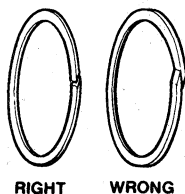


**DISASSEMBLY AND ASSEMBLY (Continued)**

7. Install seal rings on clutch cylinder hub.



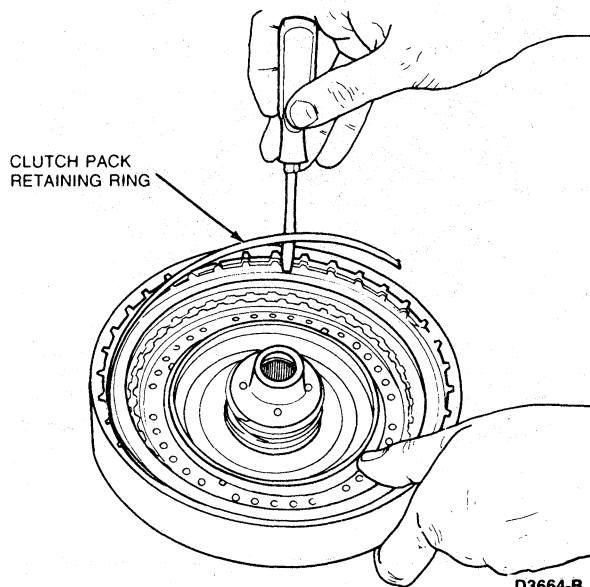
NOTE: SCARF CUT SEALS MUST OVERLAP AT THE BEVEL EDGE



SEAL RINGS

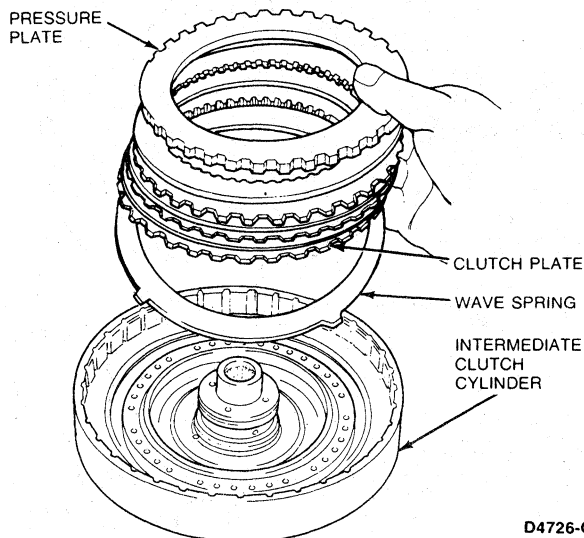
D3662-B

9. Install clutch pack retaining ring.



D3664-B

8. Install wave spring, clutch pack and pressure plate.



D4726-C

10. Check the clearance between the clutch retaining ring and the pressure plate.

Push downward on the clutch pack with at least 40 N (10 lbs) of pressure. Release pressure and zero Dial Indicator TOOL-4201-C or equivalent.

Lift pressure plate to bottom of retaining ring. Note dial indicator reading. Take two readings 180 degrees apart. Use the average of the two readings.

The clearance should be 0.76-1.12mm (0.030-0.055 inch) (reverse clutch), 0.76-1.22mm (0.030-0.044 inch) (intermediate clutch) for three plates. If the clearance is not within limits, selective snap rings are available in the following thicknesses:

#### **Intermediate Clutch**

- 1.245-1.346mm (0.049-0.053 inch)
- 1.499-1.600mm (0.059-0.063 inch)
- 1.788-1.880mm (0.070-0.074 inch)



**DISASSEMBLY AND ASSEMBLY (Continued)****Reverse Clutch**

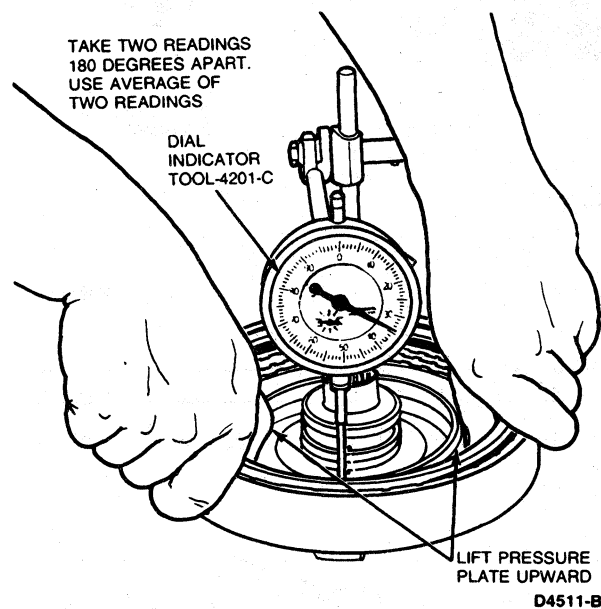
1.24-1.34mm (0.049-0.053 inch)

1.68-1.78mm (0.066-0.070 inch)

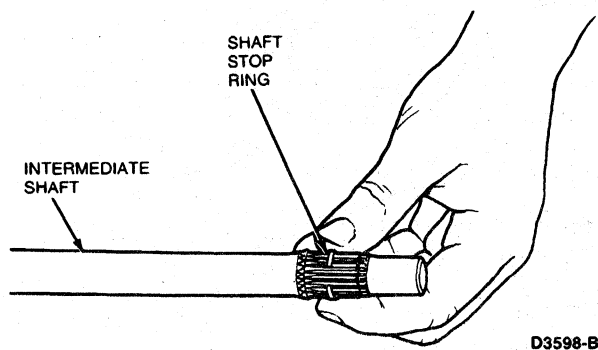
2.11-2.21mm (0.083-0.087 inch)

2.53-2.63mm (0.099-0.103 inch)

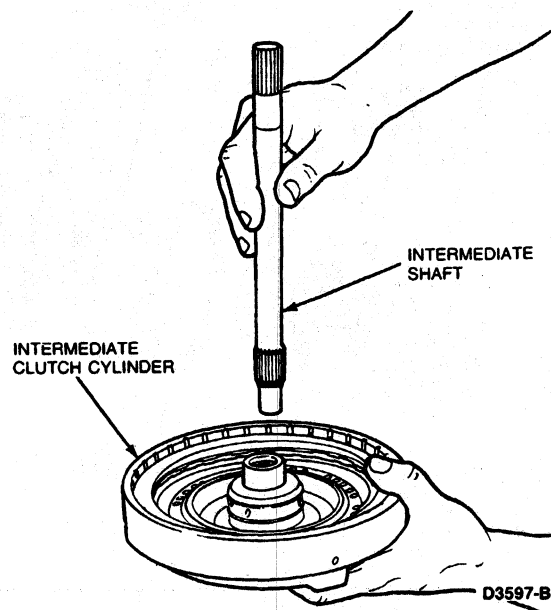
Install the correct size snap ring and recheck the clearance.



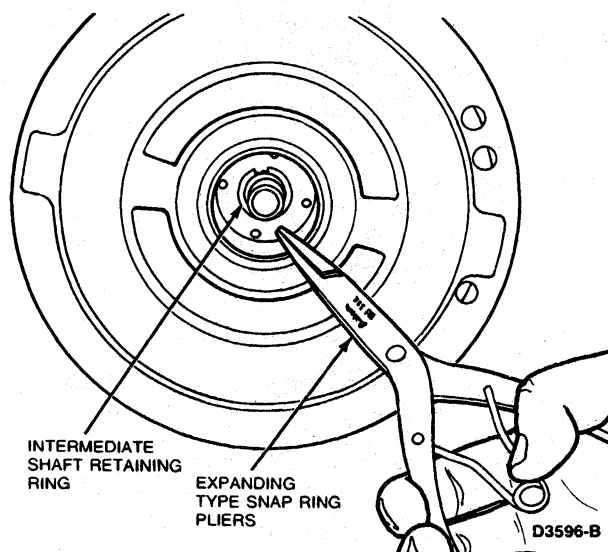
11. If removed, install stop ring on intermediate shaft.

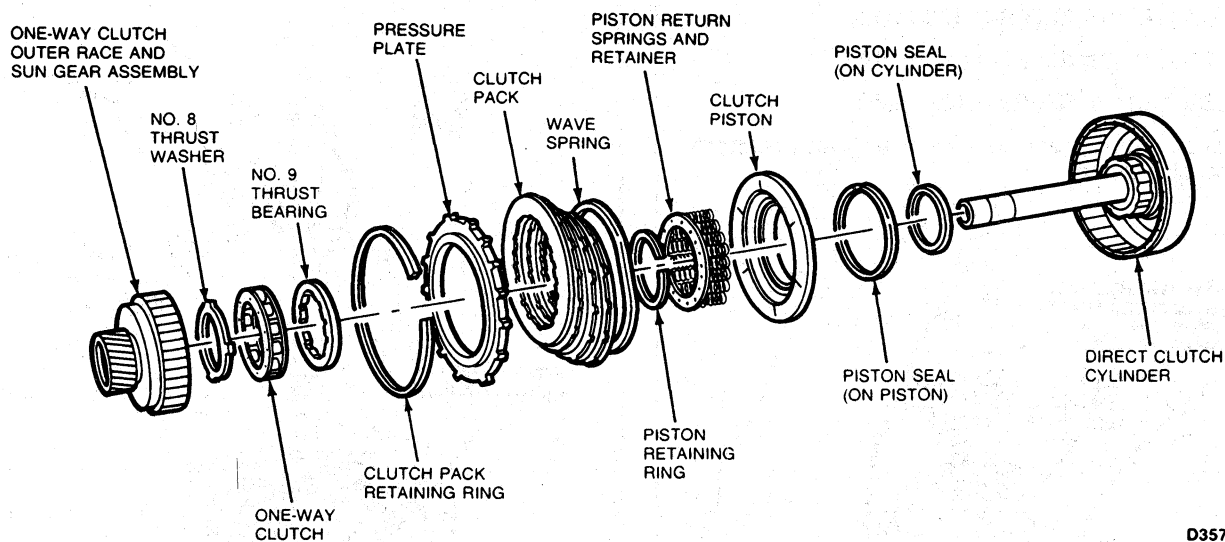


12. Install intermediate shaft in clutch cylinder.

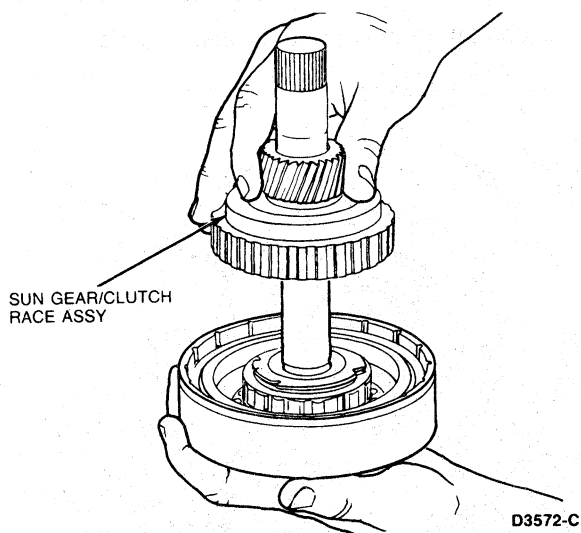


13. Install intermediate shaft retaining ring.

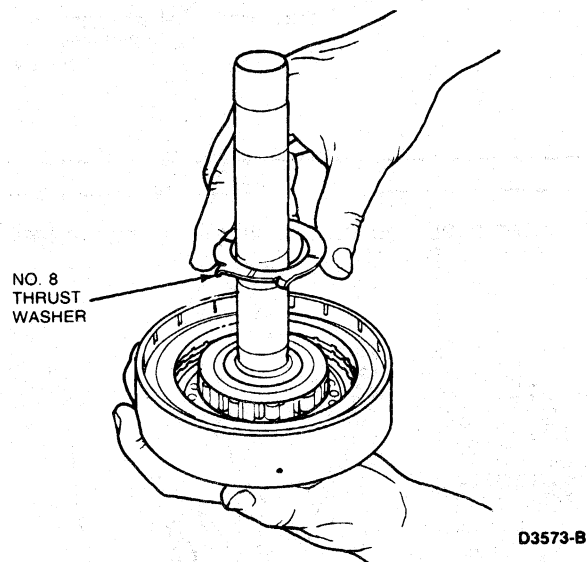


**DISASSEMBLY AND ASSEMBLY (Continued)****Direct Clutch****Disassembly**

1. Remove sun gear/clutch race assembly.

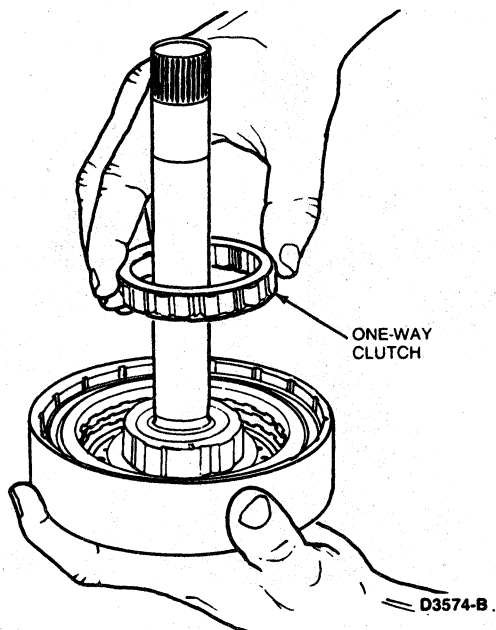


2. Remove No. 8 thrust washer.

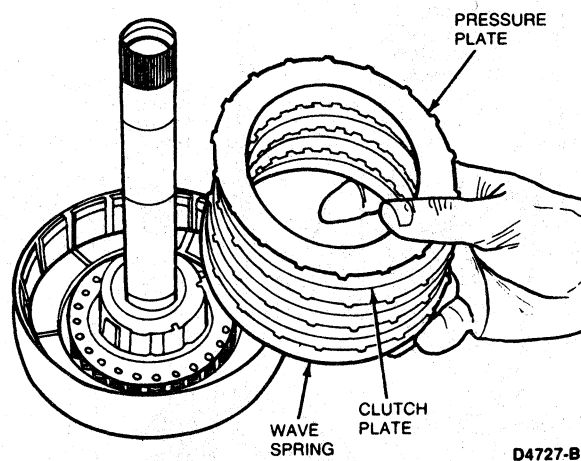


**DISASSEMBLY AND ASSEMBLY (Continued)**

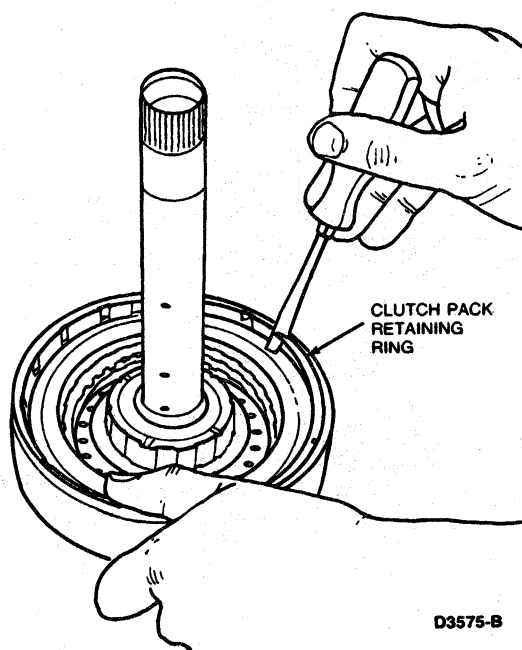
3. Remove the one-way clutch.



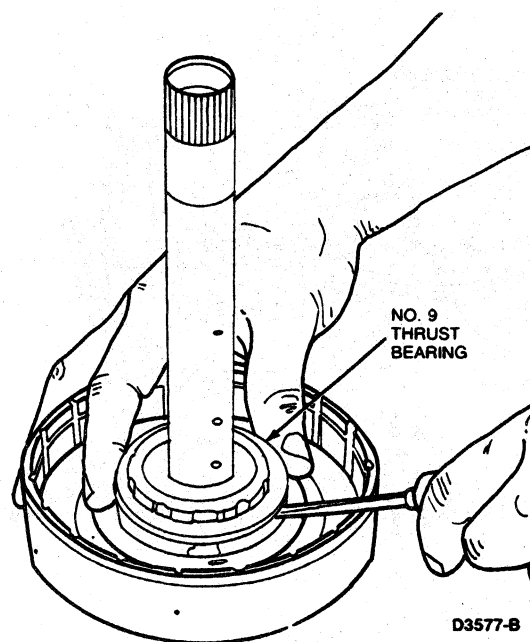
5. Remove pressure plate, clutch pack and wave spring.



4. Remove clutch pack retaining ring.

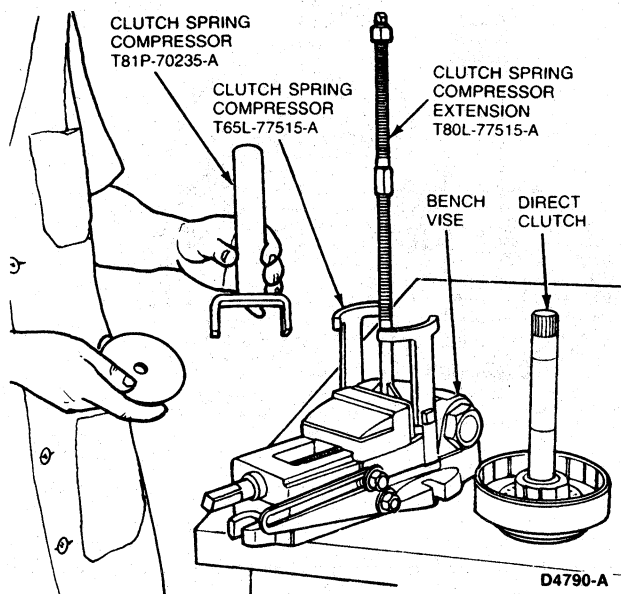


6. Remove No. 9 thrust bearing.

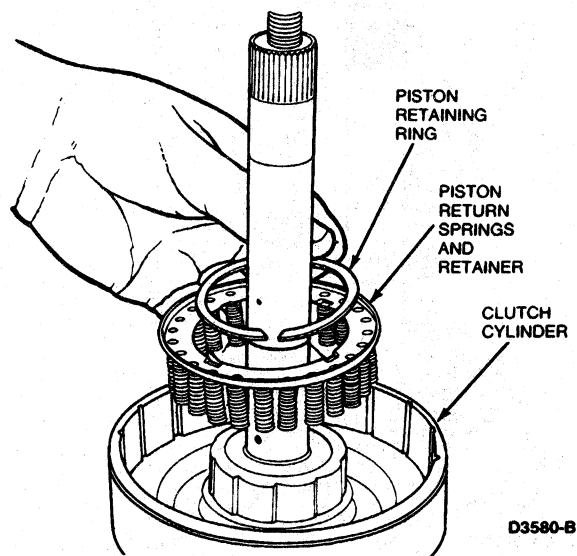


**DISASSEMBLY AND ASSEMBLY (Continued)**

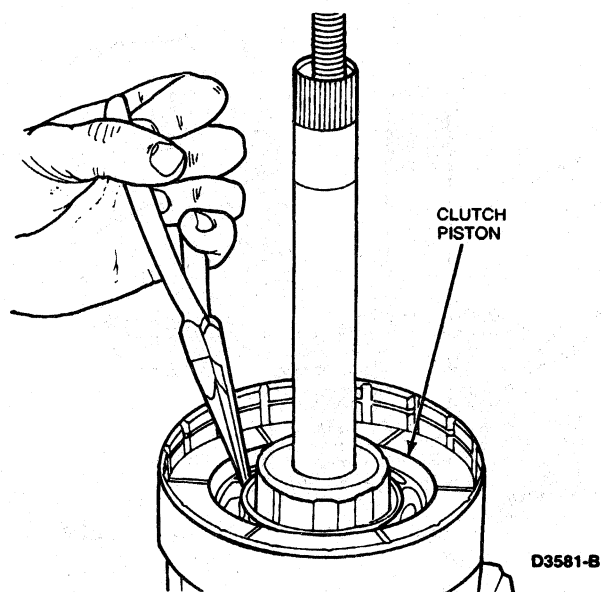
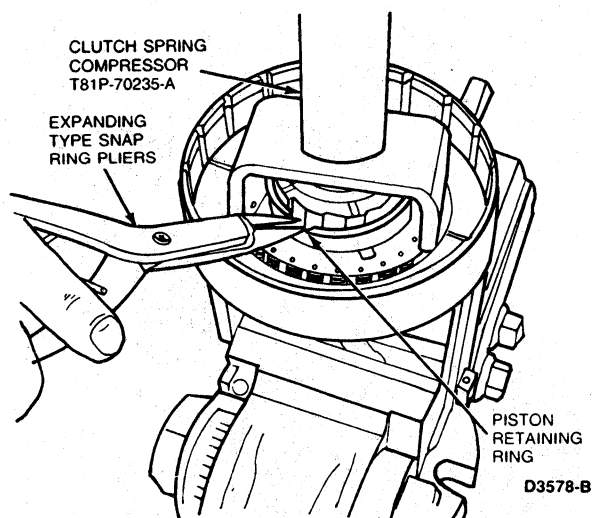
7. Remove piston retaining ring using a bench vise and special tools shown.



8. Remove retaining ring and piston return spring retainer.

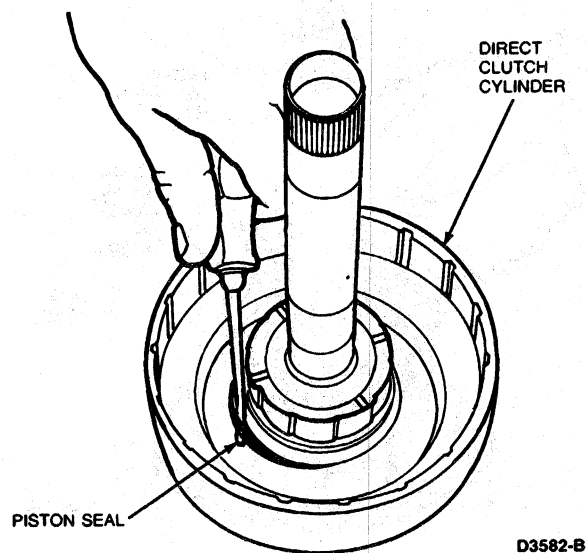


9. Remove clutch piston using pliers.

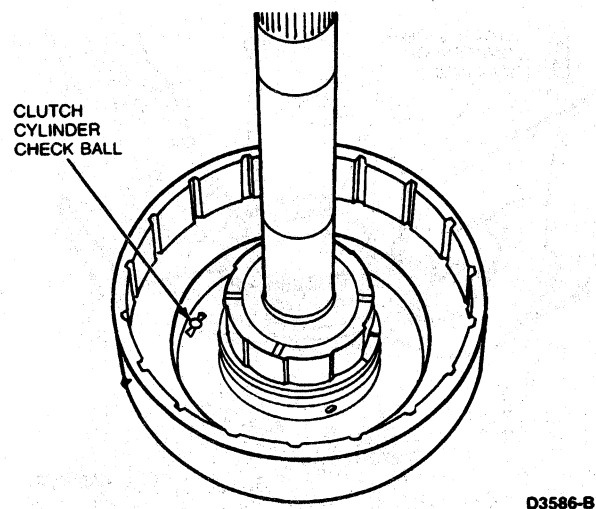


**DISASSEMBLY AND ASSEMBLY (Continued)**

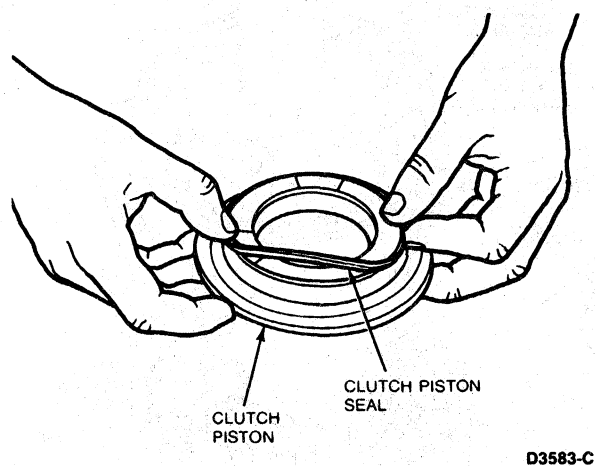
10. Remove piston seal from clutch cylinder.

**Assembly**

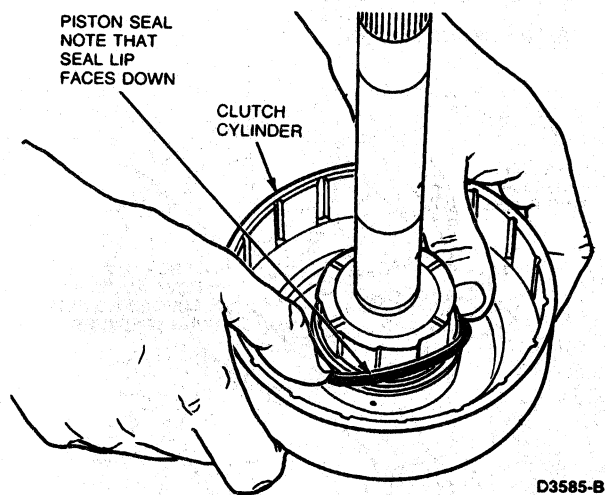
1. Inspect clutch cylinder check ball. Ensure ball is present and free in cage.



11. Remove seal from clutch piston.

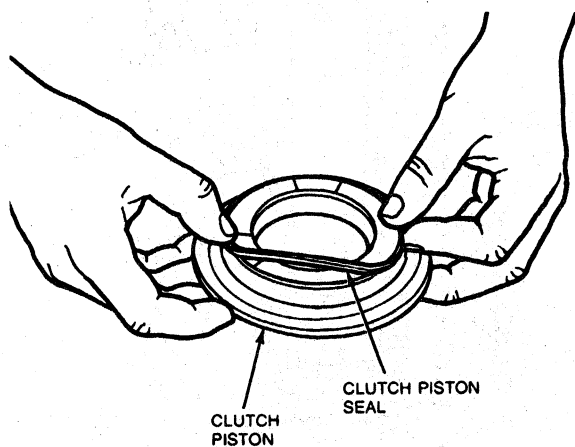


2. Install seal on clutch cylinder.



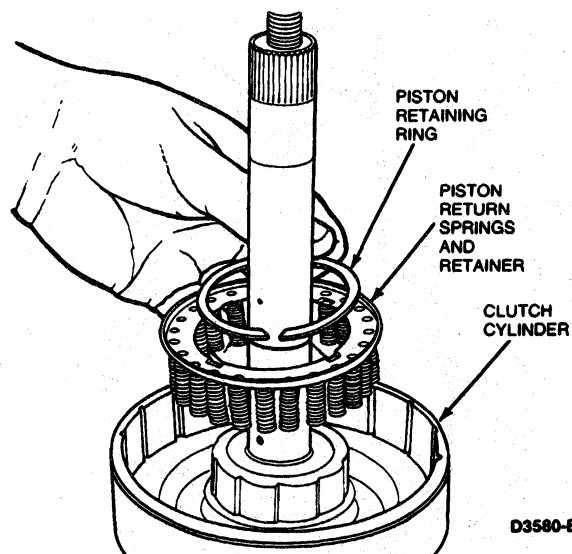
**DISASSEMBLY AND ASSEMBLY (Continued)**

3. Install seal on clutch piston.  
Note that the piston seal lip faces up.



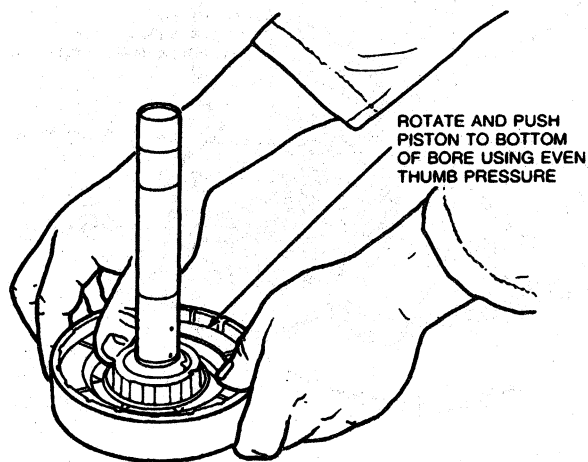
D3583-C

5. Position piston return spring retainer and piston retaining ring.



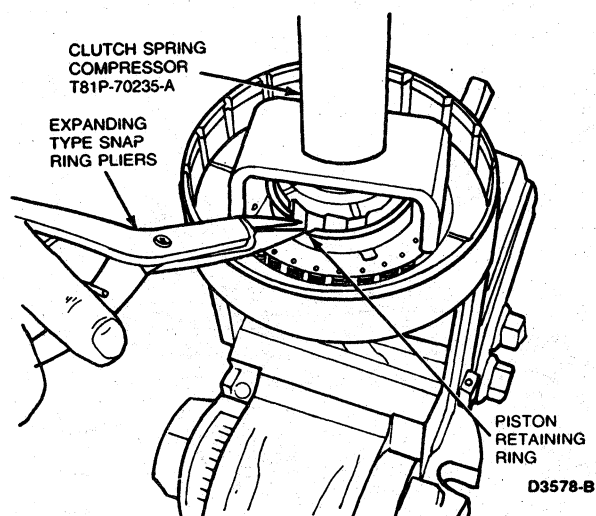
D3580-B

4. Apply a light film of petroleum jelly to piston seals, clutch cylinder seal area and clutch piston inner seal area.  
Install clutch piston.



D3587-B

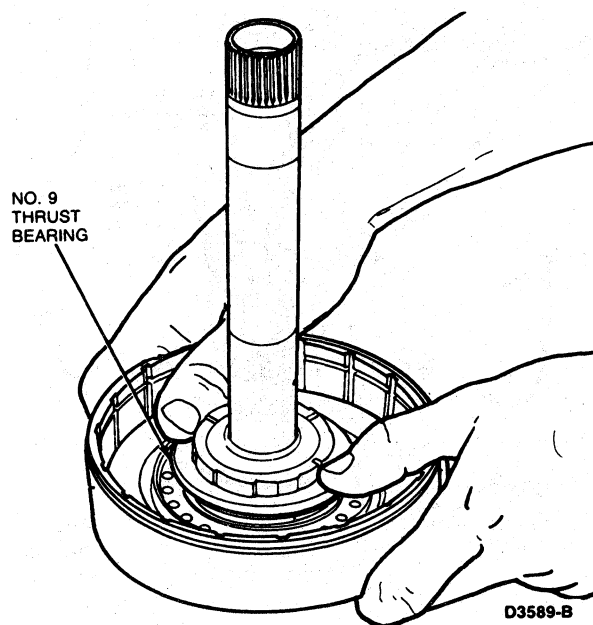
6. Using Clutch Spring Compressor T81P-70235-A or equivalent install piston retaining ring.



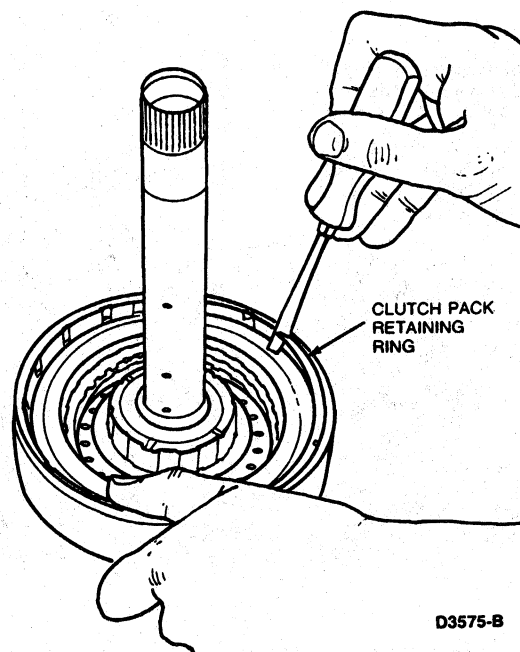
D3578-B

**DISASSEMBLY AND ASSEMBLY (Continued)**

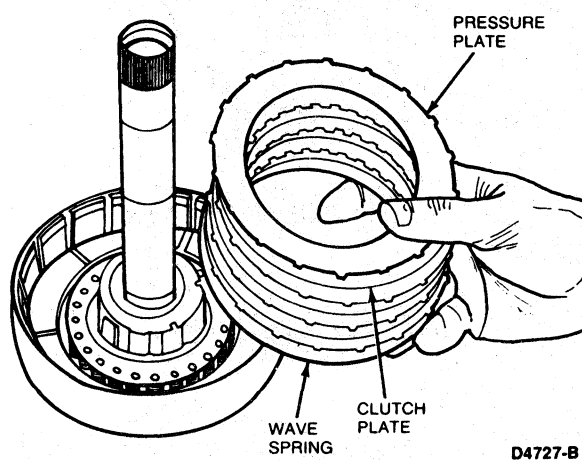
7. Install No. 9 thrust bearing.



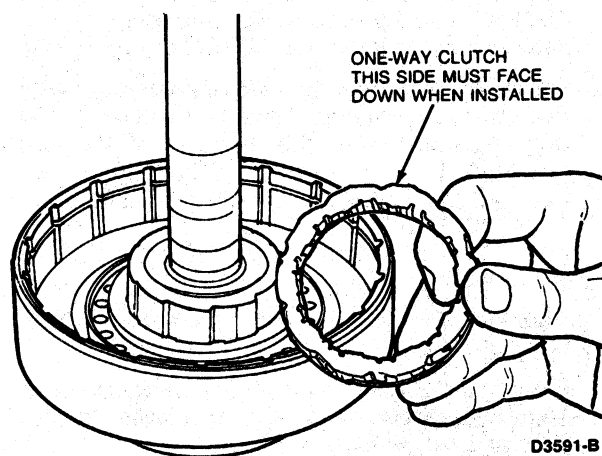
9. Install clutch pack retaining ring.



8. Install wave spring, clutch pack and pressure plate.



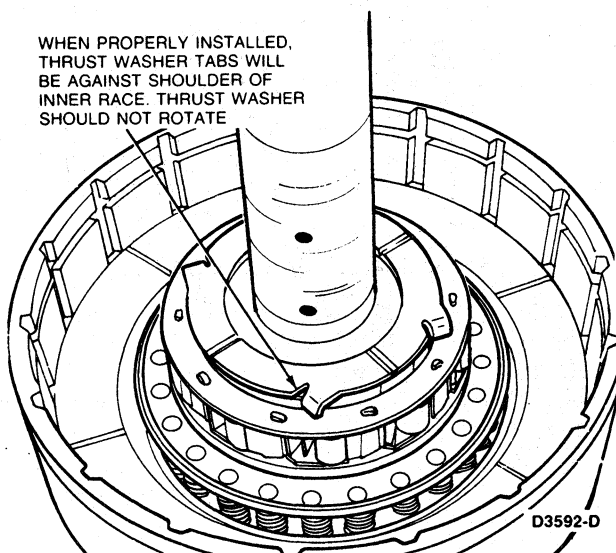
10. Install one-way clutch.



**DISASSEMBLY AND ASSEMBLY (Continued)**

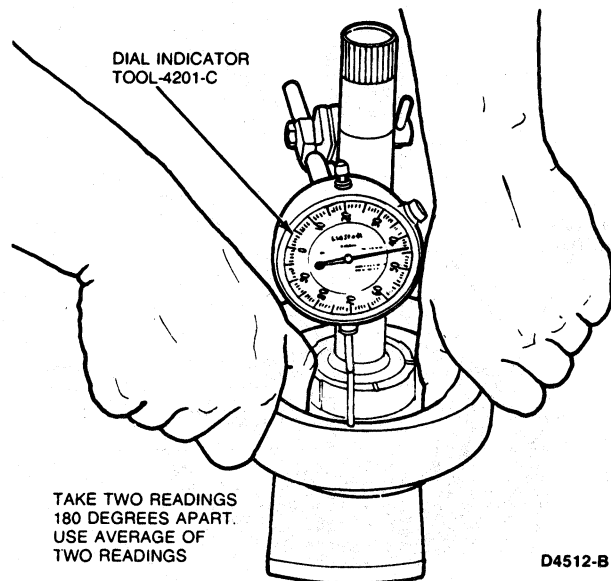
11. Install No. 8 thrust washer.

WHEN PROPERLY INSTALLED,  
THRUST WASHER TABS WILL  
BE AGAINST SHOULDER OF  
INNER RACE. THRUST WASHER  
SHOULD NOT ROTATE



Insert the correct size snap ring and recheck the clearance.

DIAL INDICATOR  
TOOL-4201-C



TAKE TWO READINGS  
180 DEGREES APART.  
USE AVERAGE OF  
TWO READINGS

12. Install the clutch pack retaining ring and check the clearance between the ring and the pressure plate.

Push downward on the clutch pack with at least 40 N (10 lbs) of pressure. Release pressure and zero Dial Indicator TOOL-4201-C or equivalent.

Lift pressure plate to bottom of snap ring. Note dial indicator reading. Take two readings 180 degrees apart. Use the average of the two readings.

The clearance should be:

Three friction plates—.078-1.20mm (0.031-0.048 inch).

Four friction plates—1.01-1.43mm (0.040-0.056 inch).

If the clearance is not within specifications, selective snap rings are available in the following thicknesses:

1.26-1.36mm (0.050-0.054 inch)

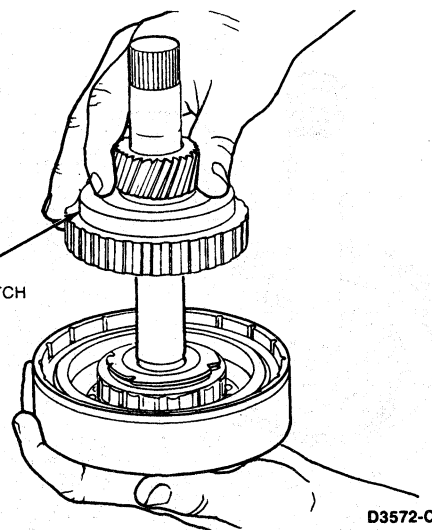
1.58-1.68mm (0.062-0.066 inch)

1.90-2.00mm (0.075-0.079 inch)

13. Install sun gear/clutch race assembly.

NOTE: The one-way clutch allows the sun gear/clutch race assembly to rotate in one direction only.

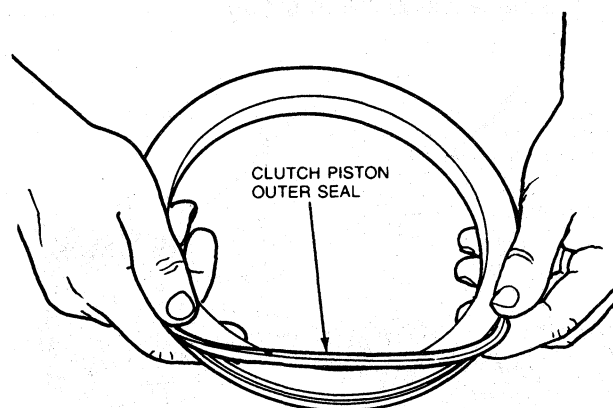
SUN GEAR/CLUTCH  
RACE ASSY





**DISASSEMBLY AND ASSEMBLY (Continued)****Reverse Clutch****Disassembly and Assembly**

1. Remove seals from clutch cylinder and clutch piston.

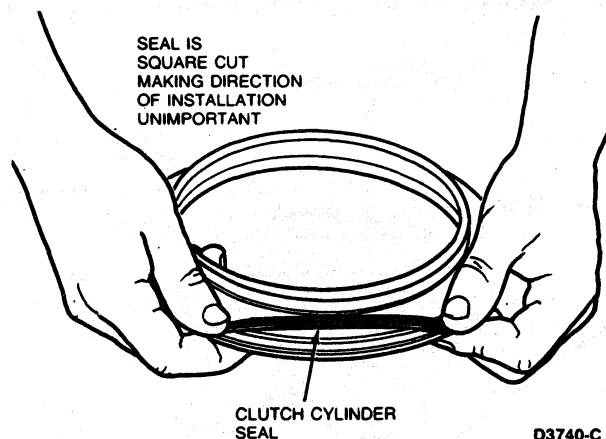


NOTE THAT  
SEAL LIP  
IS FACING UP

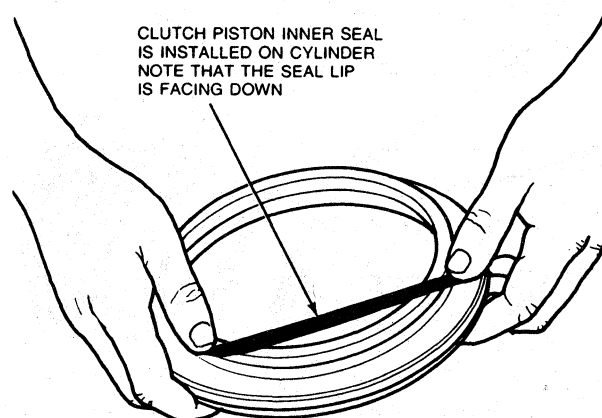
D3739-C

2. Install new seals on clutch cylinder and piston.

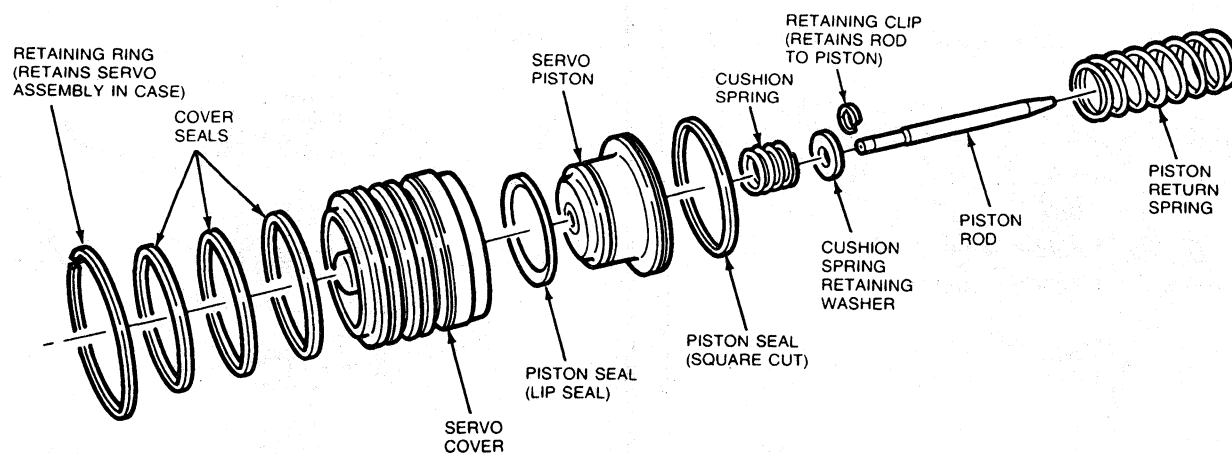
Note the direction of the inner seal lip.



D3740-C



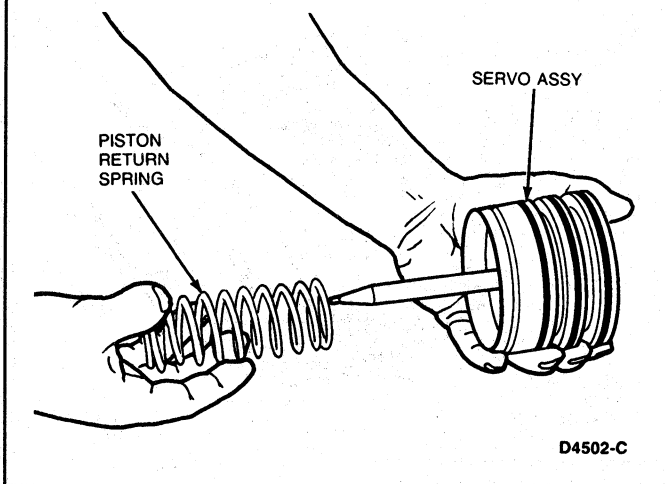
D4791-A

**Band Apply Servo**

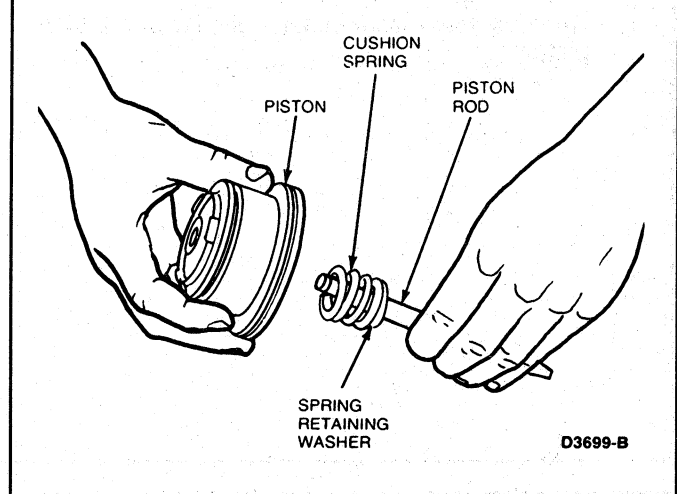
D3695-D

**DISASSEMBLY AND ASSEMBLY (Continued)****Disassembly**

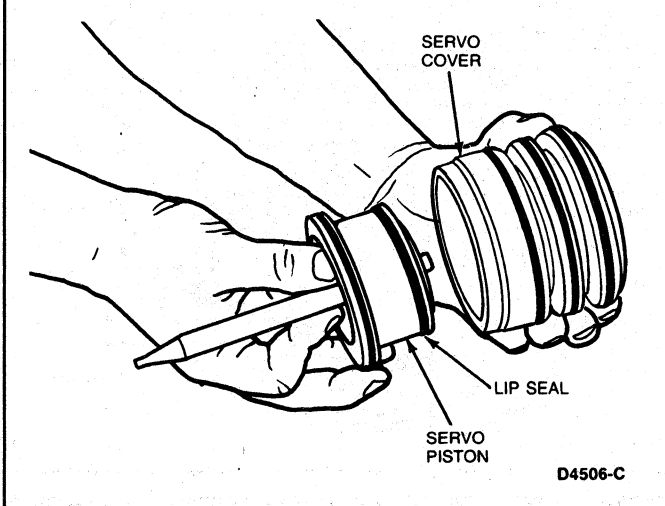
1. Remove piston return spring.



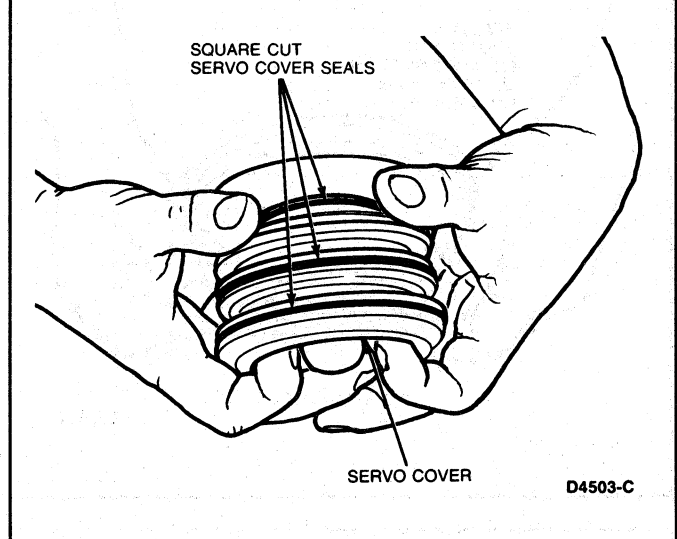
4. Remove piston rod, cushion spring and spring retaining washer from piston.



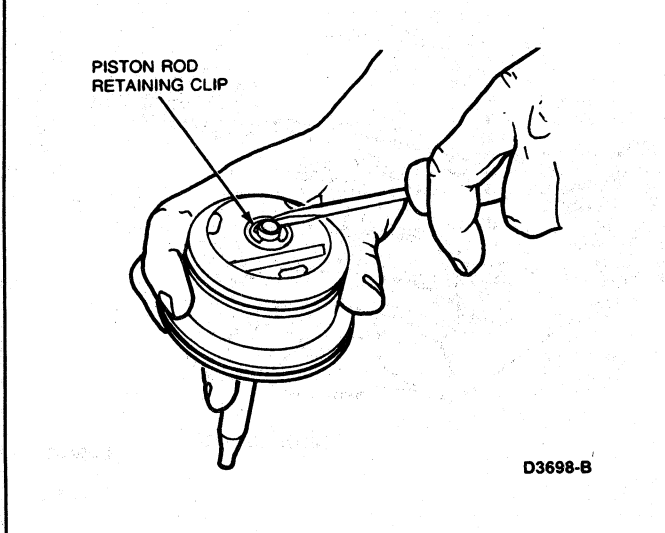
2. Remove servo piston from cover.



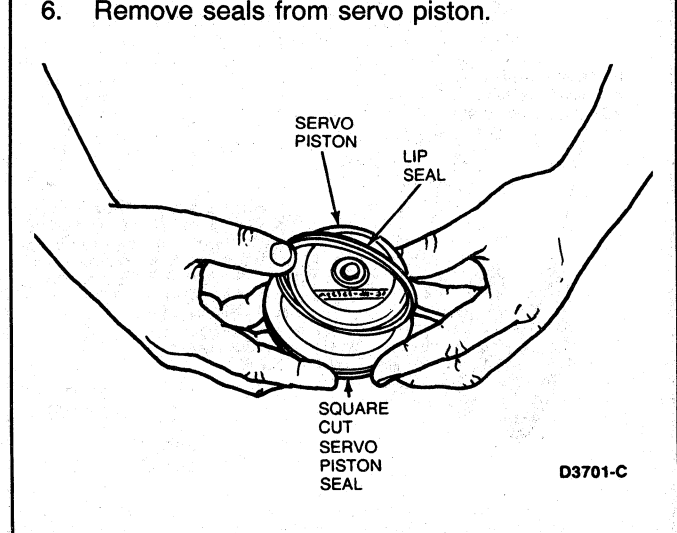
5. Remove seals from servo cover.



3. Remove piston rod retaining clip.

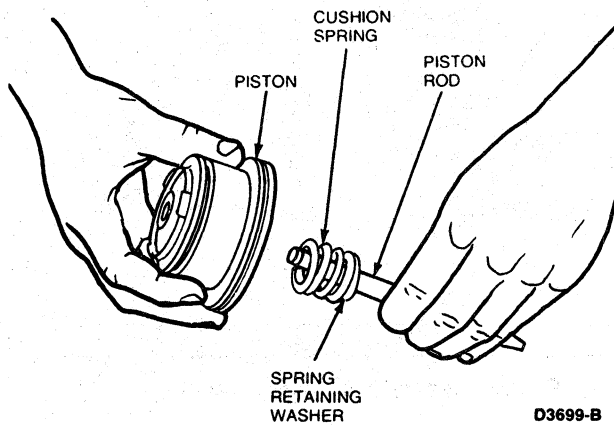


6. Remove seals from servo piston.

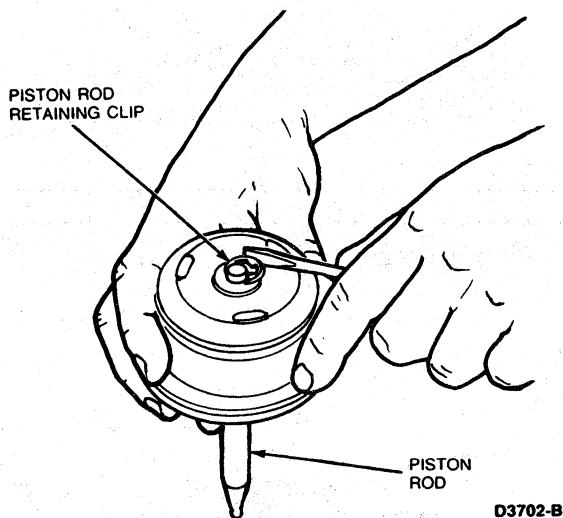


**DISASSEMBLY AND ASSEMBLY (Continued)****Assembly**

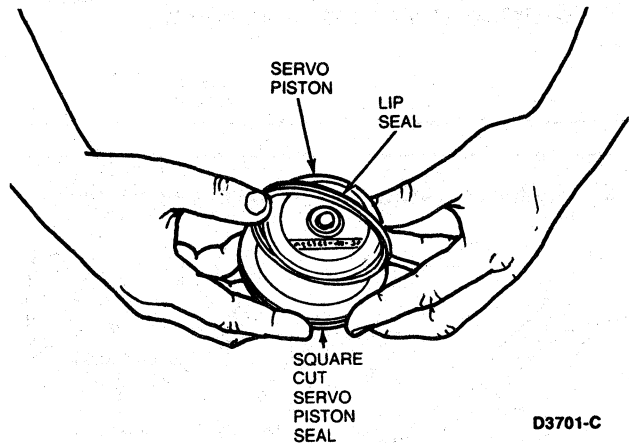
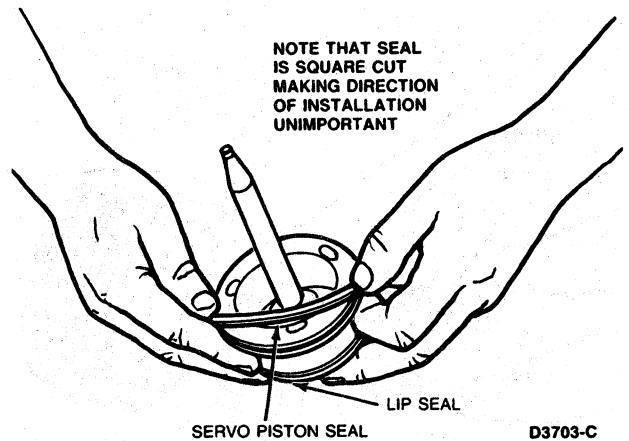
1. Position spring retainer washer and cushion spring on piston rod.  
Install spring and rod assembly in servo piston.



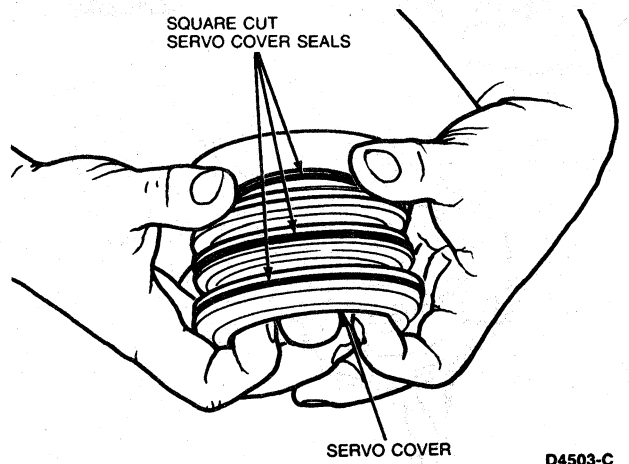
2. Compress cushion spring, and install retaining clip.



3. Install seals on servo piston.

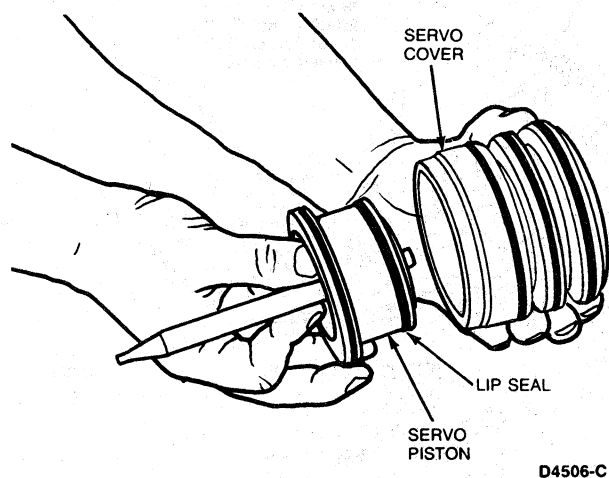


4. Install seals on servo cover.

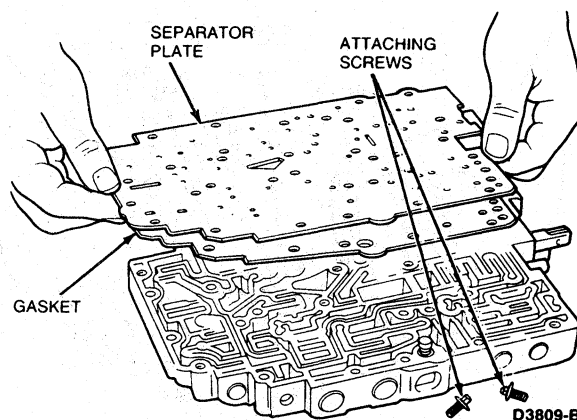


**DISASSEMBLY AND ASSEMBLY (Continued)**

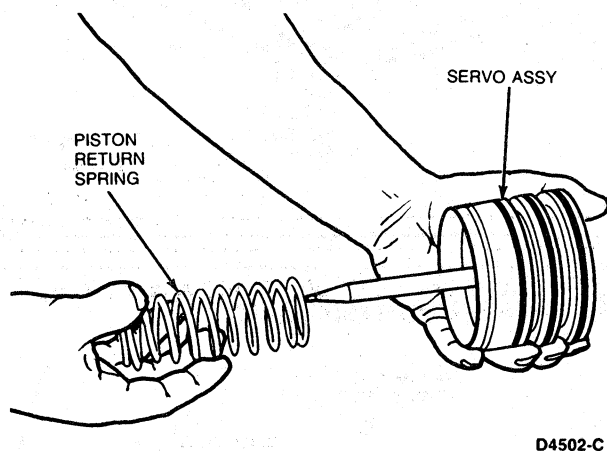
5. Lubricate piston seal with petroleum jelly and rotate piston to install in cover.

**Valve Body****Disassembly**

1. Remove separator plate attaching screws.
2. Remove separator plate and gasket.



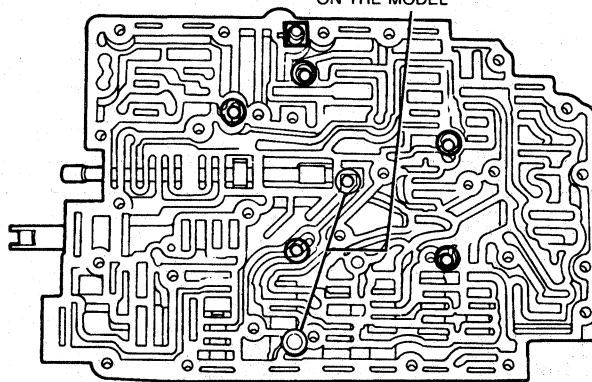
6. Install piston return spring on piston rod.



3. Remove check balls and relief valve.

- CHECK BALLS  
□ RELIEF VALVE

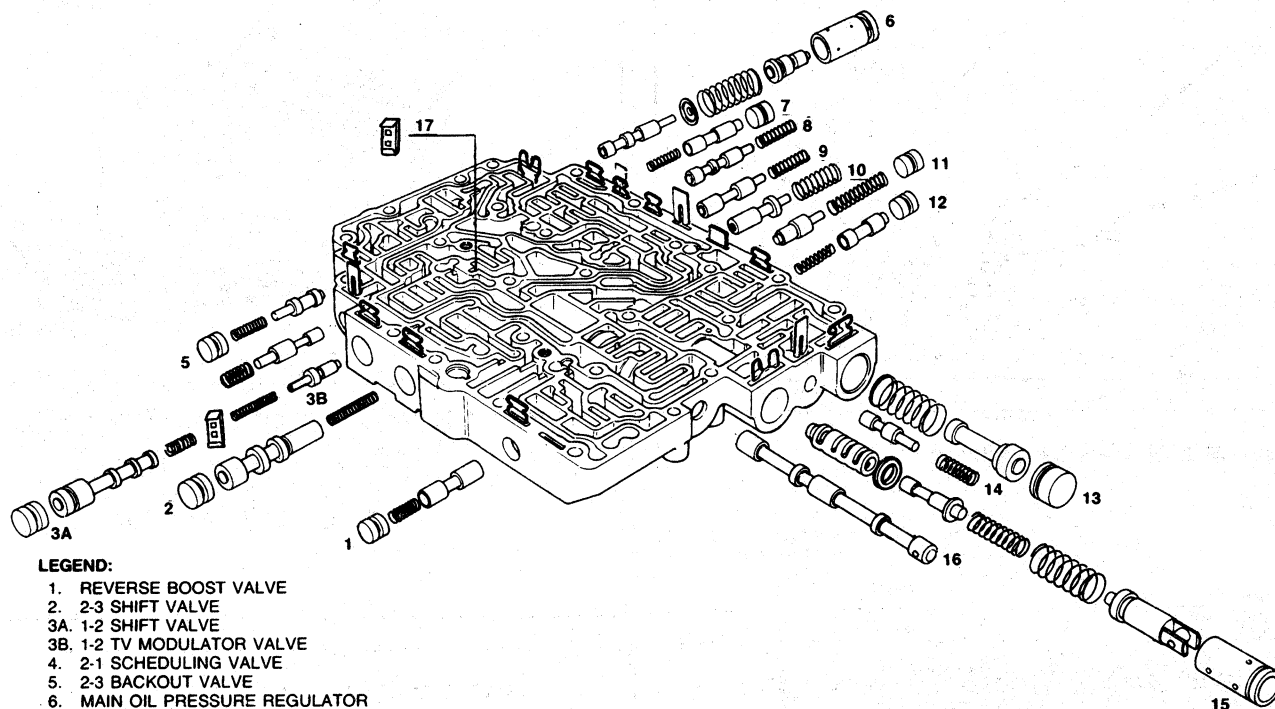
NOTE: BALL USE AT THESE LOCATIONS DEPENDS ON THE MODEL



## DISASSEMBLY AND ASSEMBLY (Continued)

4. The following illustration shows the position and components for each of the valve assemblies in the valve body.

NOTE: Do not turn the throttle valve adjusting screw. The adjustment is set during manufacture and must not be altered.



## LEGEND:

1. REVERSE BOOST VALVE
2. 2-3 SHIFT VALVE
- 3A. 1-2 SHIFT VALVE
- 3B. 1-2 TV MODULATOR VALVE
4. 2-1 SCHEDULING VALVE
5. 2-3 BACKOUT VALVE
6. MAIN OIL PRESSURE REGULATOR
7. MANUAL LOW DOWNSHIFT MODULATING VALVE
8. 3-2 TORQUE DEMAND TIMING VALVE
9. 3-2 KICKDOWN TIMING VALVE
10. 3-2 CONTROL VALVE
11. 2-3 SHIFT TV MODULATOR VALVE
12. 1-2 CAPACITY MODULATOR VALVE
13. 1-2 ACCUMULATOR VALVE
14. TV LIMIT VALVE
- 15A. THROTTLE CONTROL ASSEMBLY
- 15B. THROTTLE CONTROL ASSEMBLY
16. MANUAL CONTROL VALVE
17. PLATE

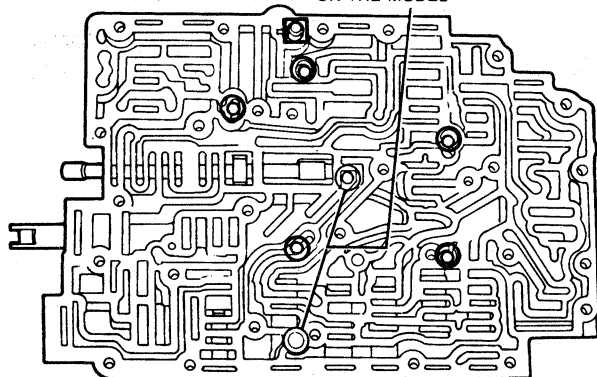
D3816-E

## Assembly

1. Install check balls and relief valve.

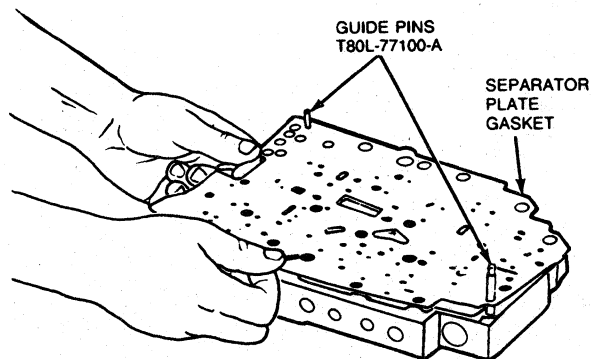
- ☐ CHECK BALLS  
☐ RELIEF VALVE

NOTE: BALL USE AT THESE LOCATIONS DEPENDS ON THE MODEL



D3811-E

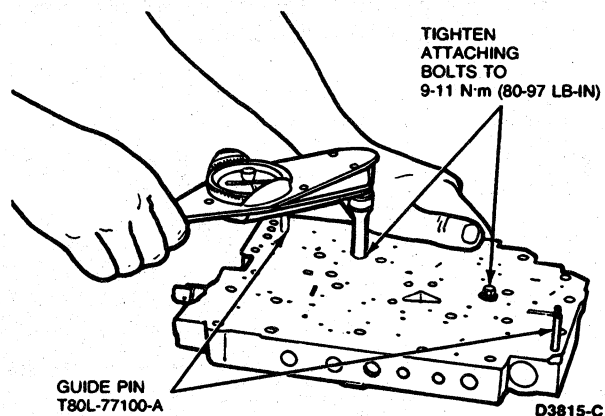
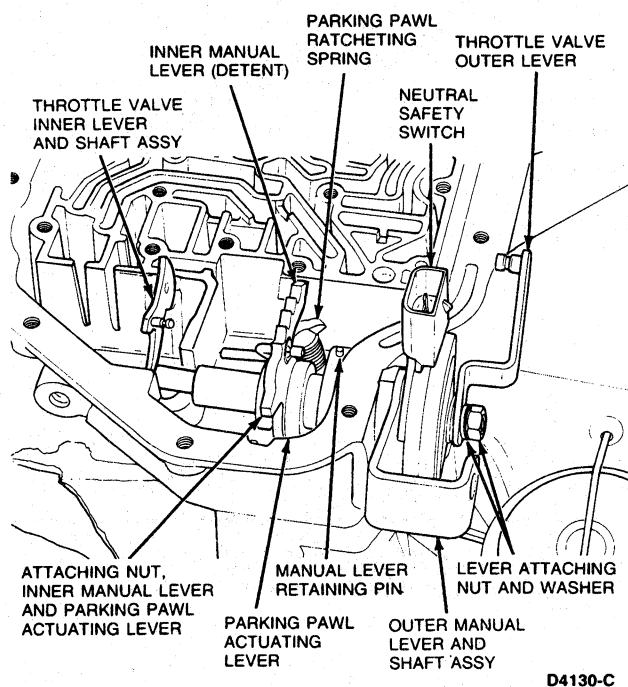
2. Install Guide Pins T80L-77100-A or equivalent, and separator plate gasket.



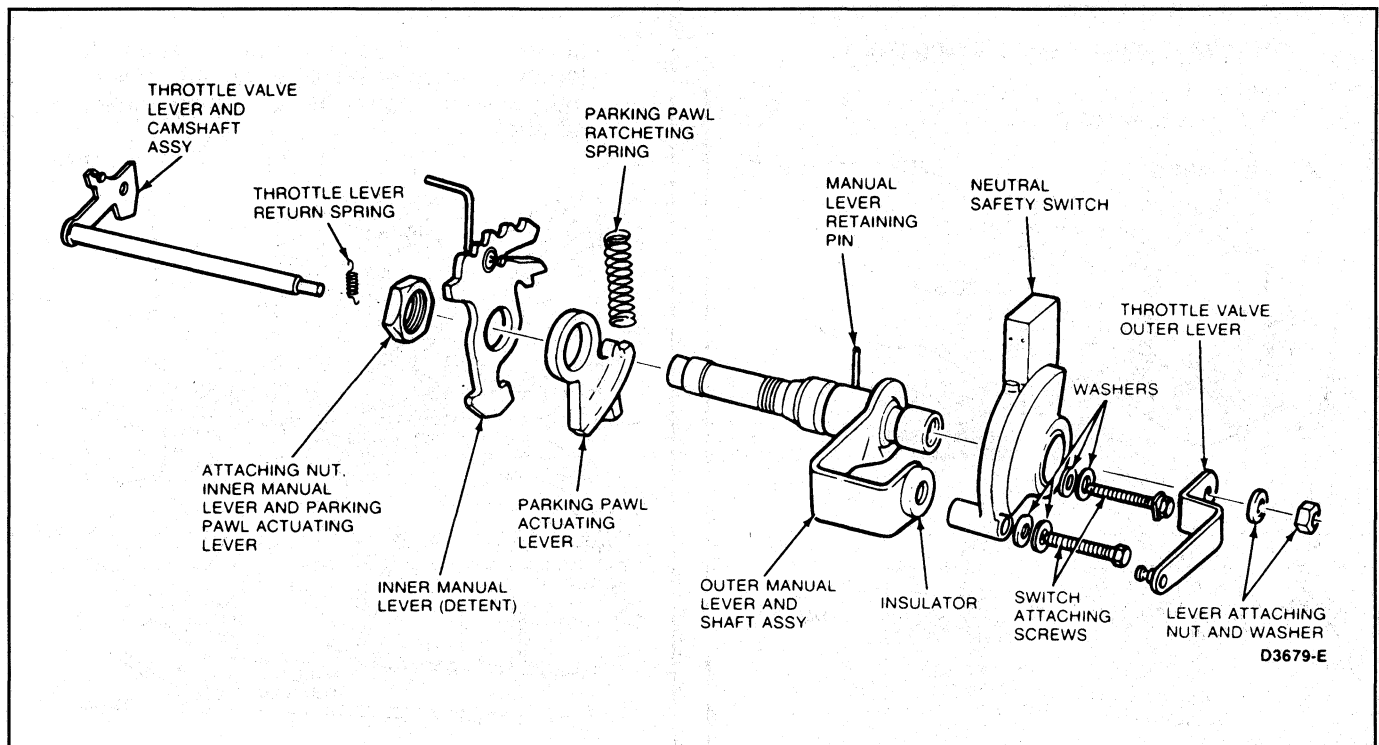
D3813-C

**DISASSEMBLY AND ASSEMBLY (Continued)**

3. Install separator plate and attaching bolts.  
Tighten bolts to 9-11 N·m (80-97 lb-in) and remove alignment pins.

**Manual and Throttle Linkage**

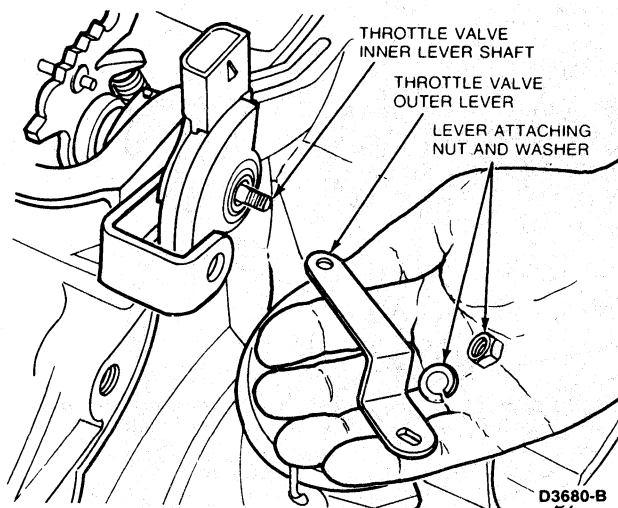
## DISASSEMBLY AND ASSEMBLY (Continued)



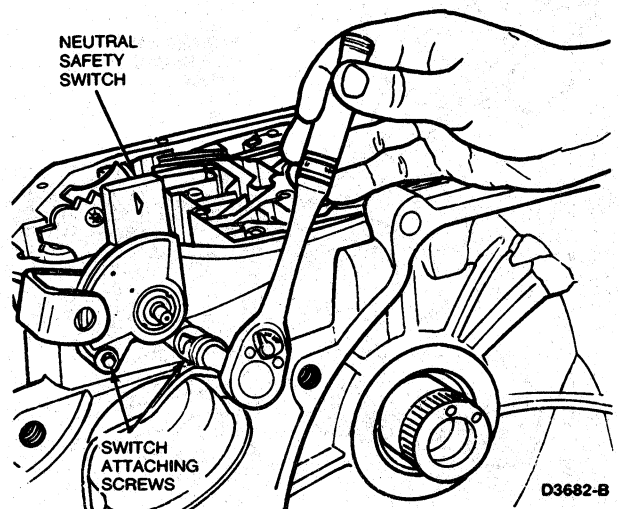
## Disassembly

1. Remove throttle valve outer lever.

NOTE: While loosening the lever attaching nut, hold the outer throttle lever stationary. Failure to hold the lever will allow the throttle shaft and cam to rotate an excessive amount causing possible damage to the cam.

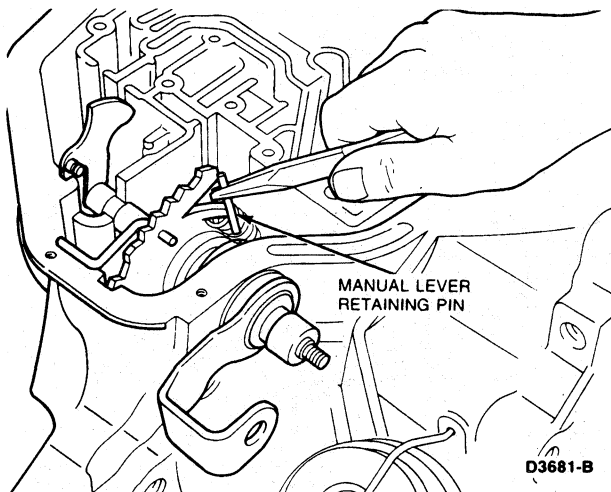


2. Remove neutral safety switch attaching screws and washers.
3. Remove neutral safety switch.

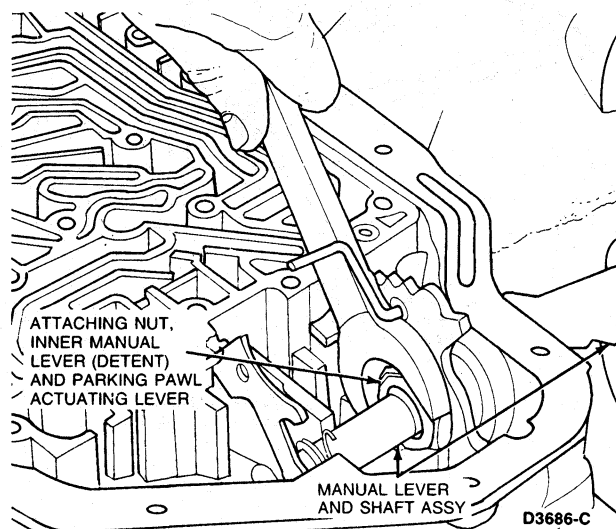


**DISASSEMBLY AND ASSEMBLY (Continued)**

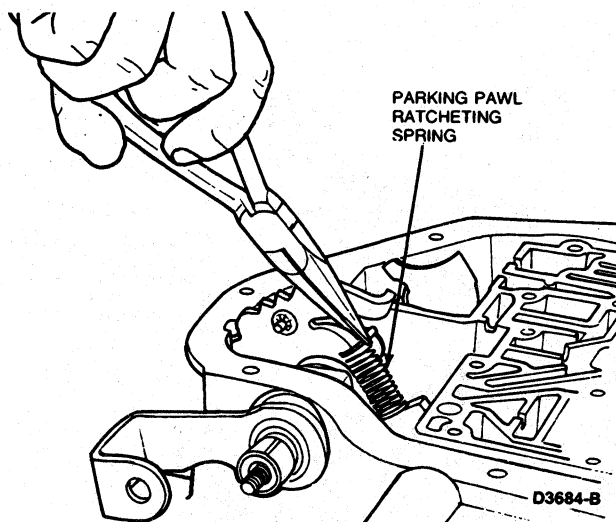
4. Remove manual lever retaining pin.



6. Loosen nut attaching inner manual lever (detent) and parking pawl actuating lever to manual lever shaft. After loosening, thread nut off shaft.

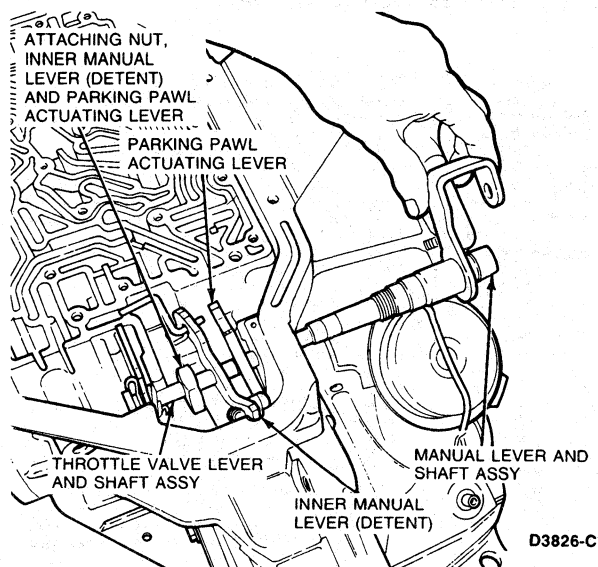


5. Remove parking pawl ratcheting spring.



7. Remove manual lever and shaft assembly.

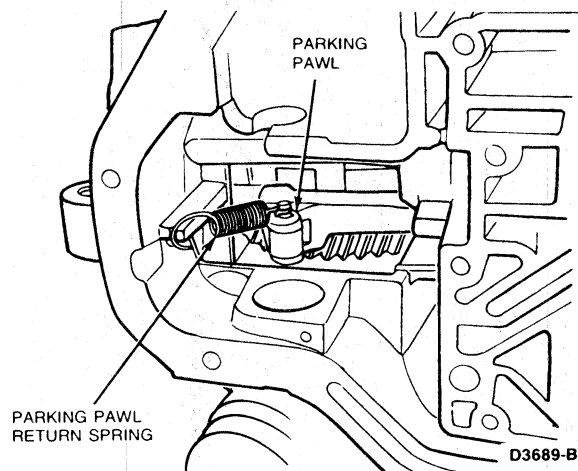
After removing manual lever, remove throttle valve lever and components on throttle valve lever shaft.



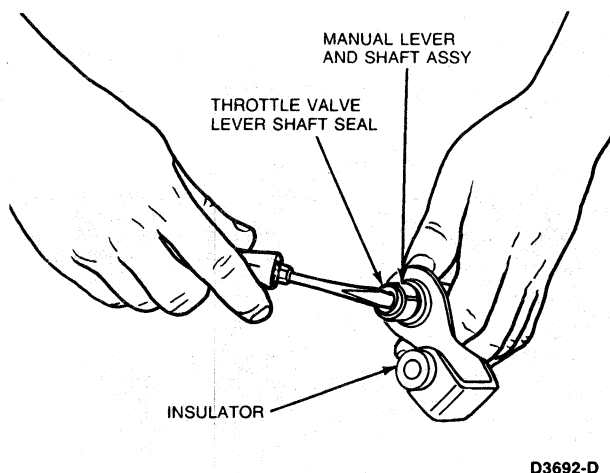


**DISASSEMBLY AND ASSEMBLY (Continued)**

8. Remove parking pawl return spring.

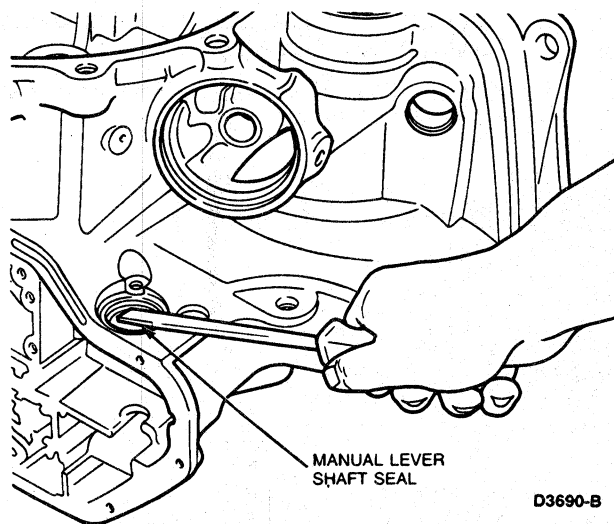


10. Remove throttle valve lever shaft seal.

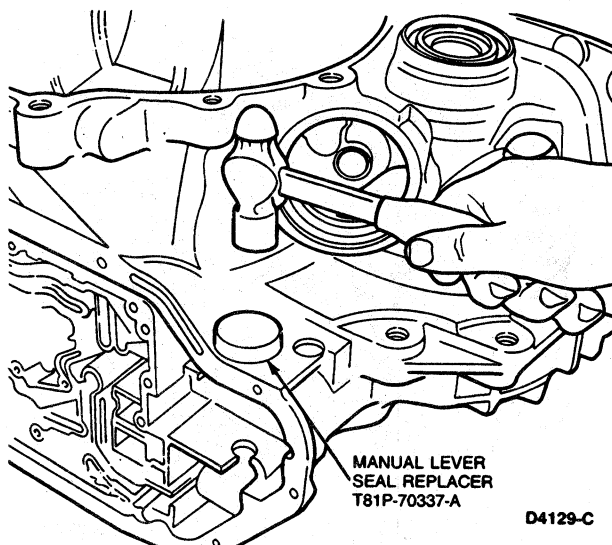


Remove insulator from manual lever using Shift Insulator Remover/Replacer T67P-7341-A, or Shift Linkage Grommet Remover T84P-7341-A, or equivalent.

9. Remove manual lever shaft seal from case.

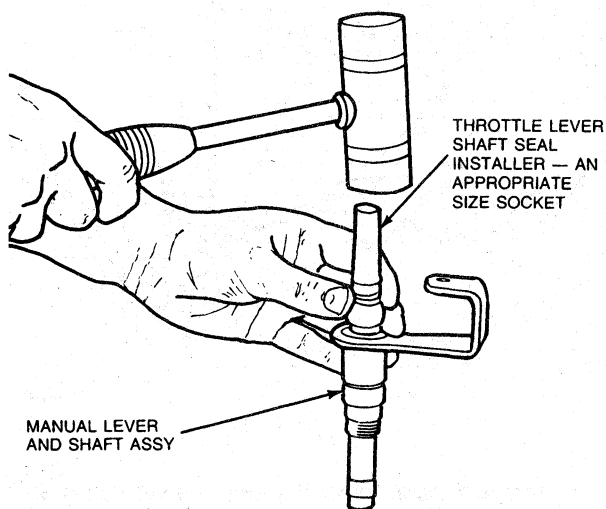
**Assembly**

1. Install manual lever shaft seal in case using Manual Lever Seal Replacer T81P-70337-A or equivalent.



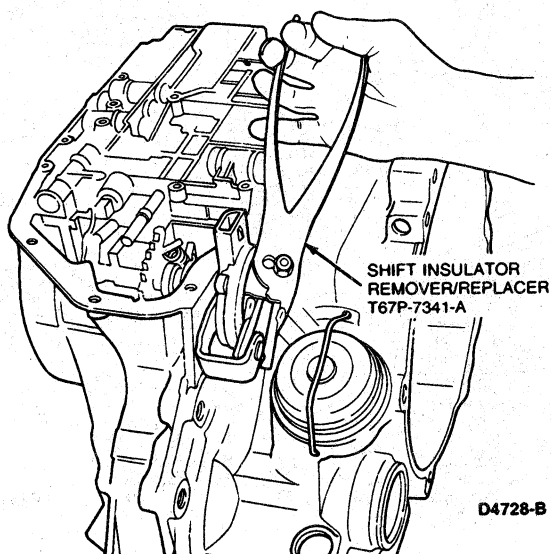
**DISASSEMBLY AND ASSEMBLY (Continued)**

2. Install throttle lever shaft seal using an appropriate size socket.



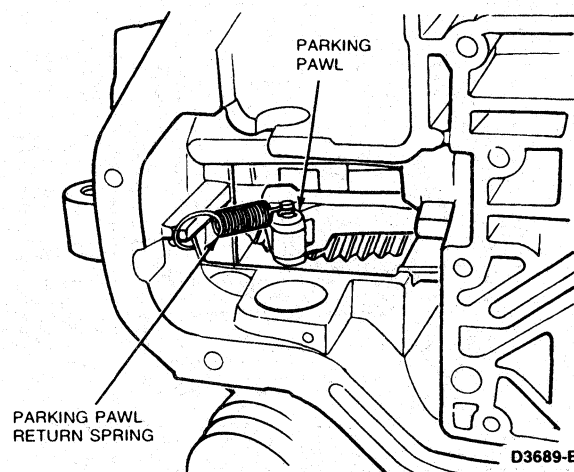
D3693-C

3. Install manual lever insulator using Shift Insulator Remover/Replacer T67P-7341-A or Replacer T84P-7341-B or equivalent.



D4728-B

4. Install parking pawl return spring.



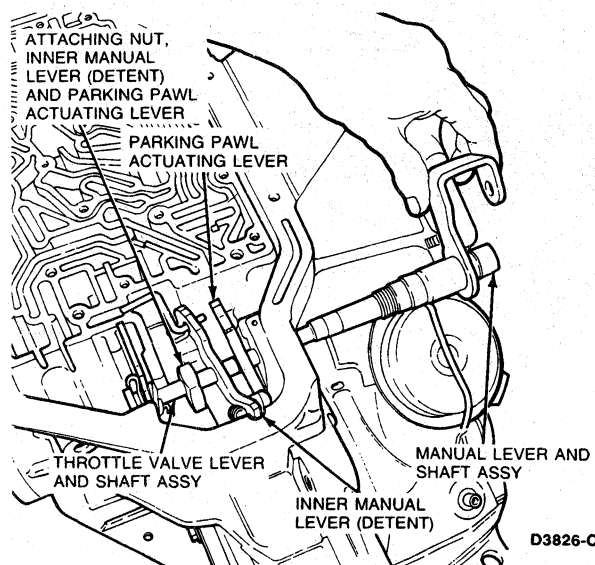
D3689-B

5. Install the following components on throttle shaft in this order:

Must be positioned on shaft in this order.

- Parking Pawl Actuator
- Inner Manual Lever (Detent)
- Inner Manual Lever (Detent) and Parking Pawl Actuator Attaching Nut

Position throttle shaft in case and install manual lever and shaft assembly.

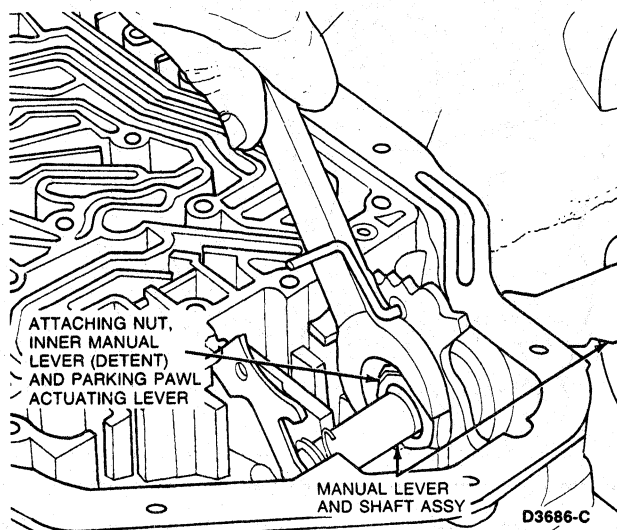


D3826-C

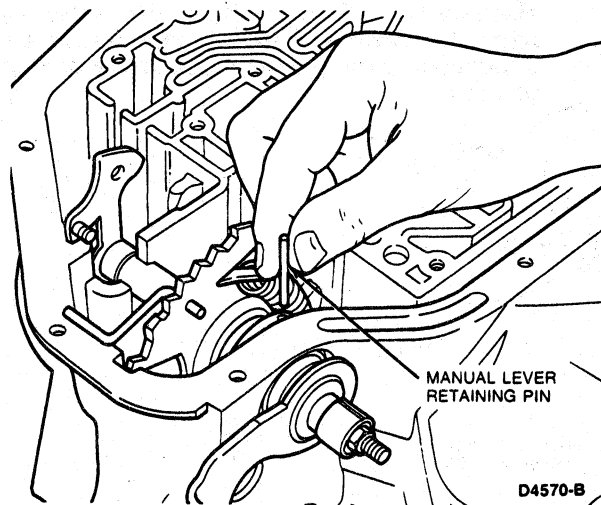
**DISASSEMBLY AND ASSEMBLY (Continued)**

6. Position parking pawl actuator and inner manual lever (detent) on manual lever shaft and install attaching nut.

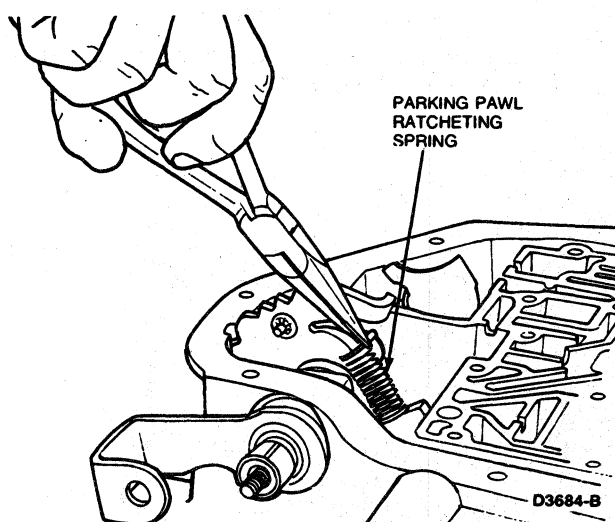
Tighten nut to 43-65 N·m (32-48 lb-ft).



8. Install manual lever retaining pin.

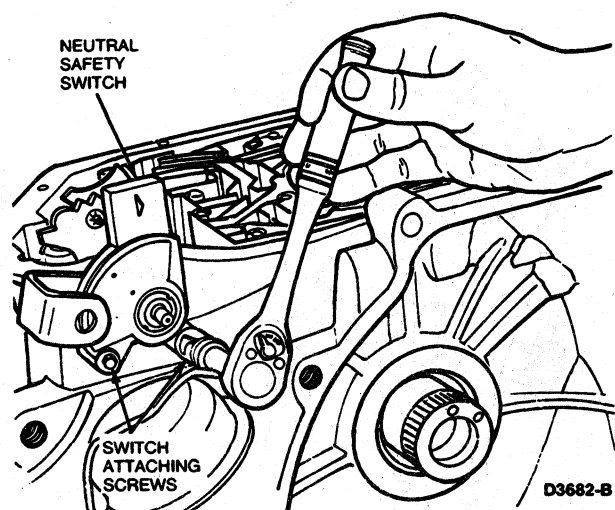


7. Install parking pawl ratcheting spring.



9. Install neutral safety switch and attaching screws and washers. Do not tighten screws.

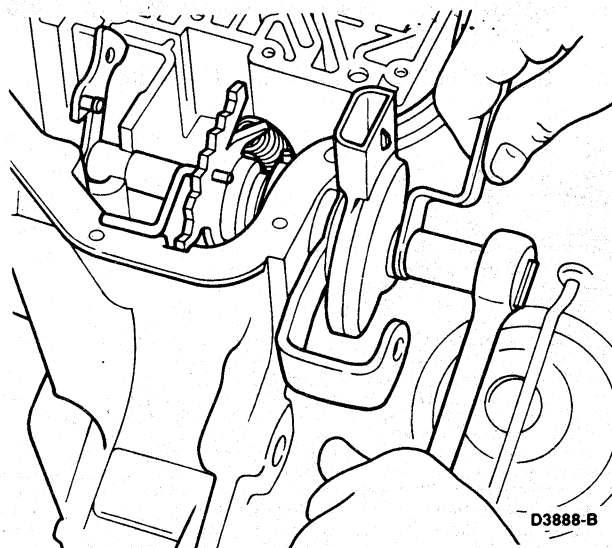
Adjust neutral safety switch as outlined before tightening switch attaching screws.



**DISASSEMBLY AND ASSEMBLY (Continued)**

10. Install outer throttle lever valve lever and adjust switch as outlined.

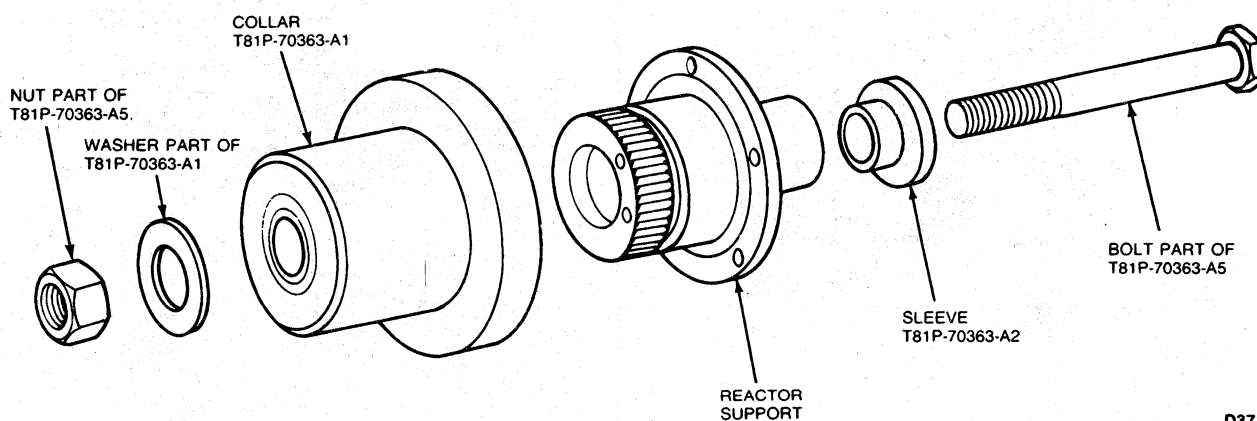
**CAUTION:** While tightening the lever attaching nut hold the outer throttle lever stationary. Failure to hold the lever will allow the throttle shaft and cam to rotate an excessive amount causing possible damage to cam.

**MAJOR SERVICE OPERATIONS****Reactor Support**

**NOTE:** The reactor support should be replaced only if inspection determines it to be damaged or otherwise unserviceable.

**Removal Tools**

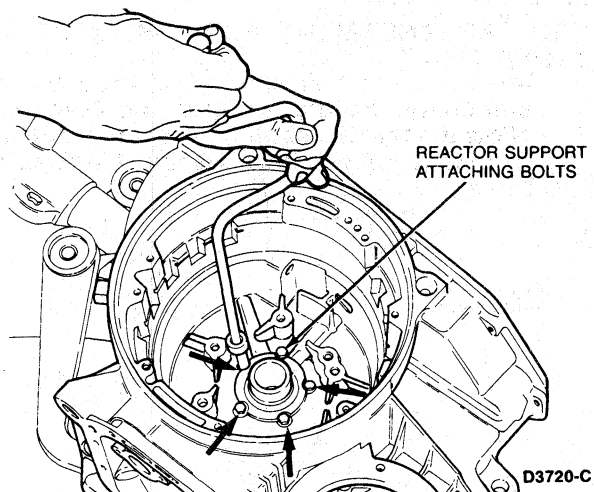
TOOL ARRANGEMENT FOR REMOVAL  
T81P-70363-A



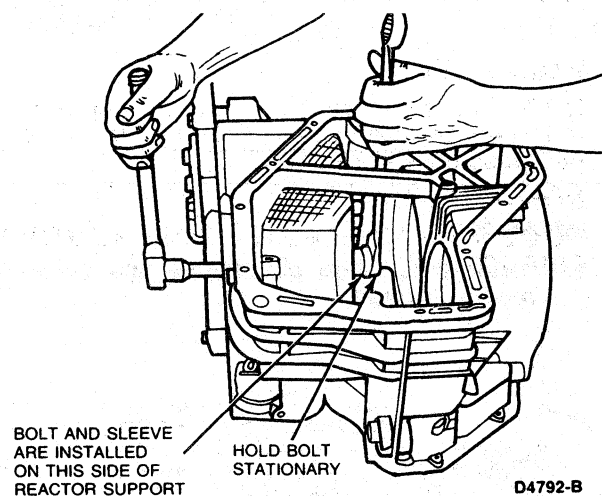
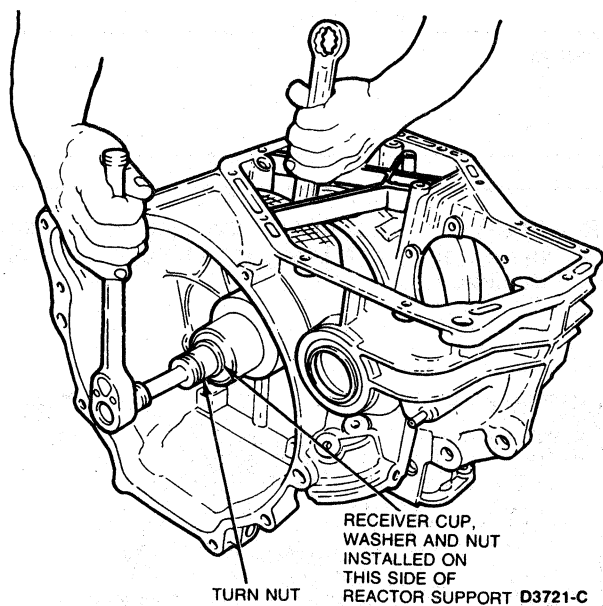
D3718-D

**MAJOR SERVICE OPERATIONS (Continued)****Removal**

1. Remove reactor support attaching bolts.



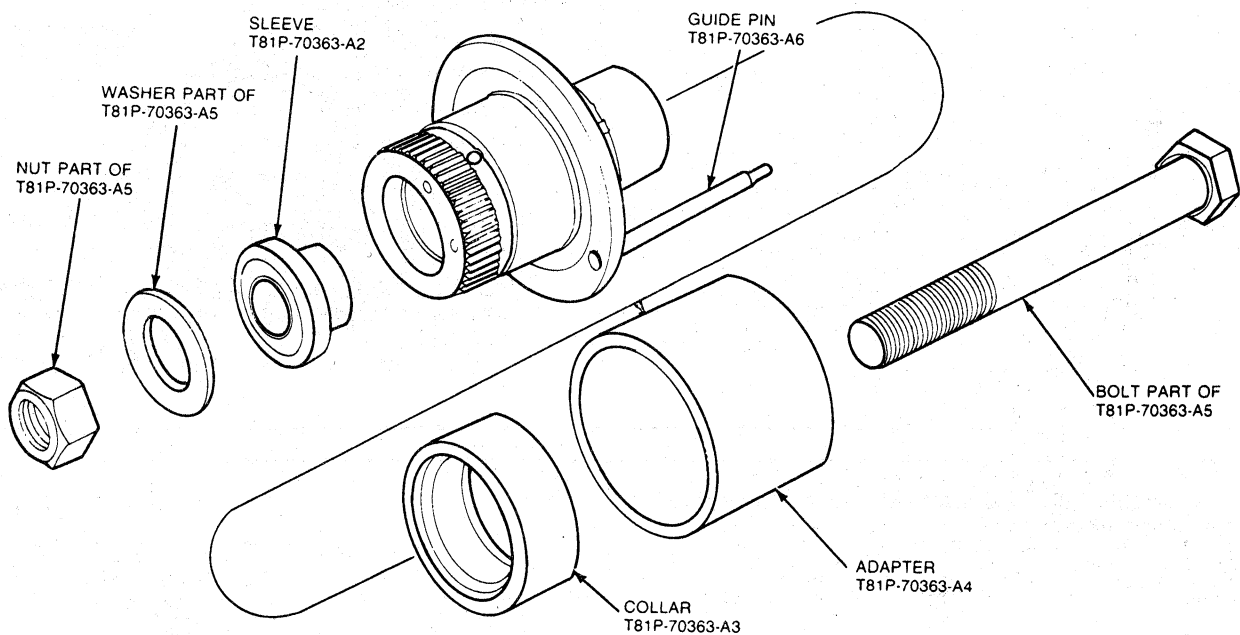
2. Assemble removal tool and remove reactor support from case.



## MAJOR SERVICE OPERATIONS (Continued)

### Installation Tools

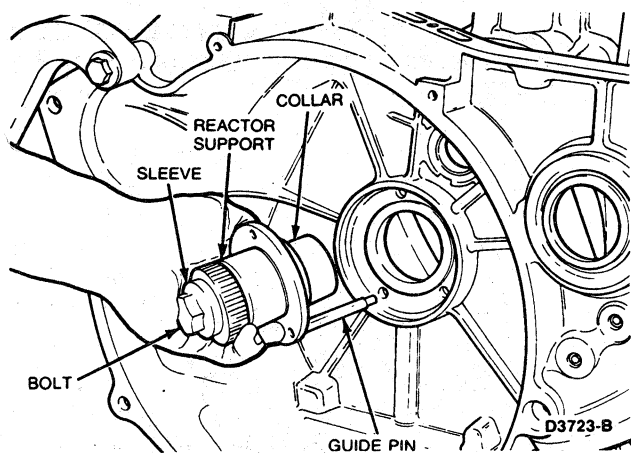
#### TOOL ARRANGEMENT FOR INSTALLATION T81P-70363-A



D3719-B

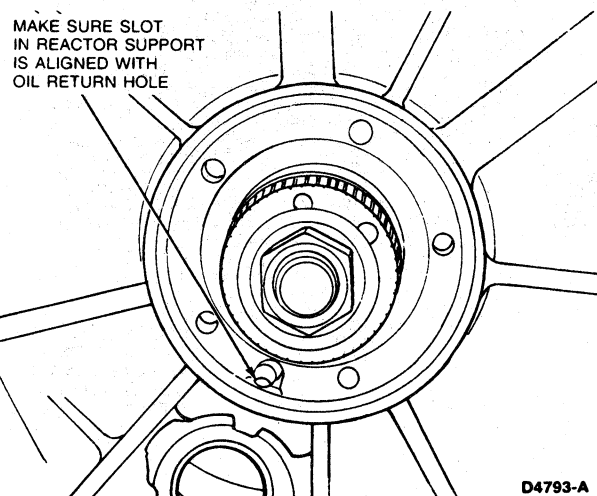
### Installation

1. Install bolt, guide pin, sleeve and collar on reactor support.



D3723-B

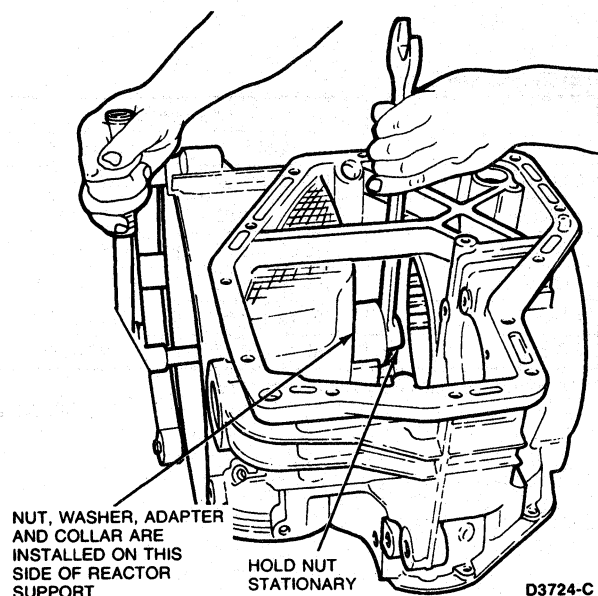
2. Position this assembly in the case. Ensure slot in reactor support is aligned with oil return hole in case.



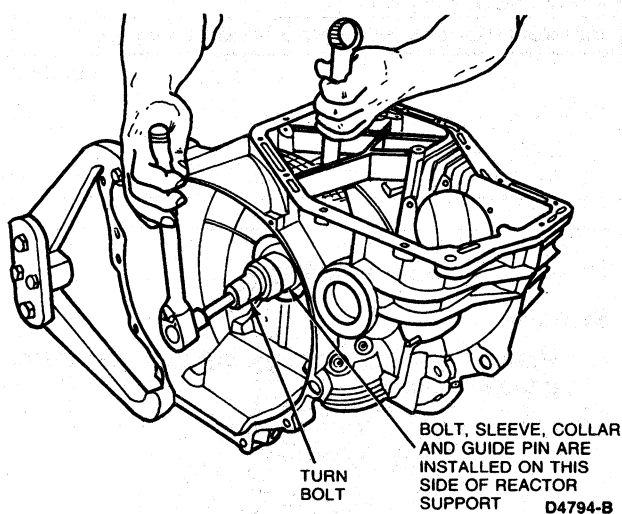
D4793-A

# MAJOR SERVICE OPERATIONS (Continued)

3. Position adapter in case and install bolt.  
Install nut and washer on bolt.



With tool properly assembled, pull reactor support into case.



4. Remove guide pin and install attaching bolts.  
Tighten bolts to 8-11 N·m (6-8 lb-ft).

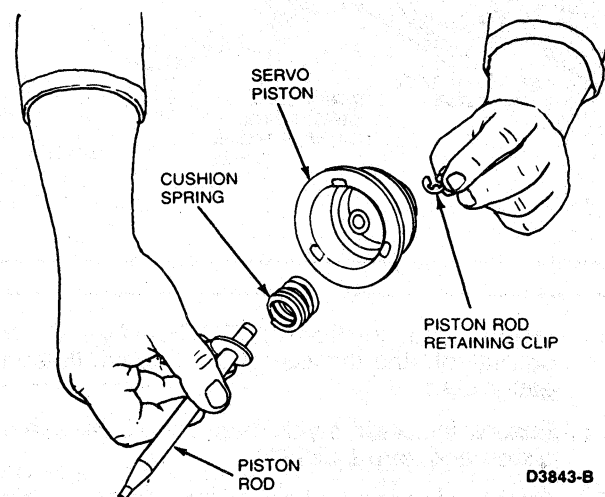
## Servo Travel Check

NOTE: The following procedure need be performed only if one of the components listed below is being replaced during assembly of the transaxle.

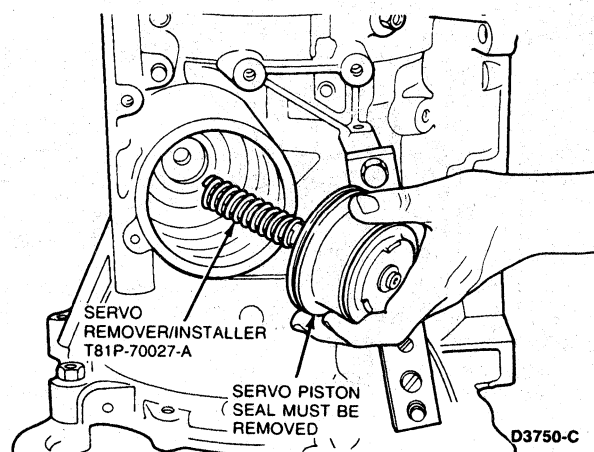
- Transaxle Case
- Band Assembly
- Drum and Sun Gear Assembly
- Servo Piston Rod
- Servo Piston
- Band Anchor Strut

1. If necessary clean and assemble the servo piston.

NOTE: Do not install piston seals. This check is performed without seals on piston.

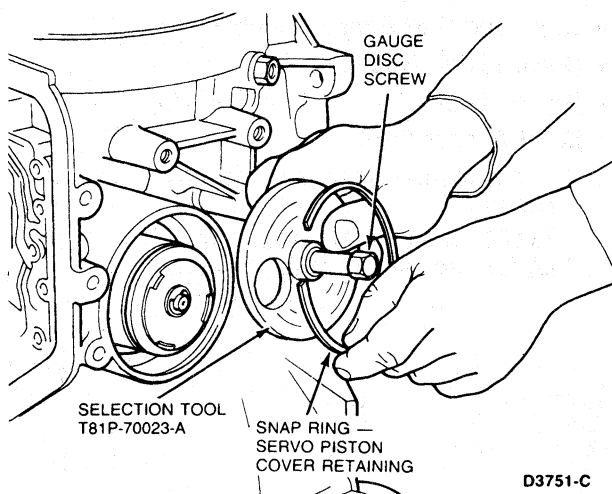


2. Install Servo Remover/Installer T81P-70027-A or equivalent on piston rod and position piston in case.



## MAJOR SERVICE OPERATIONS (Continued)

3. Install Selection Tool T81P-70023-A or equivalent and secure in case using servo cover snap ring.
4. Tighten gauge disc screw to 13.5 N·m (10 lb-ft).

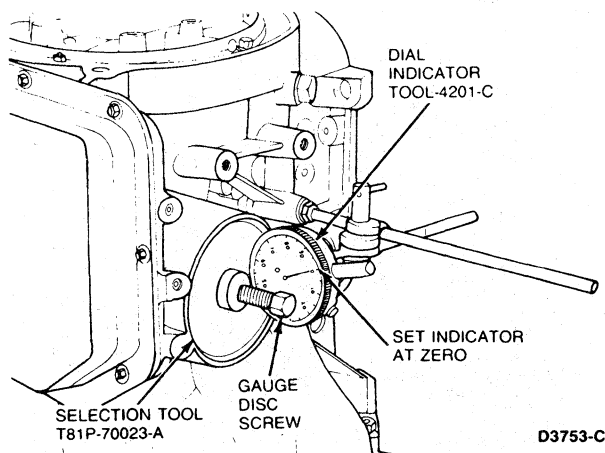


5. Mount Dial Indicator TOOL-4201-C or equivalent, and position stylus through hole in gauge disc.

Ensure indicator stylus has contacted servo piston and zero indicator.

6. Back off gauge disc screw until piston movement stops and read dial indicator.

The amount of piston travel as shown on dial indicator will determine the rod length to be installed.



7. Select a new piston rod using the measurement obtained in Step 6. Install piston rod and repeat Steps 1 through 6 to verify amount of piston travel.

### PISTON ROD SIZES

ID	Rod Length*	
	MM	Inch
0 Groove	160.22-160.52	6.313-6.324
1 Groove	159.61-159.90	6.289-6.300
2 Grooves	159.00-159.30	6.265-6.276
3 Grooves	158.39-158.69	6.240-6.252
4 Grooves	157.78-158.08	6.216-6.189
5 Grooves	157.17-157.47	6.197-6.209

\*From far end of snap ring groove to end of rod.

CD3842-B

If the dial indicator reads:

#### LESS THAN 5.15mm (.203 inch)

The piston rod is too long. A shorter rod (more grooves) will have to be installed.

#### MORE THAN 7.04mm (.247 inch)

The piston rod is too short. A longer rod (less grooves) will have to be installed.

#### 5.15-7.04mm (.203-.247 inch)

The piston rod is the correct length and no change is required.

CD3495-D

## Transfer Housing Bearing

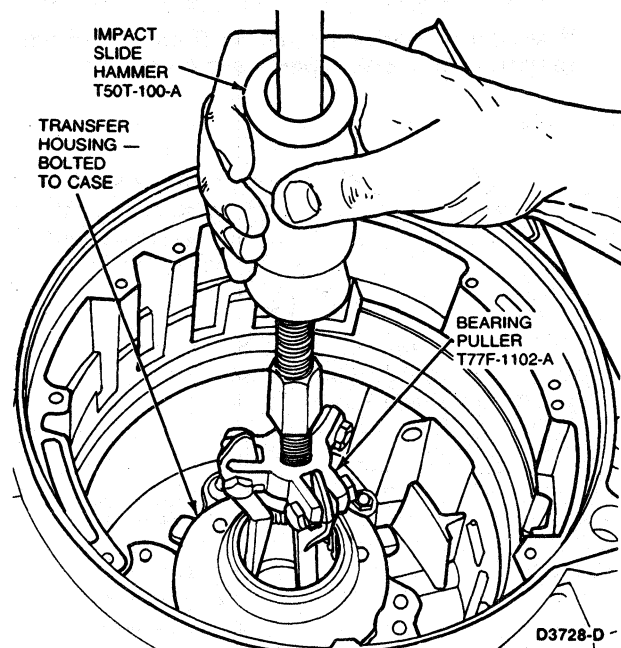
### Removal

1. Position transfer housing in case and install attaching bolts.



## MAJOR SERVICE OPERATIONS (Continued)

- Remove bearing using Bearing Puller T77F-1102-A and Impact Slide Hammer T50T-100-A or equivalent.



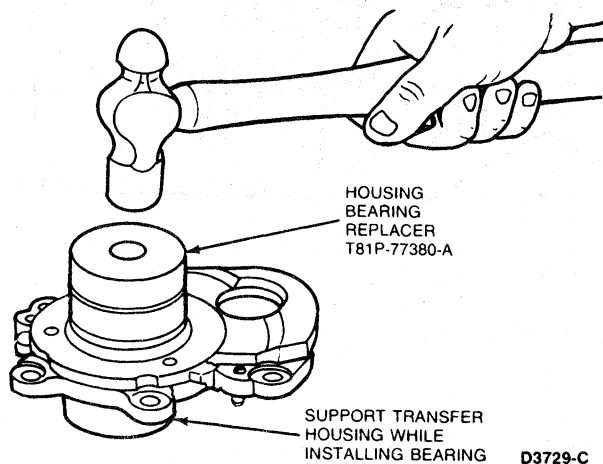
- Remove transfer housing.

### Installation

With transfer housing removed from case, install the bearing using Housing Bearing Replacer T81P-77380-A or equivalent.

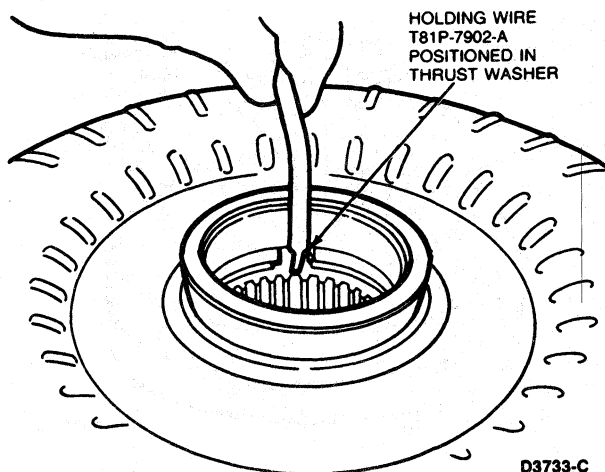
**CAUTION:** Support housing from underneath while installing bearing.

**NOTE:** The transmission case and transfer housing are matched parts. If one is damaged, both must be replaced.



### Torque Converter Reactor One-Way Clutch Check

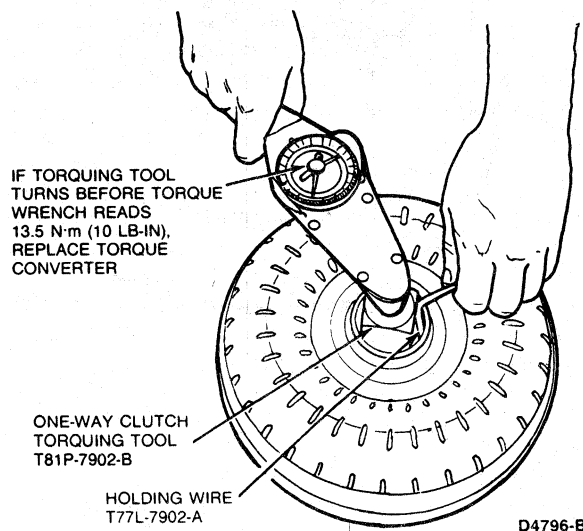
- Position Holding Wire T81P-7902-A or equivalent, with slot in thrust washer.



- While holding wire in position install One-Way Clutch Torquing Tool T81P-7902-B or equivalent in reactor spline.

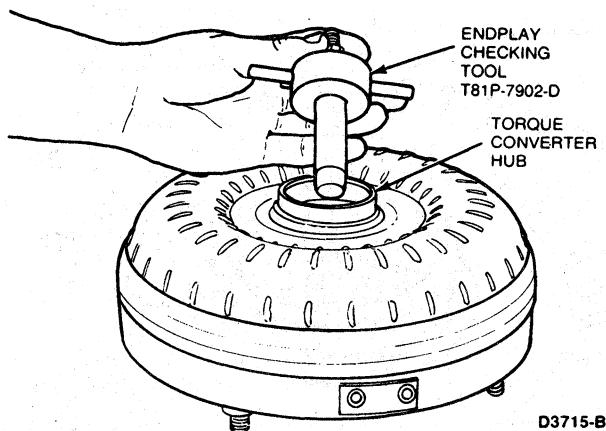
Continue holding wire and turn torquing tool counterclockwise with a torque wrench.

If torquing tool begins to turn before torque wrench reads 13.5 N·m (10 lb-ft), replace converter.

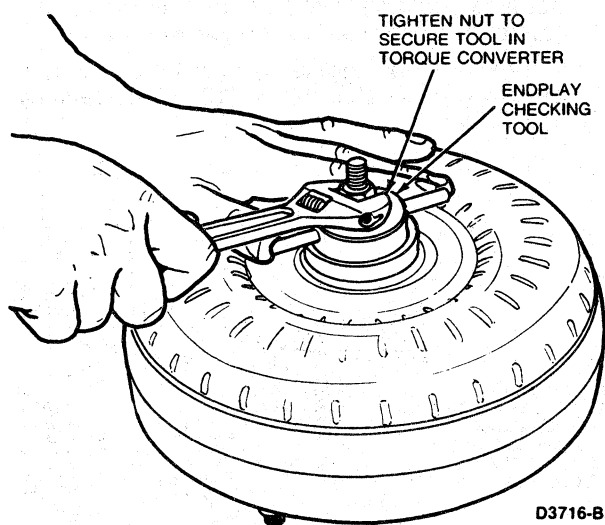


**MAJOR SERVICE OPERATIONS (Continued)****Torque Converter End Play Check**

1. Position End Play Checking Tool T81P-7902-D or equivalent in torque converter hub.



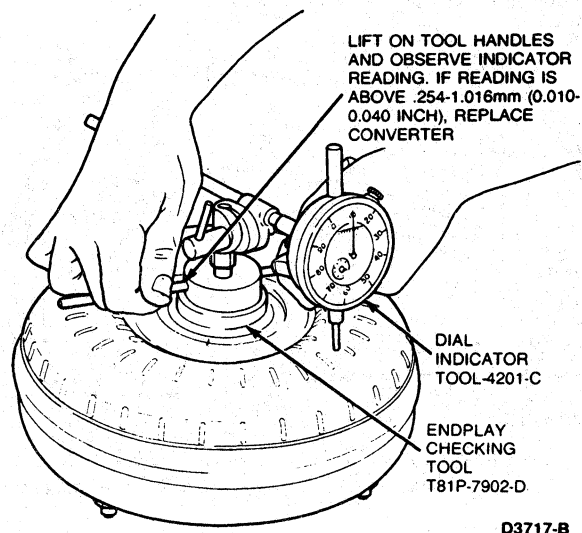
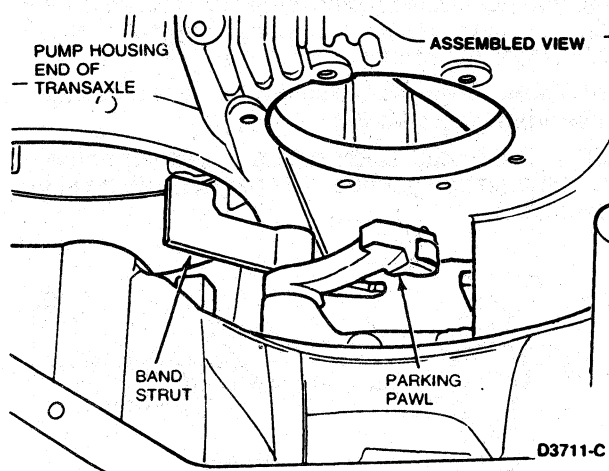
2. Tighten nut on end play checking tool.



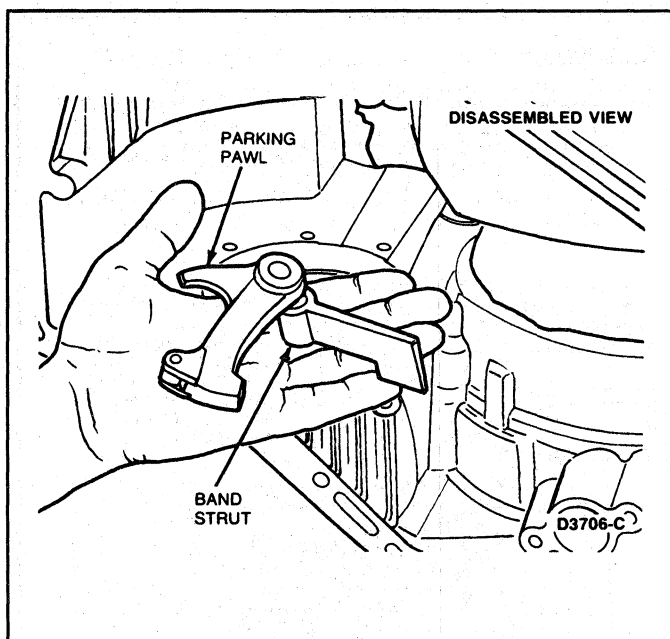
3. Mount Dial Indicator TOOL-4201-C or equivalent on end play checking tool.

With stylus contacting converter shell and with indicator zeroed, lift on checking tool handles.

If indicator reading is above 0.254-1.016mm (0.010-0.040 inch), replace the converter.

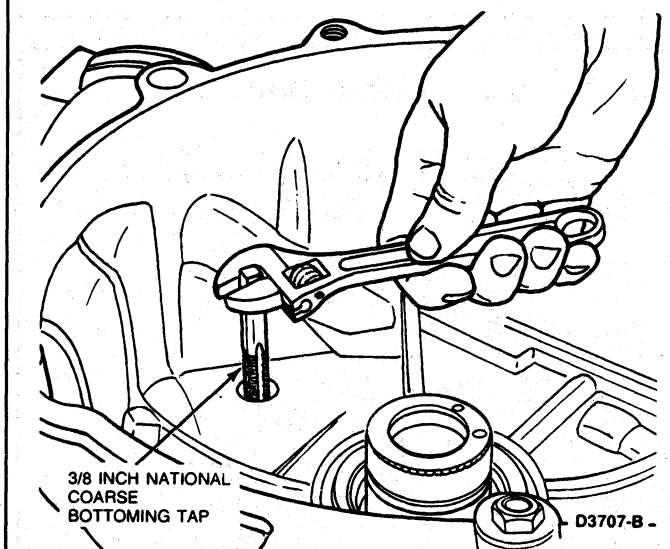
**Parking Pawl and Band Strut**

# MAJOR SERVICE OPERATIONS (Continued)



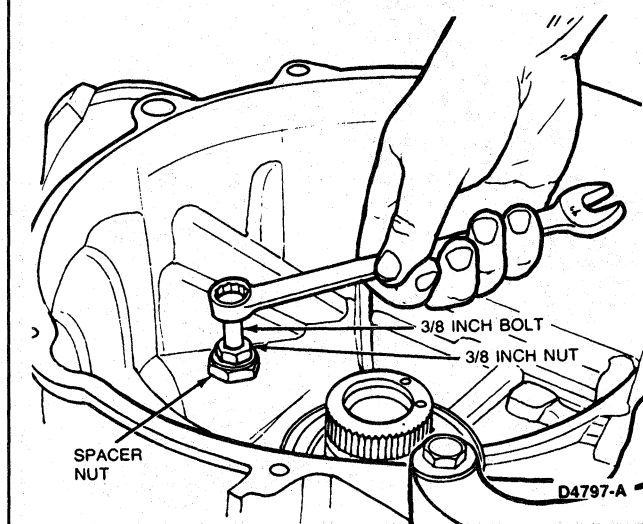
## Removal

1. Thread plug using a 3/8 inch national coarse tap. The tap has to be of the bottoming type.

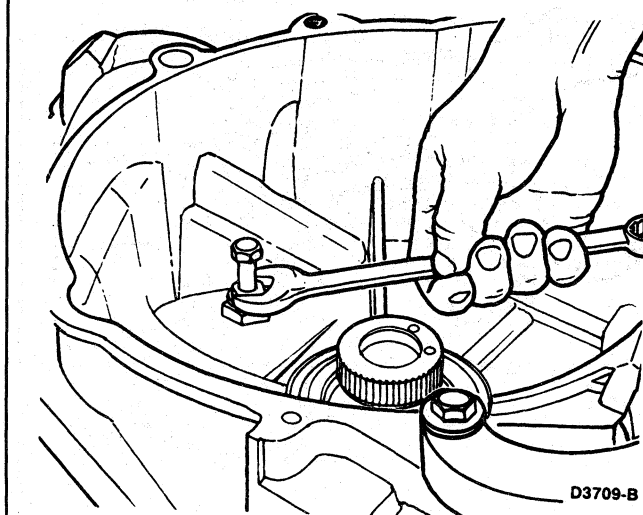


2. Position a nut over the plug to act as a spacer. The hole in the nut has to be larger than the diameter of the plug.

With spacer in position, install a nut on a 3/8-inch 16 national coarse bolt and thread bolt into plug.

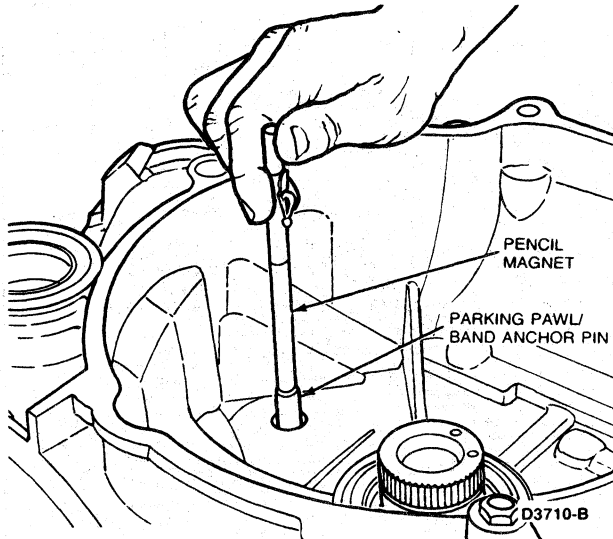


3. To remove plug, thread nut installed on bolt downward against spacer nut.

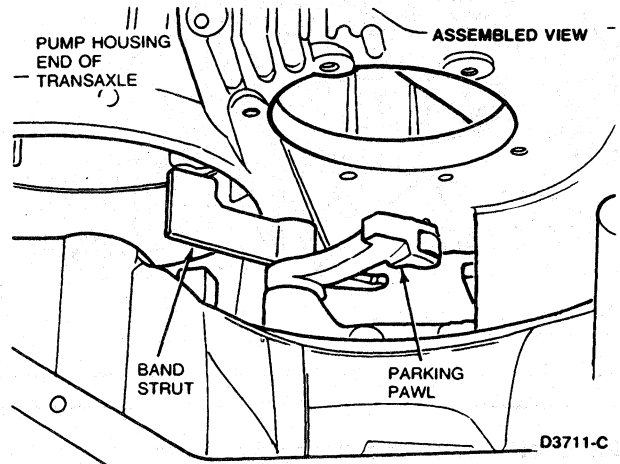


**MAJOR SERVICE OPERATIONS (Continued)**

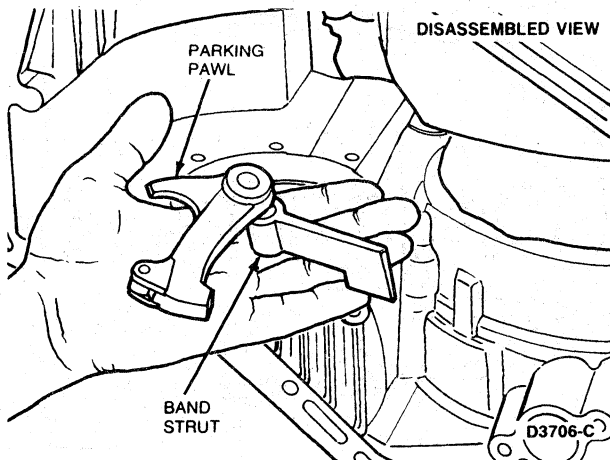
4. Remove parking pawl/band anchor pin using a magnet. Because of the tight fit between the components, it may be necessary to work the parking pawl and band strut up and down while removing pin.

**Installation**

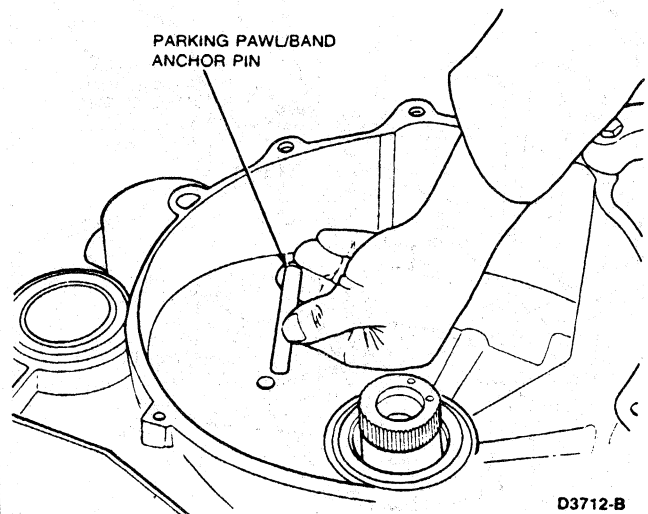
1. Position parking pawl and band anchor in case.  
Note that band strut is positioned closest to the pump housing end of the transaxle.



5. Remove parking pawl and band anchor from case.

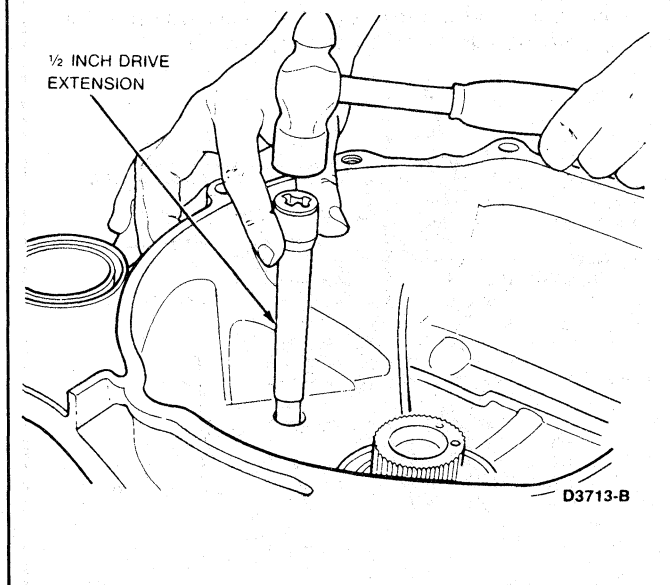


2. Install parking pawl/band anchor pin in case.

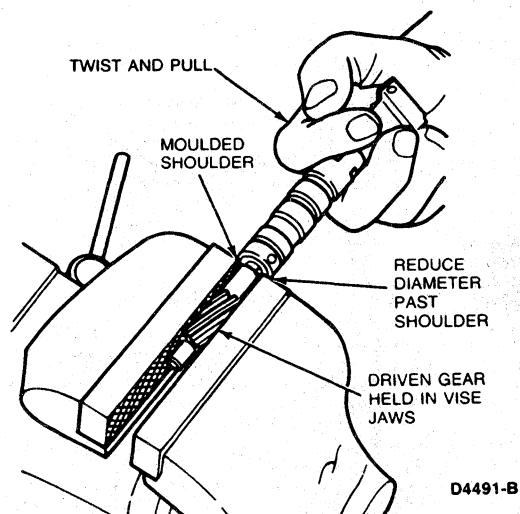


## MAJOR SERVICE OPERATIONS (Continued)

3. Position plug in case and seat in case.



2. Clamp plastic driven gear in the vise. Grip governor body firmly, then twist and pull at same time.

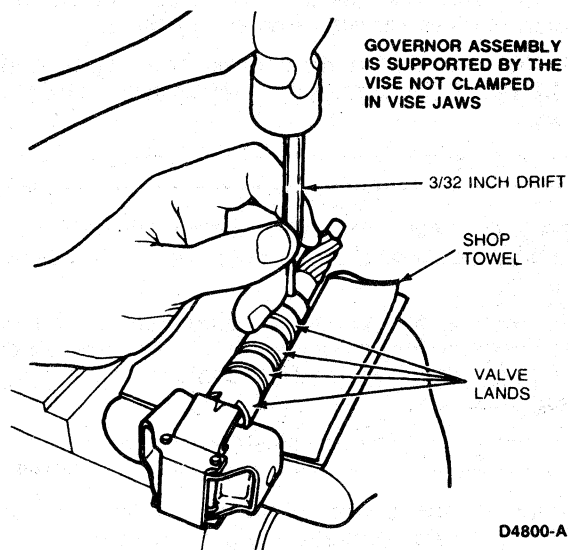


### Governor Driven Gear

#### Disassembly

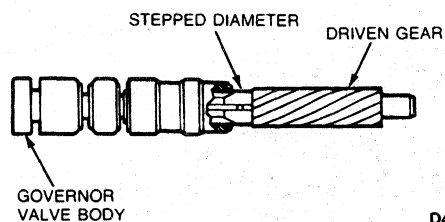
1. Support governor assembly on a vise and remove the 3/32-inch roll pin using a drift.

NOTE: Care must be taken not to damage governor body valve lands. Governor assembly is supported by vise, not clamped in vise jaws.



#### Assembly

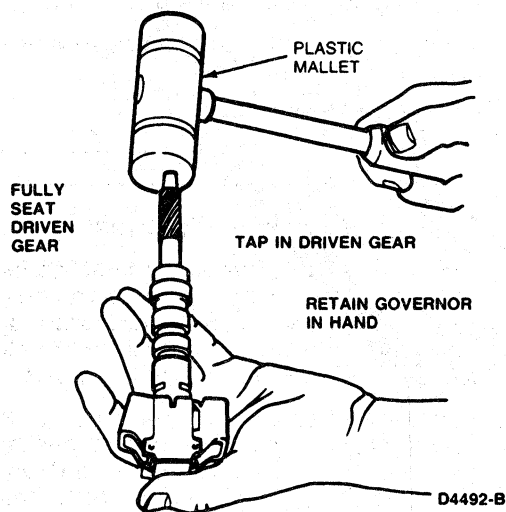
1. Align driven gear to governor body driven gear bore. Press new driven gear into body as far as possible by hand.



## MAJOR SERVICE OPERATIONS (Continued)

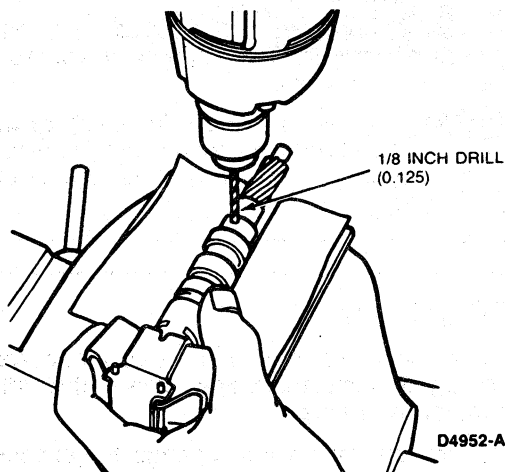
2. Ensure driven gear is properly aligned to governor body then carefully tap driven gear into position with a plastic mallet.

NOTE: Driven gear is in position when moulded shoulder is seated against governor body.



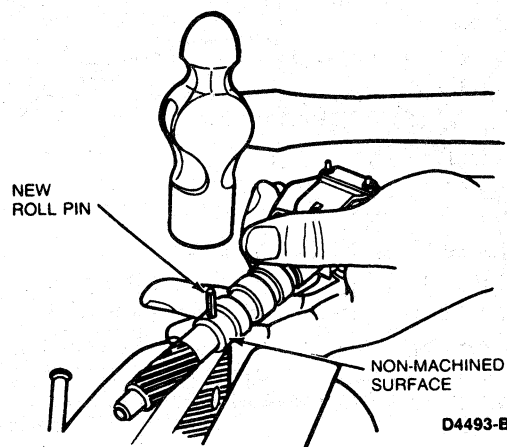
3. Drill a 1/8-inch hole through the plastic driven gear.

NOTE: Use a drill press, if possible. Proper alignment of the drill is imperative to prevent damaging the governor body.



4. Tap in new roll pin. Do not reuse old roll pin.

NOTE: The governor body must be supported on a non-machined surface.



### Transaxle Fluid Drain and Refill

Normal maintenance and lubrication requirements do not necessitate periodic automatic transaxle fluid changes. If a major service, such as a clutch band, bearing, etc., is required in the transaxle, it will have to be removed for service. **At this time the converter, transaxle cooler and cooler lines must be thoroughly flushed to remove any dirt.**

When used under continuous or severe conditions the transaxle and torque converter should be drained and refilled with fluid as specified.

**CAUTION: Use of a fluid other than specified could result in transaxle malfunction and/or failure.**

Refer to Vehicle Certification Label affixed to LH front door lock face panel or door pillar for transaxle code.

When filling a dry transaxle and converter, refer to Specifications for capacity. Check the fluid level following the room temperature checking procedures.

Procedures for partial drain and refill, due to in-vehicle service operation, are as follows:

1. Raise vehicle on a hoist or jackstands. Refer to the Pre-Delivery manual, Section 50-04.
2. Place a drain pan under transaxle.
3. Loosen pan attaching bolts and drain fluid from transaxle.

**MAJOR SERVICE OPERATIONS (Continued)**

4. When fluid has drained to level of pan flange, remove rest of pan bolts working from rear and both sides of pan to allow it to drop and drain slowly.
5. When all fluid has drained from transaxle, remove and thoroughly clean the pan. Discard gasket.
6. Place a new gasket on pan, and install pan on transaxle.
7. Fill transaxle to correct level.
8. Lower vehicle.

**Oil Cooler Tube Leakage**

When fluid leakage is found at the oil cooler, the cooler must be replaced. Refer to Section 27-03.

When one or more of the fluid cooler steel tubes must be replaced, each replacement tube must be fabricated from the same size steel tubing as the original line.

Using the old tube as a guide, bend the new tube as required. Add the necessary fittings, and install the tube.

After the fittings have been tightened, add fluid as needed and check for fluid leaks.

**CLEANING AND INSPECTION****Transaxle**

Clean the parts with suitable solvent and use moisture-free air to dry off all parts and clean out fluid passages.

**The composition clutch plates, control valve body-to-screen gasket, bands and synthetic seals should not be cleaned in a vapor degreaser or with any type of detergent solution.** To clean these parts, wipe them off with a lint-free cloth. New clutch plates or bands should be soaked in the specified transmission fluid for fifteen minutes before being assembled.

**Valve Body**

1. Clean all parts, except check balls, thoroughly in clean solvent. Blow dry with moisture-free compressed air.
2. Inspect all valve and plug bores for scores. Check all fluid passages for obstructions. Inspect all mating surfaces for burrs and scores. **If needed, use crocus cloth to polish valves and plugs. Avoid rounding the sharp edges of the valves and plugs with the crocus cloth.**
3. Inspect all springs for distortion. Check all valves and plugs for free movement in their respective bores. Valves and plugs, when dry, must fall from their own weight in their respective bores.
4. Roll the manual valve on a flat surface to check for bent condition.

**Servo**

1. Inspect the servo body for cracks and the piston bore for scores.
2. Check the fluid passages for obstructions.
3. Inspect the band and the struts for distortion. Inspect the band ends for cracks.
4. Inspect the servo spring for distortion.
5. Inspect the band lining for excessive wear and bonding to the metal band.
6. Replace damaged seals.

**Direct and Intermediate Clutches**

1. Inspect the clutch cylinder thrust surfaces, piston bore, and clutch plate serrations for scores or burrs. Minor scores or burrs may be removed with crocus cloth. Replace the clutch cylinder if it is badly scored or damaged.
2. Check the fluid passage in the clutch cylinder for obstructions. Clean out all fluid passages. Inspect the clutch piston for scores and replace if necessary. Inspect the piston check ball for freedom of movement and proper seating.
3. Check the clutch release spring for distortion and cracks. Replace the spring if it is distorted or cracked.
4. Inspect the composition clutch plates, steel clutch plates, and clutch pressure plate for worn or scored bearing surfaces. Replace all parts that are deeply scored.
5. Check the clutch plates for flatness and fit on the clutch hub serrations. Discard any plate that does not slide freely on the serrations or that is not flat.
6. Check the clutch hub thrust surfaces for scores and the clutch hub splines for wear.
7. Inspect the turbine shaft bearing surfaces for scores. If excessive clearance or scores are found, discard the unit.
8. Check the splines on the turbine shaft for wear. Replace the shaft if the splines are excessively worn. Inspect the bushing in the turbine shaft for scores.

**One-Way Clutch**

1. Inspect the outer and inner races for scores or damaged surfaces areas where the rollers contact the races.
2. Inspect the rollers and springs for excessive wear or damage.
3. Inspect the spring and roller case for bent or damaged spring retainers.

**CLEANING AND INSPECTION (Continued)****Governor**

1. Inspect the governor valve and bore for scores. Minor scores may be removed from valves with crocus cloth. Replace governor if valves or body are deeply scored.
2. Inspect the governor screen for obstructions. The screen must be free of foreign material. If contaminated, clean thoroughly in a suitable solvent and blow dry with compressed air.
3. Check for free movement of the valves in the bores. The valves should slide freely of their own weight in the bores when dry. Inspect fluid passages in the valve body and counterweight for obstructions. **All fluid passages must be clean.**
4. Inspect the governor drive gear. Replace, if the teeth are broken, chipped or excessively worn.

**Reverse Clutch**

1. Inspect the clutch piston bore and the piston inner and outer bearing surfaces for scores. Check the air bleed ball valve in the clutch piston for free movement. Check the orifice to ensure it is not plugged.
2. Check the fluid passages for obstructions. All fluid passages must be clean and free of obstructions.
3. Inspect the clutch plates for wear, scoring, and fit on the clutch hub serrations. Replace all plates that are badly scored, worn or do not fit freely in the hub serrations.
4. Inspect the clutch pressure plate for scores on the clutch plate bearing surface. Check the clutch release spring(s) for distortion.

**Case**

Inspect the case for cracks and stripped threads. Inspect the gasket surfaces and mating surfaces for burrs. Check the vent for obstructions, and check all fluid passages for obstructions and leakage.

Inspect the case bushing for scores. Check all parking linkage parts for wear or damage.

If the transaxle case thread is damaged, service kits may be purchased from local jobbers. To service a damaged thread, the following procedures should be carefully followed.

1. Drill out the damaged threads, **using the same drill size as the thread OD.** For example, use a 5/16-inch drill for a 5/16 x 18 thread.
2. Select the proper special tap and tap the drilled hole. The tap is marked for the size of the thread being repaired. Thus, the special tap marked 5/16 x 18 will not cut the same thread as a standard 5/16 x 18 tap. It does cut a thread large enough to accommodate the insert, and after the insert is installed the original thread size (5/16 x 18) is restored.

3. Place the insert on the tool and adjust the sleeve to the length of the insert being used. Press the insert against the face of the tapped hole. Turn the tool clockwise and wind the insert into the hole until the insert is 1/2-turn below the face.
4. Working through the insert, bend the insert tang straight up and down until it breaks off at the notch.
5. Improperly installed inserts can be removed with extractor tool. Place the extractor tool in the insert so that the blade rests against the top coil 1/4 to 1/2 turn away from the end of the coil. Tap the tool sharply with a hammer so that the blade cuts into the insert. Exert downward pressure on the tool and turn it counterclockwise until the insert is removed.

These tools are marked with the thread size being repaired. Place the insert on the tool and adjust the sleeve to the length of the insert being used. Press the insert against the face of the tapped hole. Turn the tool clockwise and wind the insert into the hole until the insert is 1/2 turn below the face.

**Pinion Carriers**

**Individual parts of the planet carriers are not serviceable.**

1. The pins and shafts in the planet assemblies should be checked for loose fit and/or complete disengagement. Use a new planet assembly if either condition exists. Before installing a planet assembly, the shaft welds should also be checked.
2. Inspect the pinion gears for damaged or excessively worn teeth.
3. Check for free rotation of the pinion gears.

**Input Idler and Final Drive Gears**

Inspect the gear teeth. They should be smooth with a uniform contact pattern without signs of excessive wear. Replace any gear that is cracked, chipped, broken or excessively worn.

**Idler Gear Bearings**

Wash the idler gear bearings thoroughly in cleaning solvent. Blow the bearings dry with compressed air.

**CAUTION: Do not allow bearings to spin, turn them slowly by hand. Air spinning of the bearings will result in damage to the bearing races and rollers.**

Make certain the bearings are clean, then lubricate with transmission fluid. Refer to the Tapered Roller Bearing Diagnosis chart for specific bearing conditions.



**CLEANING AND INSPECTION (Continued)****Thrust Bearings**

Wash the thrust bearings thoroughly in cleaning solvent. Blow the bearings dry with compressed air.

Ensure the bearings are clean and then lubricate with transmission fluid. Replace any bearings and races which show signs of pitting or roughness.

NOTE: This bearing is serviced only as part of the transfer housing assembly.

**Stator to Impeller Interference Check**

1. Position the stator support assembly on a bench with the spline end of the stator shaft pointing up.
2. Mount a converter on the stator support with the splines on the one-way clutch inner race engaging the mating splines of the stator support.
3. Hold the stator support stationary, and try to rotate the converter counterclockwise. The converter should rotate freely without any signs of interference or scraping within the converter assembly.
4. If there is an indication of scraping, the trailing edges of the stator blades may be interfering with the leading edges of the impeller blades. In such cases, replace the converter.

**Stator to Turbine Interference Check**

1. Position the converter on the bench, front side down.
2. Install a stator support assembly to engage the mating splines of the stator support and stator, and pump drive gear lugs.
3. Install the turbine shaft, engaging the splines with the turbine hub.
4. Hold the stator support stationary and attempt to rotate the turbine with the turbine shaft. The turbine should rotate freely in both directions without any signs of interference or scraping noise.
5. If interference exists, the stator front thrust washer may be worn, allowing the stator to hit the turbine. In such cases, the converter must be replaced.

The converter crankshaft pilot should be checked for nicks or damaged surfaces that could cause interference when installing the converter into the crankshaft. Check the converter hub for nicks or sharp edges that would damage the converter seal.

**Flywheel****Inspection**

Inspect the flywheel for cracks or other damage that would make it unfit for further service. Inspect the flywheel ring gear for worn, chipped or cracked teeth. If the teeth are damaged, replace the ring gear and flywheel assembly.

With the flywheel installed on the crankshaft, check the gear face runout.

**Stator Support**

Inspect the stator splines for burrs and wear.

**Converter and Oil Cooler**

When internal wear or damage has occurred in the transaxle, metal particles, clutch plate material, or band material may have been carried into the converter and oil cooler. These contaminants are a major cause of recurring transaxle troubles and **MUST** be removed from the system before the transaxle is put back into service.

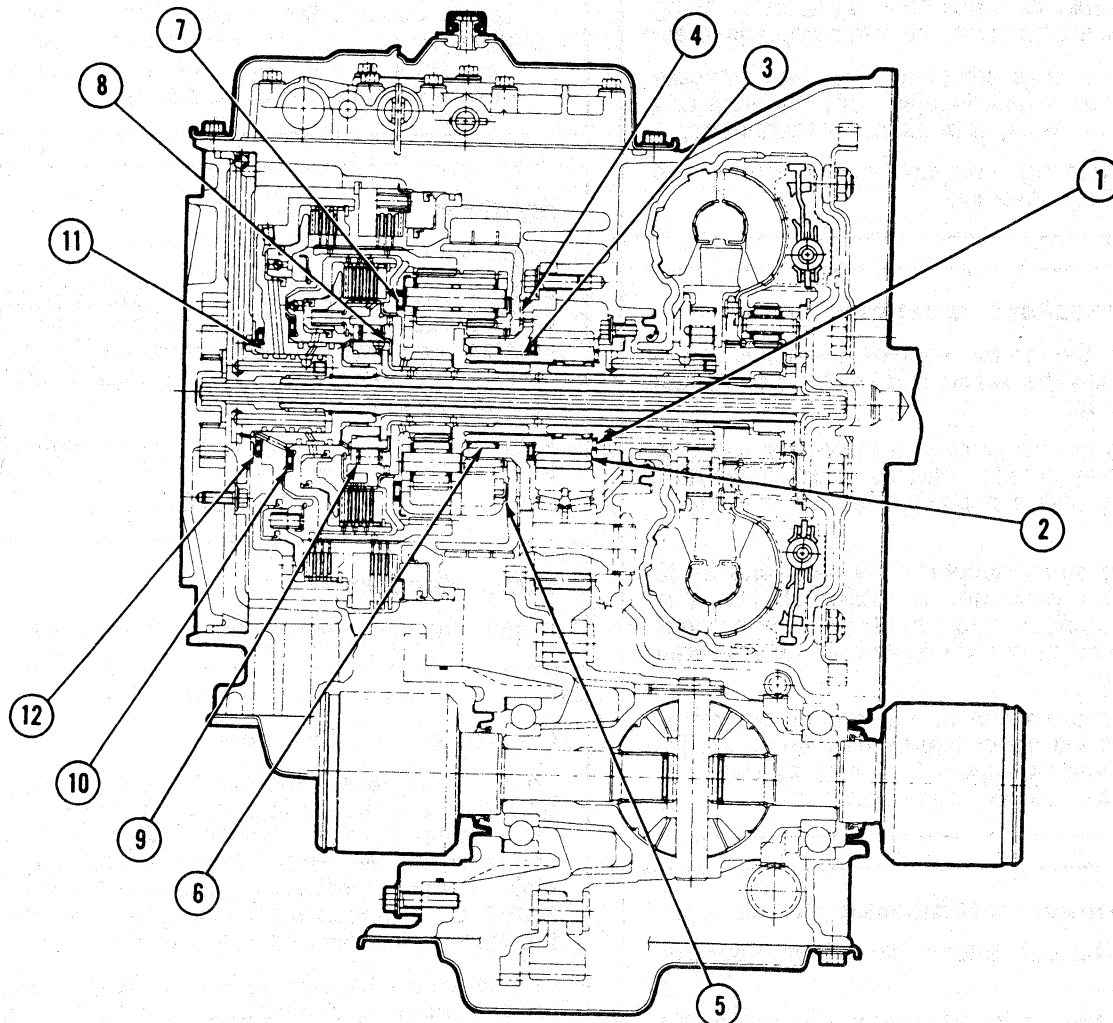
Whenever a transaxle has been disassembled to replace worn or damaged parts or because the valve body sticks from foreign material, the converter and oil cooler **MUST** be cleaned by using a mechanically agitated cleaner, such as Rotunda model 014-00028 or equivalent.

The lack of a drain plug in the ATX converter increases the amount of residual flushing solvent retained in the converter after cleaning. This retained solvent is not acceptable and a method of diluting it is required. The following procedure is to be used after removal of the ATX torque converter from the cleaning equipment.

1. **Thoroughly drain** remaining solvent through the hub.
2. Add 1.9L (2.0 U.S. quarts) of clean transmission fluid to the converter. Agitate by hand.
3. **Thoroughly drain** solution through the converter hub.

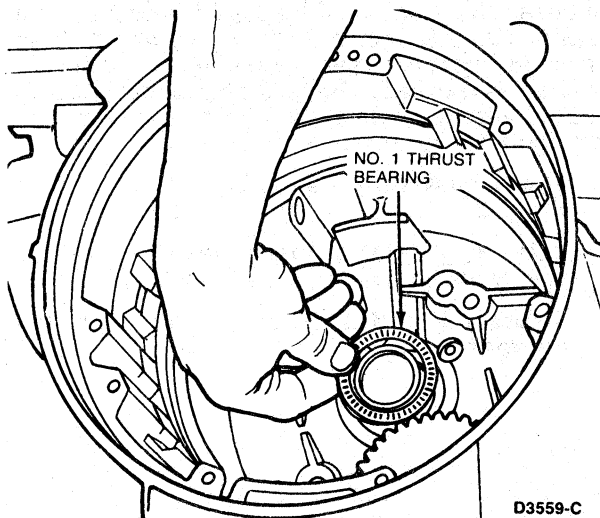
## CLEANING AND INSPECTION (Continued)

## Bearing Locator



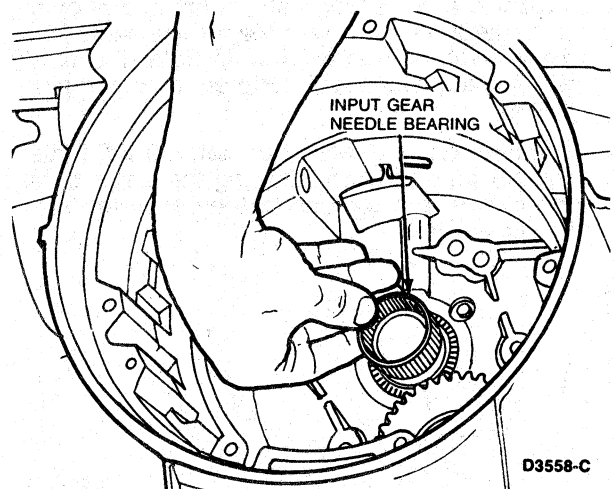
D6305-A

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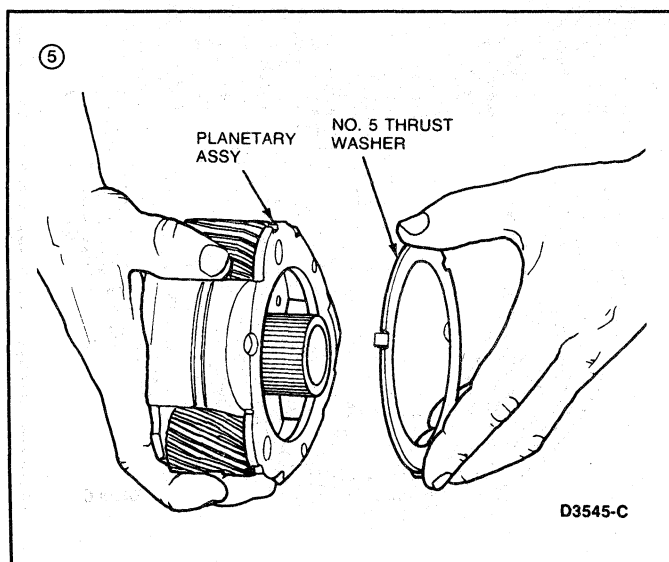
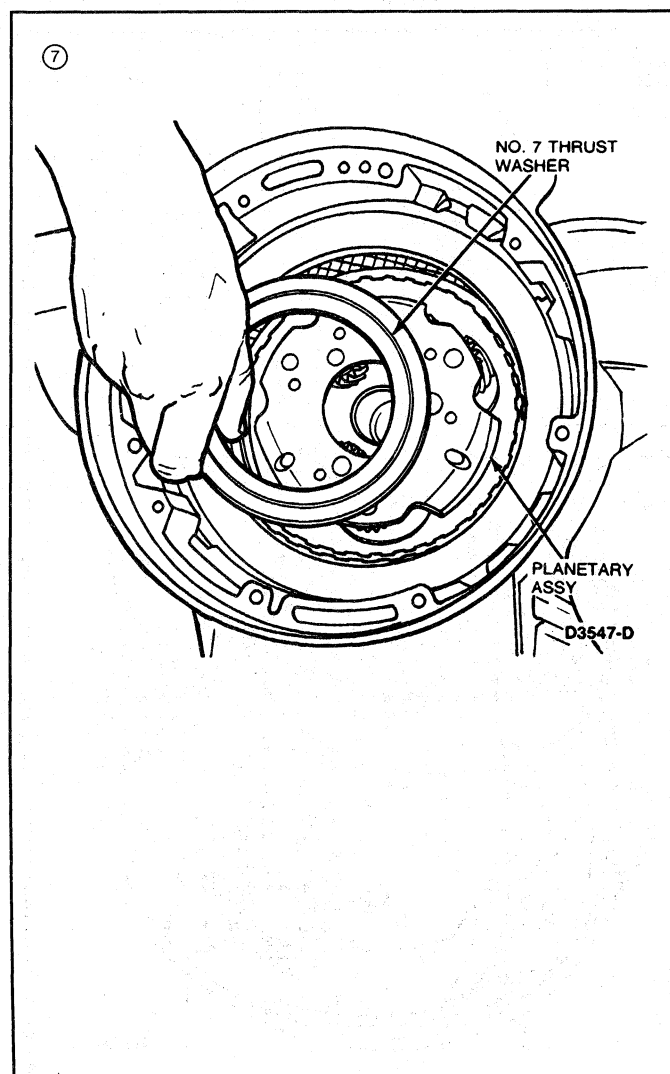
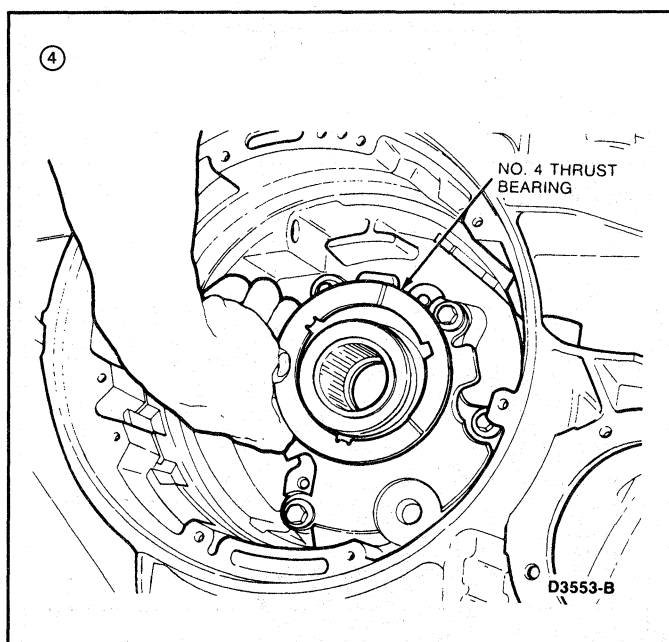
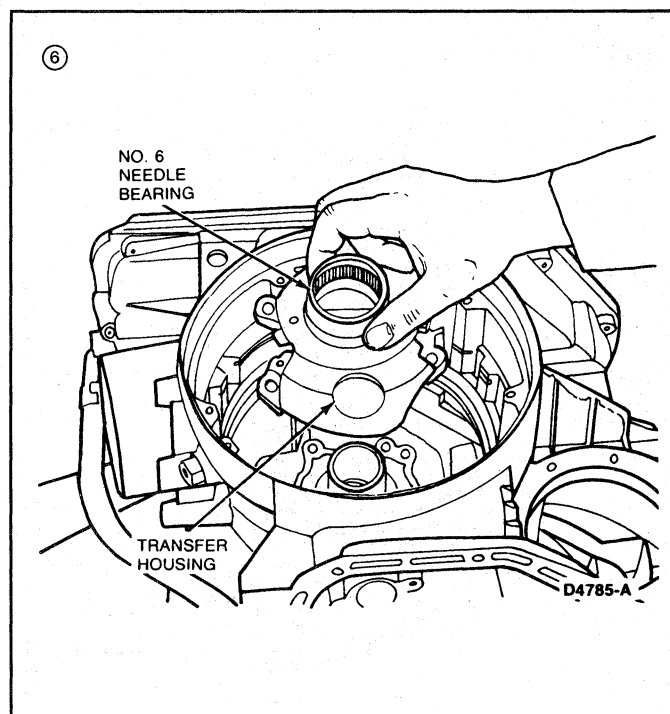
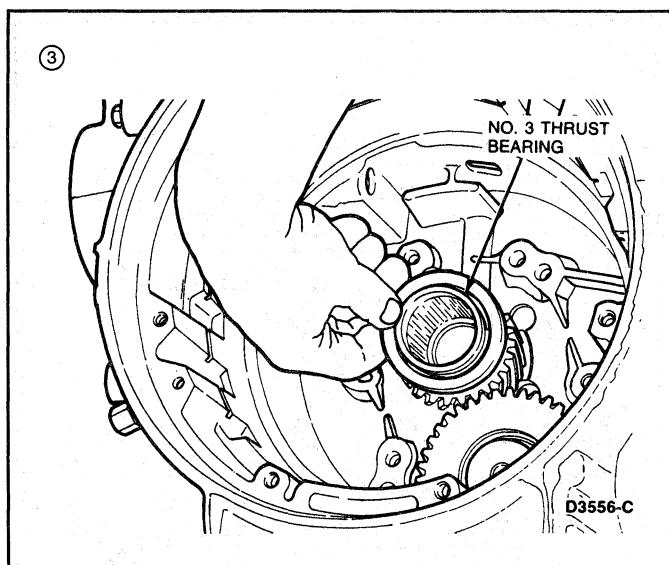
D3559-C

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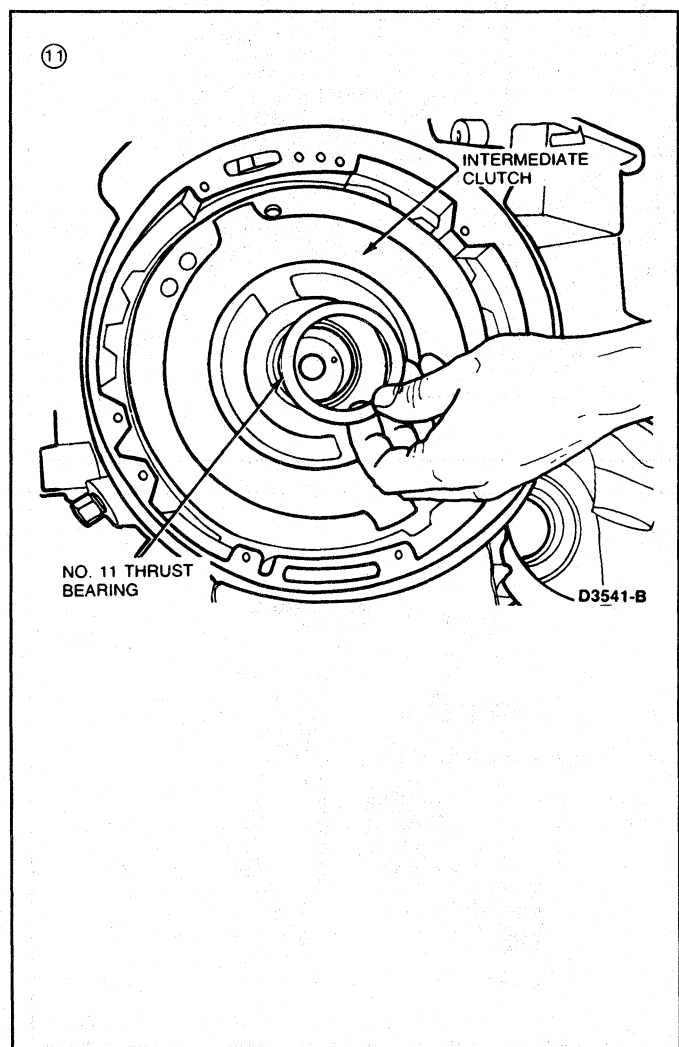
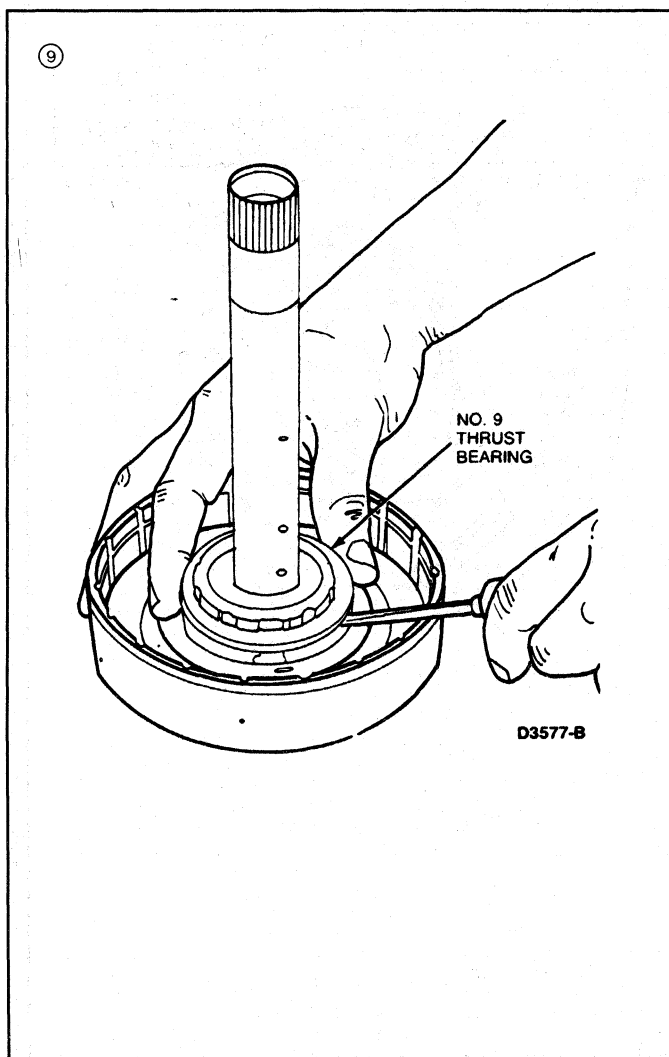
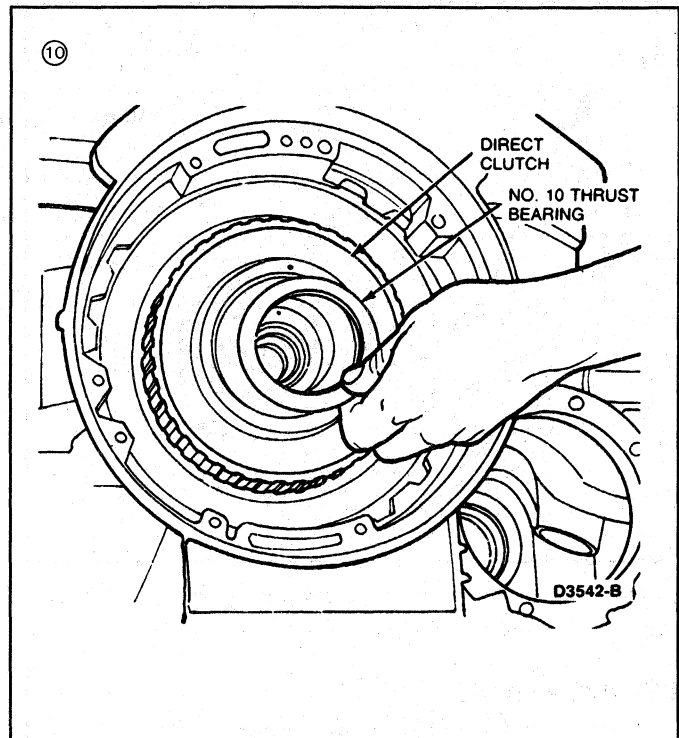
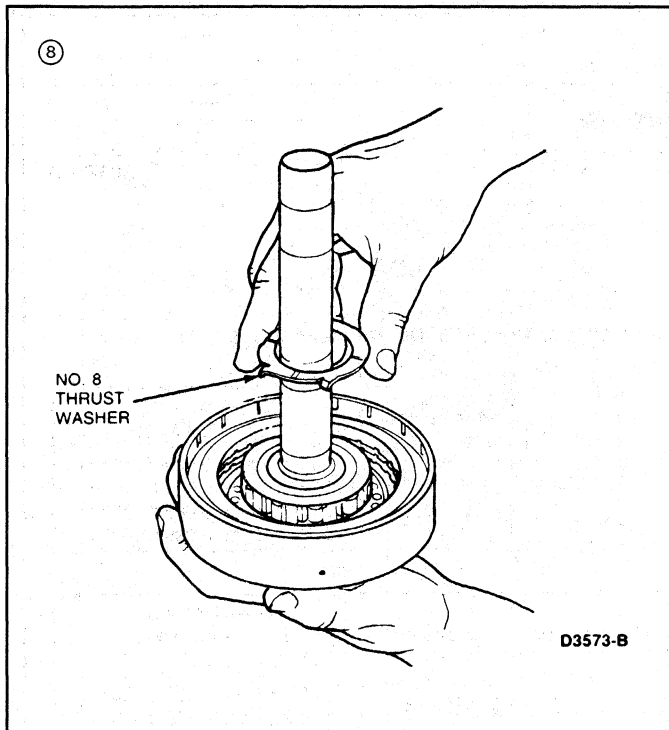


D3558-C

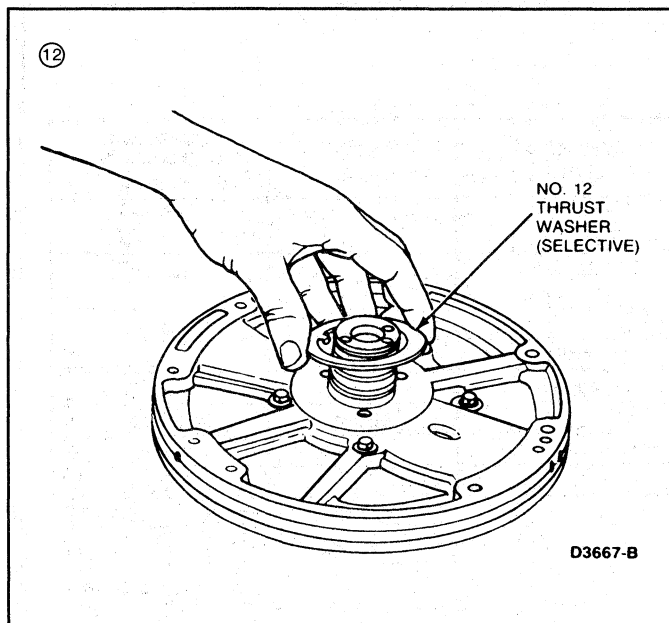
## CLEANING AND INSPECTION (Continued)



## CLEANING AND INSPECTION (Continued)



## CLEANING AND INSPECTION (Continued)



## SPECIFICATIONS

Description	N-m	Lb-Ft
Cooler Line Fittings at Radiator	11-16 ①	8-12
Transaxle	24-31 ①	18-23
Cooler Line Nut	16-24	12-18
Push Connector Fitting to Transaxle	24-31	18-23
Tube Nut to Connector	16-24	12-18
Threaded Connector to Oil Cooler	11-16	8-12

① 1/4 inch x 18 Straight Pipe Fitting

CD4507-B

## FLUID CAPACITY

Liters	Quarts
8.0	8.4

CD6779-A

## CLUTCH PACK PLATE USAGE AND CLEARANCE

## Reverse Clutch

Steel	Friction	Clearance	Selective Snap Ring — Thickness
3	3	0.76-1.40mm (0.030-0.055 in.)	1.24-1.34mm (0.049-0.053 in.) 1.68-1.78mm (0.066-0.070 in.) 2.11-2.21mm (0.083-0.087 in.) 2.53-2.63mm (0.099-0.103 in.)

## Direct Clutch

Steel	Friction	Clearance	Selective Snap Ring — Thickness
3*	3*	0.78-1.20mm (0.031-0.048 in.)	1.26-1.36mm (0.050-0.054 in.) 1.58-1.68mm (0.062-0.066 in.) 1.90-2.00mm (0.075-0.079 in.)

## Intermediate Clutch

Steel	Friction	Clearance	Selective Snap Ring — Thickness
3	3	0.75-1.12mm (0.030-0.044 in.)	1.24-1.34mm (0.049-0.053 in.) 1.51-1.61mm (0.060-0.064 in.) 1.78-1.88mm (0.071-0.075 in.)

\*With Cushion Spring

CD3873-G

## SPECIFICATIONS (Continued)

## CLUTCH AND BAND APPLICATION CHART

Gear	Band	Direct Clutch	Intermediate Clutch	Reverse Clutch	Intermediate One-Way Clutch
1st Gear Manual Low	Applied	Applied			Holding
2nd Gear Manual Low	Applied		Applied		
1st Gear (Drive)	Applied				Holding
2nd Gear (Drive)	Applied		Applied		
3rd Gear (Drive)		Applied	Applied		
Reverse (R)		Applied		Applied	Holding
Neutral (N)					Holding
Park (P)					Holding

CD3874-B

Description	N-m	Lb-Ft	Description	N-m	Lb-Ft
Reactor Support to Case	8-11	6-8	Transmission Oil Pan to Case	20-26	15-19
Separator Plate to Valve Body	8-11	6-8	Lower Ball Joint to Steering Knuckle	50-60	37-44
Filler Tube Bracket to Case	9-12	7-9	Transfer Housing to Case	24-32	18-23
Filter to Case	9-12	7-9	Differential Retainer to Case (with sealant)	20-26	15-19
Valve Body Cover to Case	9-12	7-9	Pressure Test Port Plugs to Case	5-11	4-8
Pump Support to Pump Body	8-11	6-8	Outer Throttle Lever to Shaft Nut	10-13	7.5-9.5
Neutral Safety Switch to Case	9-12	7-9	Inner Manual Lever to Shaft Nut	43-65	32-48
Pump Assembly to Case	9-12	7-9	Idler Shaft Attaching	108-136	80-100
Valve Body to Case	8-11	72-96 (lb-in)			

CD3500-E

## TORQUE SPECIFICATIONS

Bolt	N-m	Lb-Ft
Transaxle to Engine	34-45	25-33
Control Arm to Knuckle	50-60	36-44
Stabilizer U-Clamp to Bracket	81-95	60-70
Stabilizer to Control Arm	133-169	98-125
Brake Hose Routing Clip	11	8
Tie Rod to Knuckle①	31-47	23-35
Manual Cable Bracket	14-27	10-20
Starter	41-54	30-40
Dust Cover	20-28	15-21
Torque Converter to Flywheel	31-53	23-39
Insulator to Bracket	75-90	55-70
Insulator Bracket to Frame	55-70	40-50
Insulator Mount to Transmission	34-45	25-33

① Tighten to minimum specified torque, continue tightening to nearest cotter pin slot.

CD4798-A

**SPECIAL SERVICE TOOLS**

Tool Number	Description	Tool Number	Description
T50T-100-A	Slide Hammer (Large)	T81P-70222-A	Compressor Adapter
T57L-500-B	Bench Mounting Fixture	T81P-70235-A	Spring Compressor
T77F-1102-A	Bearing Puller	T81P-70337-A	TV Seal Replacer
TOOL-1175-AC	Seal Remover	T81P-70363-A	Spacer
T81P-1177-B	Shipping Plug	T81P-70363-A1	Receiver
TOOL-3290-C	Tie Rod End Remover	T81P-70363-A2	Sleeve
T81P-3504-W	Tie Rod End Remover	T81P-70363-A3	Collar
D83P-4026-A	Halfshaft Remover	T81P-70363-A4	Adapter
T81P-4026-A	Differential Rotator	T81P-70363-A5	Screw
TOOL-4201-C	Dial Indicator	T81P-70363-A6	Guide Pins
TOOL-7000-DD	Rubber Tip — Air Nozzle	T81P-70401-A	Converter Hub Seal Replacer
TOOL-7000-DE	Air Nozzle	T81P-70402-A	Seal Protector
T82P-7006-B	Adapter Plate	T80L-77003-A	Gauge Bar
T82P-7006-C	Attaching Screws	T80L-77100-A	Guide Pins (2)
T67P-7341-A	Shift Insulator Remover/Replacer	T86H-77265-AH	Cooler Line Disconnect Tool
T84P-7341-A	Shift Linkage Grommet Remover	T81P-77380-A	Housing Bearing Replacer
T84P-7341-B	Shift Linkage Grommet Replacer	T81P-77389-A	Alignment Cup
T81P-7902-A	Holding Wire	T65L-77515-A	Spring Compressor
T81P-7902-B	1-Way Clutch Torquing Tool	T80L-77515-A	Clutch Spring Compressor
T81P-7902-C	Converter Handles	T81P-78103-A	Remover Adapter
T81P-7902-D	End Play Checking Tool	T81P-78103-B	Adapter Bolts
T81P-70023-A	Selection Tool	014-00028	Torque Converter Cleaner (Rotunda)
T81P-70027-A	Servo Remover/Installer Tool		

CD4779-D

**ROTUNDA EQUIPMENT**

Model	Description
014-00210	Hi-Lift Jack
014-00737	Automatic Transmission Tester Kit
021-00047	Torque Converter Leak Test Kit

CD6416-A





# NOISE, VIBRATION AND HARSHNESS DIAGNOSIS

## GROUP 18

### SECTION 18-01 Noise, Vibration and Harshness— Diagnosis

SUBJECT	PAGE	SUBJECT	PAGE
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DIAGNOSTIC THEORY		ROAD TEST	
Diagnosis Charts .....	18-01-2	Road Test Quick Checks .....	18-01-6
GLOSSARY .....	18-01-2	SPECIAL SERVICE TOOLS .....	18-01-12
HOW TO USE THIS DIAGNOSTIC		VEHICLE APPLICATION .....	18-01-1
PROCEDURE SECTION .....	18-01-2		

#### VEHICLE APPLICATION

Taurus/Sable.

#### DIAGNOSTIC THEORY

Diagnosis is more than just following a series of interrelated steps in order to find the solution to a specific condition. It is a way of looking at systems that are not functioning the way they should and finding out why. Also, it is knowing how the system **should** work, and whether it is working correctly. If you check closely, you will find that all good diagnosticians use the same basic procedure.

There are basic rules for diagnosis. If you follow these rules, you will usually find the cause of the condition the first time through the system.

#### Know the System

This means know how the parts go together; know how the system operates and its limits, and what happens when something goes wrong. Sometimes this means getting your hands on a system that is working properly and checking it against the one you are working on.

## DIAGNOSTIC THEORY (Continued)

### Know the History of the System

How old or new is the system? What kind of treatment has it had? Has it been serviced in the past in such a manner that might relate to the present condition? What is the service history? A clue in any one of these areas might save a lot of diagnosis time.

### Know the Probability of Certain Conditions Developing

It is true that most conditions are caused by simple things rather than by complex ones, and they occur in a fairly predictable pattern. Electrical problem conditions, for instance, usually occur at connections rather than in components. An engine "no-start" is more likely to be caused by a loose wire or some component out of adjustment than a sheared-off camshaft. Make sure you know the difference between **impossible** and **improbable**. Many good technicians have spent hours diagnosing a system because they thought certain failures were "impossible," only to eventually find out the failures were just "improbable" and actually had happened. A thing to remember is that new parts are just that: new. It does **not** mean they are **good** functioning parts.

### Don't Cure the Symptom and Leave the Cause

Lowering the air pressure in a front tire may correct the condition of a vehicle leaning to one side, but it does not correct the original problem.

### Be Positive the Cause Is Found

Do not be fooled into thinking you have found the cause when you have not. Double check your findings. If you find a worn component or something out of adjustment, ask yourself: "What else could be wrong?" If one of the engine mounts was loose, could the other one be loose, too? What about the transmission mounts? Build up a picture in your mind of the relationship of the affected parts.

- **Certainty** of narrowing down the search to a small portion before performing in-depth testing.

After working with diagnosis charts for a while, you will find that the fastest way to find a condition is to work with the tools that are available, which means working with proven diagnosis charts and the proper special tools for the system you are working on.

## HOW TO USE THIS DIAGNOSTIC PROCEDURE SECTION

Noise, vibration and harshness (NVH in engineering shorthand) is becoming more and more important because vehicles are becoming more sensitive to these vibrations. This section is designed to give a working knowledge of the process of diagnosing noise and vibration situations. It is divided into several sections **based on the description of the condition**. If the condition occurs at high speed, for instance, you will find the most likely place to start is under High Speed Shake. The Road Test Section will tell how to sort out the conditions into categories and how to tell a **vibration** from a **shake**. It will give a few hints on quick checks to make sure that a source is either pinpointed or eliminated.

Become familiar with the terms. Use the Glossary Section to find the descriptive name of conditions not encountered before. After naming it, proceed to the section entitled Identifying the Condition, and locate the proper diagnosis section. Remember, just by beginning at that point, most of the other systems in the vehicle have been eliminated. When the proper section is identified, the job is partly done. Follow the steps within the section. Quick Checks are described within the step, while more involved tests and adjustments are found in Services and Adjustments. Always follow each step exactly, and make notes along the way to allow recall of important findings.

### Diagnosis Charts

No matter what form charts may take, they are simply a way of expressing the relationship between basic logic and a physical system of components. It is a way of letting you "corner" the cause of a condition in the **shortest possible amount of time**. Diagnosis charts combine many areas of diagnosis into one visual display:

- **Probability** of certain things occurring in a system.
- **Speed** of checking certain components, or functions, before others.
- **Simplicity** of performing certain tests before others.
- **Elimination** of checking huge portions of a system by performing simple tests.

## GLOSSARY

### Acceleration

1. **Light:** Part throttle increase in speed such as 0-97 km/h (0-60 mph) in approximately 30 seconds.
2. **Heavy:** One-half to full throttle increase in speed such as 0-97 km/h (0-60 mph) in approximately 20 seconds.

### Ambient Temperature

Surrounding or prevailing temperature. Normally, the temperature in the service area or outdoors, depending on where testing is taking place.

**GLOSSARY (Continued)****Boom**

A cycling, rhythmic noise often accompanied by a sensation of pressure on the ear drums.

**Bound Up**

Refers to a stressed, rubber-mounted component that transmits any NVH which would normally be absorbed by the mount. Refer to Neutralize.

**Brake Applied**

When vehicle is stationary; service brakes applied with enough force to hold vehicle against acceleration with transmission in gear.

**Coast/Neutral Coast**

Engine/transmission taken out of gear by placing transmission selector in NEUTRAL or by depressing clutch in manual transmission.

**CPS**

Cycles Per Second.

**Cruise**

Steady highway speed; neither accelerating nor decelerating; even pressure on accelerator pedal on level ground.

**Deceleration**

Slowing of vehicle by releasing foot from accelerator at cruise and allowing engine to slow vehicle without application of brakes.

**Drivetrain**

Includes all power transmitting components from the rear of the engine to the wheels, including clutch/torque converter and transaxle halfshafts.

**Engine Runup Test**

Operation of engine through normal rpm range while vehicle is sitting still. Used for engine vibration check.

**Engine Misfire**

One or more cylinders in the engine fails to fire at the proper time.

**Engine Imbalance**

Some component in the engine which is normally smoothly balanced now causing a perceptible vibration in the vehicle.

**Gravelly Feel**

A grinding or growl in a component, similar to the feel experienced while driving on gravel.

**Harshness**

A harder than usual behavior of a component, like riding a vehicle with overinflated tires usually associated with road impacts.

**Hz**

Hertz (Cycles Per Second).

**Imbalance**

Out of balance; more weight on one side of a rotating component causing shake or vibration.

**Inboard**

Toward the centerline of the vehicle. Refer to Outboard.

**Isolate**

Separate from the influence of other components.

**NVH**

Noise, Vibration, Harshness.

**Neutralize (Normalize)**

To return to unstressed position. Used to describe mounts. Refer to Bound Up.

**Outboard**

Toward the outside of the vehicle, rather than toward the centerline. Refer to Inboard.

**Pumping Feel**

A very slow vibration that results in a movement of vehicle components similar to pumping the service brakes slightly.

**Radial/Lateral**

Radial is in the plane of rotation, while lateral is at 90 degrees to the plane of rotation.

**Road Test**

Operation of vehicle under conditions designed to recreate the problem condition.

**Runout**

Out of round or wobble.

**Shake**

Low frequency vibration; usually results in visual movement of components.

**Tire Force Vibration**

Tire vibration caused by variations in the construction of the tire, resulting in a vibration when the tire rotates against the pavement. This condition may be present on perfectly round and perfectly balanced tires because of variations in the inner construction.

**Two-Plane Balance**

Radial and lateral balance.

**Tire Deflection**

Bending of the body of the tire during rotation.

**T.I.R.**

Total indicator runout.

**GLOSSARY (Continued)****Tip-In Moan**

A light moaning noise is heard when the vehicle is lightly accelerated between 40-64 km/h (25-40 mph).

**Tires—Flat Spots**

Commonly caused by letting vehicle stand when tires are warm. Can be cured by operating vehicle until tires are warm and then raising vehicle immediately.

**Vibration**

Regular movement of a component that results in a sound or feel of movement.

**NVH DIAGNOSIS**

NVH diagnosis should always start with the road test.

Noise, vibration and harshness (NVH) usually occur in four areas: tires, engine accessories, suspension

and drivetrain. It is important, therefore, that an NVH problem is isolated into its specific area as soon as possible. The easiest and quickest way to do this is to perform a road test.

**ROAD TEST**

A gear-driven unit will produce a certain amount of noise. Some noise is acceptable and may be audible at certain speeds or under various driving conditions. The slight noise is in no way detrimental and must be considered normal.

The road test and customer interview (if available) will provide much of the information that will allow you to identify the condition you are dealing with, steering you to the correct starting point for diagnosis.

1. Make notes throughout diagnosis routine. It will help cover all bases when starting to add up clues. Use a road test form that includes space for comments. Make sure to write down even the smallest bit of information; it may turn out to be most important.
2. Road test the vehicle, and define the condition by reproducing it several times during the road test.
3. Perform the road test quick checks as soon as the condition is reproduced. This will identify

the proper section of the diagnostic procedure. Run through the quick checks, more than once, to make sure they are getting a useable result. Remember, the road test quick checks may not tell where the problem is, but they will tell where it **is not**.

4. Do not touch anything until a road test and a thorough visual inspection of the vehicle have been performed. Do not change tire pressure or vehicle load. Adjusting tire pressures, vehicle load, or making some other adjustment may reduce the condition's intensity to a point where it cannot be identified clearly. It may also inject something new into the system, preventing proper diagnosis. Make a visual inspection as part of the preliminary diagnostic routine, writing down anything that does not look right. Note tire pressures, but do not adjust them yet. Note leaking fluids, loose nuts and/or bolts, or bright spots where components may be rubbing against each other. Check luggage compartment or cargo area for unusual loads.

## ROAD TEST (Continued)

## ROAD TEST FORM

1. Did condition exist when car was new? ☐ Yes ☐ No

How did condition begin?

☐ Gradually occurred

Mileage \_\_\_\_\_

☐ Suddenly occurred

Mileage \_\_\_\_\_

2. Car vibrates between \_\_\_\_\_ MPH and \_\_\_\_\_ MPH and \_\_\_\_\_ gear.

3. What driving conditions affect the vibration?

☐ Light to medium acceleration

☐ Hard acceleration

☐ Deceleration (foot off accelerator pedal)

☐ Constant speed

4. Where is the vibration noticed?

☐ Seat

☐ Steering Wheel

☐ Instrument panel pad

☐ Floor

☐ Hood and fenders

5. Is there a sound or sensation of sound?

☐ Buzz

☐ Clicking

☐ Moan

☐ Popping

☐ Drone

☐ Grinding

☐ Rumble

☐ Hum

☐ Other

Describe: \_\_\_\_\_

## ROAD TEST (Continued)

## Road Test Quick Checks

1. **24-80 km/h (15-50 mph):** With light acceleration, a moaning noise is heard, and possibly a vibration is felt in the floorpan. It is usually worse at a particular engine speed and at a particular throttle setting during acceleration at that speed.

Refer to Tip-In Moan Diagnosis charts.

2. **High Speed:** With slow acceleration and deceleration, a shake is sometimes noticed in the steering wheel/column, seats, floorpan, trim panels or front end sheet metal. It is a low frequency vibration (around 9-15 cycles per second). It may or may not be increased by applying brakes lightly.

Refer to High Speed Shake Diagnosis charts.

3. **High Speed:** A vibration is felt in the floorpan or seats with no visible shake, but with an accompanying sound or rumble, buzz, hum, drone or booming noise. Coast with clutch depressed or automatic transmission selector in NEUTRAL and engine idling. If vibration is still evident, it may be related to wheels, tires, brake rotors, hubs or bearings.

Refer to High Speed Shake Diagnosis charts.

4. **O-High Speed:** A vibration is felt whenever the engine reaches a particular rpm. It will disappear in NEUTRAL coast. The vibration can be duplicated by operating the engine at the problem rpm while the vehicle is sitting still. It can be caused by any component, from the accessory drive belts to the clutch or torque converter which turns at engine speed when the vehicle is stopped.

Refer to Engine Accessory Diagnosis charts.

5. **Noise and vibration while turning.** Clicking, popping or grinding noises may be due to the following:
  - a. Inadequate or contaminated lube fill in outboard or inboard CV joints.
  - b. Loose CV joint boot clamp.
  - c. Other component contacting halfshaft assembly.
  - d. Worn, damaged or improperly installed wheel bearing.

## DIAGNOSIS AND TESTING

These diagnosis charts are designed to take technician through a step-by-step diagnosis procedure to determine the cause of a condition. It may not always be necessary to follow the chart to its conclusion. Perform only the steps necessary to correct the condition. Then check the operation of the system to be sure cause has been found.

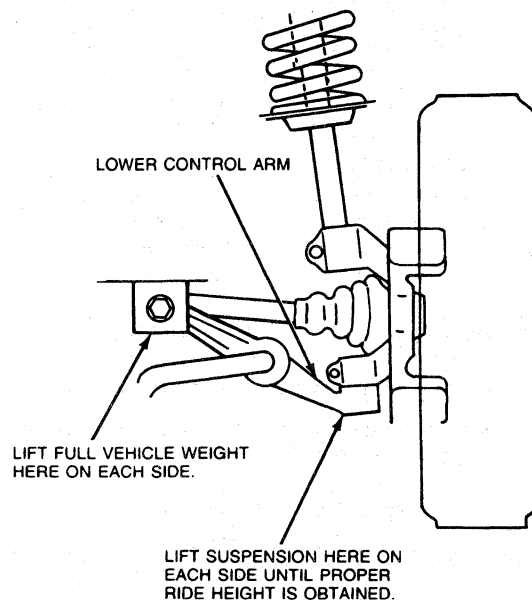
It is sometimes necessary to remove various components of vehicle to gain access to component to be tested. Refer to applicable Section for removal and installation of components. After you have verified that the condition has been corrected, ensure all components removed have been installed.

When performing the High Speed Shake Diagnosis or Engine Accessory Vibration Diagnosis, observe the following precautions:

**CAUTION:** The suspension should not be allowed to hang free. When the constant velocity joint is run at a very high angle, extra vibrations as well as damage to seals and joints can occur.

The lower control arm should be supported as far outboard as possible. To bring the vehicle to its proper ride height, the full weight of the vehicle should be supported in front by floor jacks, as shown. Refer to the Pre-Delivery manual, Section 50-04 for jacking instructions.

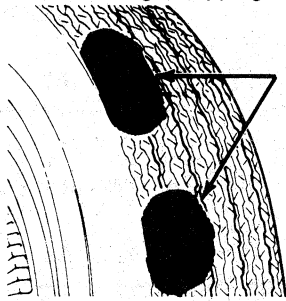
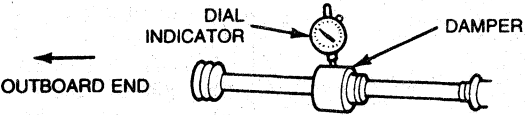
**WARNING:** IF ONLY ONE DRIVE WHEEL IS ALLOWED TO ROTATE, SPEED MUST BE LIMITED TO 55 KM/H (35 MPH) INDICATED ON THE SPEEDOMETER SINCE ACTUAL WHEEL SPEED WILL BE TWICE THAT INDICATED ON THE SPEEDOMETER. SPEED EXCEEDING 55 KM/H (35 MPH) OR ALLOWING THE DRIVE WHEEL TO HANG UNSUPPORTED COULD RESULT IN TIRE DISINTEGRATION, DIFFERENTIAL FAILURE AND/OR CONSTANT VELOCITY JOINT AND HALFSHAFT FAILURE, WHICH COULD CAUSE SERIOUS PERSONAL INJURY AND EXTENSIVE VEHICLE DAMAGE.



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## DIAGNOSIS AND TESTING (Continued)

## HIGH SPEED SHAKE DIAGNOSIS

TEST STEP		RESULT	ACTION TO TAKE
<b>A0</b>	<b>ROAD TEST</b>		
	<ul style="list-style-type: none"> <li>Accelerate vehicle to the speed which the customer indicated the shake occurred.</li> </ul>	(OK) ► (X) ►	Vehicle OK. GO to A1.
<b>A1</b>	<b>INSPECT TIRES</b>		
	<ul style="list-style-type: none"> <li>Raise vehicle on hoist. Inspect tires for extreme wear or damage, cupping or flat spots.</li> </ul>  <p>CUPPED OR DISHED TREADS</p>	(OK) ► (X) ►	GO to A2. CHECK suspension components for misalignment, abnormal wear, or damage that may have contributed to the tire wear. CORRECT suspension problems and REPLACE damaged tires. ROAD TEST vehicle.
<b>A2</b>	<b>INSPECT WHEEL BEARINGS</b>		
	<ul style="list-style-type: none"> <li>Spin front tires by hand to check for wheel bearing roughness. Check bearing end play.</li> </ul>	(OK) ► (X) ►	GO to A3. ADJUST or REPLACE and lubricate bearings as necessary. ROAD TEST vehicle.
<b>A3</b>	<b>INSPECT CV JOINT BOOTS FOR DAMAGE</b>		
	<ul style="list-style-type: none"> <li>Spin front tire by hand. Inspect CV joint boots for evidence of cracks, tears, splits or splattered grease.</li> </ul> <p><b>NOTE:</b> The silicone boot used on the 3.0L engine RH inboard CV joint has a vent near the small clamp and may show some grease leakage, which is acceptable. Silicone boots will sweat, which is also acceptable. Do not replace the boot for these conditions.</p>	(OK) ► (X) ►	GO to A4. REPLACE damaged boot, or clamp, clean and inspect CV joint for wear or damage. REPLACE CV joint only if necessary.
<b>A4</b>	<b>HALFSAFT RUNOUT IN VEHICLE</b>		
	<ul style="list-style-type: none"> <li>Attach dial indicator to vehicle underbody.</li> <li>Check the radial runout at the center of shaft Max. — 4.0mm (.160 inch)</li> </ul> 	(OK) ► (X) ►	GO to A5. REPLACE interconnecting shaft only.
<b>A5</b>	<b>WHEEL TIRE RUNOUT</b>		
	<ul style="list-style-type: none"> <li>Spin front wheels at low speed with a wheel balance spinner, observing wheel tire runout.</li> </ul>	(OK) ► (X) ►	BALANCE wheels. GO to A5. GO to A9.

## DIAGNOSIS AND TESTING (Continued)

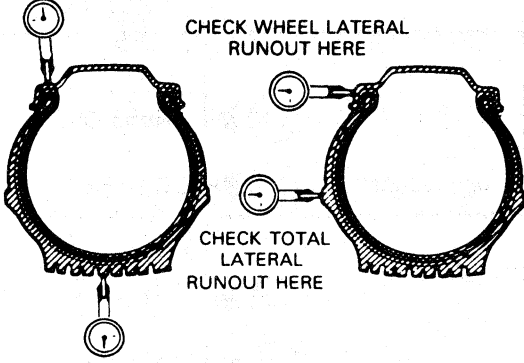
## HIGH SPEED SHAKE DIAGNOSIS — Continued

TEST STEP		RESULT	ACTION TO TAKE
<b>A6</b>	<b>DRIVE TRAIN</b>		
	<ul style="list-style-type: none"> <li>Engage drive train and carefully accelerate the drive wheels.</li> </ul>	(OK) ► GO to <b>A10</b> . (X) ► GO to <b>A7</b> .	
<b>A7</b>	<b>DRIVE WHEELS</b>		
	<ul style="list-style-type: none"> <li>Remove front wheels. Secure brake rotor, if so equipped, by installing the lug nuts, reversed. Carefully accelerate the drive wheels.</li> </ul>	(OK) ► BALANCE front wheels. ROAD TEST. (X) ► GO to <b>A8</b> .	
<b>A8</b>	<b>FRONT ROTORS</b>		
	<ul style="list-style-type: none"> <li>Remove the brake rotors. Carefully accelerate the drive wheels.</li> </ul>	(OK) ► REPLACE the rotors. (X) ► GO to <b>A9</b> .	
<b>A9</b>	<b>HUB RUNOUT</b>		
	<ul style="list-style-type: none"> <li>With rotor removed, check axle hub face runout, lug bolt circle radial runout, drum rotor pilot radial runout.</li> </ul> <div> </div>	(OK) ► GO to Drivetrain Vibration Diagnosis. (X) ► REPLACE hub.	
<b>A10</b>	<b>WHEEL RUNOUT</b>		
	<ul style="list-style-type: none"> <li>Install wheels and tires in original positions. Check all wheels for total radial and lateral tire runout.            Radial Runout — 1.14mm (0.045 inches)            Lateral Runout — 1.52mm (0.060 inches)</li> </ul>	(OK) ► GO to <b>A12</b> . (X) ► CHECK wheel rim runout, radial and lateral. If either exceeds 1.14mm (0.045 inches). REPLACE the wheel and recheck runout. If new rim is within limits. LOCATE and MARK the low point of rim radial runout. GO to <b>A11</b> .	



## DIAGNOSIS AND TESTING (Continued)

## HIGH SPEED SHAKE DIAGNOSIS — Continued

TEST STEP		RESULT	ACTION TO TAKE
<b>A11</b>	<b>TIRE RUNOUT</b>		
<ul style="list-style-type: none"> <li>Check total lateral and radial runout 1.14mm (0.045 inches).</li> </ul> <p>CHECK WHEEL RADIAL RUNOUT HERE</p>  <p>CHECK WHEEL LATERAL RUNOUT HERE</p> <p>CHECK TOTAL LATERAL RUNOUT HERE</p> <p>CHECK TOTAL RADIAL RUNOUT HERE</p>		<p>Lateral</p> <p>Radial</p>	<p>GO to <b>A12</b>.</p> <p>REPLACE tire.</p> <p>MARK the highest point of tire, dismount, re-index and remount the tire with the high point aligned with the low point of the wheel. RECHECK radial tread runout. If still out, REPLACE the tire and RECHECK runouts, re-indexing as necessary to bring radial runout within limits. GO to <b>A12</b>.</p>
<b>A12</b>	<b>WHEEL BALANCE</b>		
<ul style="list-style-type: none"> <li>Balance all wheels not previously balanced. Road test vehicle.</li> </ul>			<p>Vehicle OK.</p> <p>GO to <b>A13</b>.</p>
<b>A13</b>	<b>SUBSTITUTE WHEELS AND TIRES</b>		
<ul style="list-style-type: none"> <li>Substitute a known good set of wheels and tires.</li> </ul>			<p>REINSTALL the original tire wheel assemblies, one by one, road testing at each step until the damaged tire(s) is identified. REPLACE tire(s) as necessary and retest.</p> <p>REFER to Drivetrain Vibration Diagnosis.</p>

## DIAGNOSIS AND TESTING (Continued)

## TIP-IN MOAN DIAGNOSIS

TEST STEP		RESULT	ACTION TO TAKE
<b>B0</b>	<b>AIR CLEANER</b>		
	<ul style="list-style-type: none"> <li>Check air cleaner for proper installation of base gasket, lid, element and air inlet duct assembly.</li> </ul>	(OK) ► (X) ►	GO to <b>B1</b> .  CORRECT condition and ROAD TEST. If moan persists, GO to <b>B1</b> .
<b>B1</b>	<b>POWERTRAIN RESONANCE</b>		
	<ul style="list-style-type: none"> <li>Loosen all converter or clutch housing-to-engine attaching bolts 3-4 turns and road test. Tighten bolts after test.</li> </ul>	(OK) ► Moan reduced or (X) ►	Vehicle OK.  GO to <b>B2</b> .
<b>B2</b>	<b>ENGINE MOUNTS</b>		
	<ul style="list-style-type: none"> <li>Center engine and normalize engine mounts by loosening two left mounts and metal cup (MTX only). Jack engine/transmission assembly and shake. Tighten fasteners, making sure metal cup is centered on rubber ball (MTX only). Repeat road test.</li> </ul>	(OK) ► (X) ►	Vehicle OK.  GO to <b>B3</b> .
<b>B3</b>	<b>EXHAUST SYSTEM</b>		
	<ul style="list-style-type: none"> <li>Warm up system to normal operating temperature. Loosen all hanger attachments and reposition hangers until they hang free and straight. Then loosen all flange joints and with engine running, shift transmission from NEUTRAL to DRIVE and back to NEUTRAL (or load engine with clutch), and retighten all hanger clamps and flanges. Road test vehicle.</li> </ul>	(OK) ► (X) ►	Vehicle OK.  REFER to Engine Accessory Vibration Diagnosis.

CF3488-B

## DIAGNOSIS AND TESTING (Continued)

## ENGINE ACCESSORY VIBRATION DIAGNOSIS

TEST STEP		RESULT	ACTION TO TAKE
<b>C0</b>	<b>ENGINE RUN-UP</b>		
<ul style="list-style-type: none"> <li>Run-up to problem rpm observed in road test, with vehicle stationary.</li> </ul>		Vibration occurs ►  Vibration does not occur ►	GO to <b>C1</b> .  PERFORM stall test in DRIVE with brakes locked (or load engine by slipping clutch in gear with manual transmission). If vibration occurs, GO to Tip-In Moan Diagnosis in this Section.
<b>C1</b>	<b>DRIVE BELTS AND PULLEYS</b>		
<ul style="list-style-type: none"> <li>With engine stopped, inspect all engine accessory drive belts and pulleys for wear or damage, and check belt tension.</li> </ul>		(OK) ► (X) ►	GO to <b>C2</b> .  REPLACE worn or damaged belts or pulleys. CORRECT belt tension. GO to <b>C2</b> .
<b>C2</b>	<b>MOUNTING HARDWARE</b>		
<ul style="list-style-type: none"> <li>Inspect mounting brackets and adjusting hardware for proper alignment and <b>tightness</b>.</li> </ul>		(OK) ► (X) ►	GO to <b>C3</b> .  ALIGN and TIGHTEN mounting hardware to specifications. CORRECT belt tension. START UP engine and run-up to problem rpm. If vibration still exists, GO to <b>C3</b> .

CF3489-D

## DIAGNOSIS AND TESTING (Continued)

## ENGINE ACCESSORY VIBRATION DIAGNOSIS — Continued

TEST STEP		RESULT	ACTION TO TAKE
<b>C3</b>	<b>ENGINE IDLING</b>		
<ul style="list-style-type: none"> <li>With engine idling, visually check all accessory drive belts and pulleys for misalignment, runout or irregular motion. Maximum runout is 3mm (1/8 inch).</li> </ul>		<p>OK ►</p> <p>OK/NO ►</p>	<p>GO to <b>C4</b>.</p> <p>If pulley(s) exceeds maximum runout. <b>REPLACE</b> pulley. If belt rides up and down in pulley, a variable-width condition exists. If it occurs on just one pulley, <b>REPLACE</b> that pulley. Otherwise, <b>REPLACE</b> the belt. <b>RUN</b> engine up to problem rpm. If belt whips, <b>ADJUST</b> belt tension to specification. If belt still whips, <b>REPLACE</b> belt. If vibration still exists, <b>GO</b> to <b>C4</b>.</p>
<b>C4</b>	<b>ACCESSORIES</b>		
<ul style="list-style-type: none"> <li>Run-up engine to problem rpm and, with stethoscope-type device, check each component.</li> </ul>		Noisy component located	<p>► <b>REPLACE</b> belt. If vibration still exists, <b>SERVICE</b> or <b>REPLACE</b> component.</p>
<ul style="list-style-type: none"> <li>If the source cannot be detected by probing, remove each belt, one at a time, until vibration goes away.</li> </ul>		Unable to locate vibration	<p>► Possible engine component imbalance. This situation is possible, but unlikely.</p>

CF3490-B

## SPECIAL SERVICE TOOLS

Tool Number	Description
T63L-8620-A	Belt Tension Gauge
T00L-4201-A	Dial Indicator with Bracketry

CF3491-B

# GASOLINE ENGINES

# GROUP 21

(6000 & 9000)

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ENGINE, 2.5L .....	21-10-1		

## SECTION 21-01 Engines, Gasoline—Service

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Camshaft .....	21-01-19	Static Engine Off Valve Train Analysis .....	21-01-5
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Cylinder Block .....	21-01-23	Crankshaft .....	21-01-14
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## VEHICLE APPLICATION

Taurus/Sable.

## DESCRIPTION

All engines incorporate a closed-type crankcase ventilation system and exhaust emission control system. All engine/emission control systems are covered in the Engine/Emissions Diagnosis\* manual.

To maintain the required exhaust emission levels, the fuel system, ignition system and engine must be kept in good operating condition and meet recommended adjustment specifications.

When performing tests, adjustments or service to the engine, ignition system or fuel system, it is essential to follow the procedures and specifications in Groups 21, 23 and 24 in this manual, and in the Engine/Emissions Diagnosis\* manual.

Before replacing damaged or worn engine components such as the crankshaft, cylinder heads,

valve guides, valves, camshafts or cylinder block, ensure the part(s) are not serviceable.

This Section covers various engine tests, adjustments, service procedures and cleaning/inspection procedures. Engine assembly and service specifications appear at the end of each Section in this Group.

For engine removal, disassembly, assembly, installation and adjustment procedures, refer to the applicable Section in this Group.

**WARNING: TO AVOID THE POSSIBILITY OF PERSONAL INJURY OR DAMAGE TO THE VEHICLE, DO NOT OPERATE THE ENGINE WITH THE HOOD OPEN UNTIL THE FAN HAS FIRST BEEN EXAMINED FOR POSSIBLE CRACKS AND SEPARATION.**

## Engine Identification

For quick engine identification, refer to the Safety Certification Decal. The decal is mounted on the LH front door lock face panel. Find the engine code (letter or number) on the decal, then refer to the engine identification chart to determine the engine type and size. An engine identification label is also attached to the engine. The symbol code on the identification tag identifies each engine for determining parts usage; for instance, engine cubic inch displacement and model year.

The change level and engine code number determine if parts are unique to specific engines. The engine plant codes designate where engines were built. It is imperative that the codes on the engine identification label be used when ordering parts or making inquiries about the engine. The pertinent codes are shown in the Master Parts catalog to designate unique parts.

## Safety Certification Decal

CODE	ENGINES	CYL.	FUEL METERING
D	2.5L (153 CID)	4	CFI
U	3.0L (186 CID)	6	EFI

**1FABP43F2FZ100001**

VEHICLE IDENTIFICATION NUMBER

MFD. BY FORD MOTOR CO. IN U.S.A.											
DATE: 09-86						GVWR: 5347 LB - 2425 KG					
FRONT GAWR: 2714 LB						REAR GAWR: 2683 LB					
1231 KG						1216 KG					
THIS VEHICLE CONFORMS TO ALL APPLICABLE FEDERAL MOTOR VEHICLE SAFETY AND BUMPER STANDARDS IN EFFECT ON THE DATE OF MANUFACTURE SHOWN ABOVE.											
VEH. IDENT. NO. 1FABP43MZHX100001										F0276	
TYPE PASSENGER										R0141	
2A										482450	
EXTERIOR PAINT COLORS										DSO	
BODY	VR	MLDG.	INT. TRIM	A/C	R	S	AX	TR			
54K	YP	S9P	GG	A	2	B	8	TB88B			

ENGINE CODE

A8371-B

\*Can be purchased as a separate item.

## DIAGNOSIS AND TESTING

### Positive Closed-Type Crankcase Ventilation System

A malfunctioning closed crankcase ventilation system may be indicated by loping or rough engine idle. Do not attempt to compensate for this idle condition by disconnecting the crankcase ventilation system and making throttle adjustments. **The removal of the crankcase ventilation system from the engine will adversely affect the fuel economy and engine ventilation resulting in a shortened engine life.** To determine whether the loping or rough idle condition is caused by a malfunctioning crankcase ventilation system refer to the Engine/Emissions Diagnosis\* manual.

### Engine Oil Leaks

When diagnosing engine oil leaks, it is important that the source and location of the leak be positively identified before service. The following procedure has been found to be very effective and requires only a minimum of equipment. Prior to using this procedure, it is important to clean the cylinder block, cylinder head(s), rocker cover(s), oil pan and flywheel housing areas with a suitable solvent to remove all traces of oil.

To perform oil leak diagnosis use Rotunda Oil Leak Detection Tool 112-00001 or equivalent, or fabricate the following:

1. Air supply and air hose.
2. Air pressure gauge that registers pressure in one psi increments.
3. Air line shut-off valve.
4. Appropriate fittings to attach the above parts to oil fill and PCV grommet holes.
5. Appropriate plugs to seal any openings leading to the crankcase.
6. A solution of liquid detergent and water to be applied with a suitable type applicator such as a squirt bottle or brush.

Fabricate the air supply hose to include the air line shut-off valve and the appropriate adapter to permit the air to enter the engine through the PCV valve opening. Fabricate the air pressure gauge to a suitable adapter for installation on the engine at the oil fill opening.

### Testing Procedure

Open the air supply valve until the pressure gauge registers 34.5 kPa (5 psi) (maintain 34.5 kPa (5 psi) pressure).

Inspect the sealed and/or gasketed areas for leaks by applying Snoop Pressure Check or a solution of liquid detergent and water over the areas for the formation of bubbles, which indicates leakage. The areas to examine are:

#### Under Hood

- Rocker cover gasket.
- Cylinder front cover gasket.

- Intake manifold gaskets.
- Front and rear intake manifold end seals.
- Cylinder head gasket.
- Rubber grommets.
- Distributor O-ring.
- Oil level indicator (dipstick) tube connection.
- Oil pressure sending unit.
- Cup plugs and/or pipe plugs at the end of oil passages.

#### Under Engine—With Vehicle on Hoist

- Oil pan gasket.
- Cylinder front cover gasket.
- Front crankshaft seal.
- Oil pressure sending unit.
- Oil filter seal.
- Oil cooler mounting gasket and/or cover gasket.

#### With Transmission and Flywheel Removed

- Rear crankshaft seal.

Air leakage in the area around the rear crankshaft oil seal does not necessarily indicate a rear seal leak. However, if no other cause can be found for oil leakage (air leaking from the rear oil pan seal, rear main bearing cap parting line, cup plugs, etc.) it can be assumed that the seal is the cause of the oil leakage.

A moderate amount of air leakage past the seal is also acceptable.

NOTE: Light foaming (similar to beer foam) equally around rocker arm cover bolts and crankshaft seals is not detrimental and no corrections are required in such cases.

If standard engine oil leak diagnosis procedures are unable to find an oil leak, the following procedure is recommended:

1. Clean engine with a suitable solvent to remove all traces of oil.
2. Drain engine oil crankcase and refill with recommended oil, premixed with Fluorescent Oil Additive ESE-M99C103-A or equivalent. Use a minimum 14.8ml (1/2 fluid oz) to a maximum 29.6ml (1 fluid oz) of fluorescent additive to all engines. If oil is not premixed, fluorescent additive must be added to crankcase first.
3. Run engine for 15 minutes. Stop engine and inspect all seal and gasket areas for leaks using Rotunda Oil Leak Detector 112-00001 or equivalent. A clear bright yellow or orange area will identify leak.
4. If necessary, pressurize main oil gallery system to locate leaks due to improperly sealed, loose or cocked plugs. If flywheel bolts leak oil, look for sealer on threads.
5. Service all leaks as required.

\*Can be purchased as a separate item.

**DIAGNOSIS AND TESTING (Continued)****Compression Tests****Compression Gauge Check**

1. Ensure oil in crankcase is at proper level and battery is properly charged. Operate vehicle until engine is at normal operating temperature. Turn ignition switch off, then remove all spark plugs.
2. Set throttle plate in wide-open position.
3. Install compression gauge in No. 1 cylinder.
4. Install auxiliary starter switch in starting circuit. With ignition switch off, and using auxiliary starter switch, crank engine at least five compression strokes and record the highest reading.

Note the approximate number of compression strokes required to obtain the highest reading.

5. Repeat Steps 1 through 4 on remaining cylinders.

**Test Conclusion**

The indicated compression pressures are considered within specification if the lowest reading cylinder is within 75-100 percent of the highest. Refer to the percentage chart.

If one or more cylinders read low, squirt approximately one tablespoon of engine oil on top of the pistons in the low reading cylinders. Repeat compression pressure check on these cylinders.

1. If compression improves considerably, piston rings are at fault.
2. If compression does not improve, valves are sticking or seating poorly.
3. If two adjacent cylinders indicate low compression pressures and squirting oil on pistons does not increase compression, the cause may be a cylinder head gasket leak between cylinders. Engine oil and/or coolant in cylinders could result from this problem.

It is recommended the quick reference chart be used when checking cylinder compression pressures. The chart has been calculated so that the lowest reading number is 75 percent of the highest reading.

**Example**

If, after checking the compression pressures in all cylinders, it was found that the highest reading obtained was 196 psi and the lowest pressure reading was 155 psi, the engine is within specification and the compression is considered satisfactory.

Maximum PSI	Minimum PSI	Maximum PSI	Minimum PSI	Maximum PSI	Minimum PSI	Maximum PSI	Minimum PSI
134	101	164	123	194	145	224	168
136	102	166	124	196	147	226	169
138	104	168	126	198	148	228	171
140	105	170	127	200	150	230	172
142	107	172	129	202	151	232	174
144	108	174	131	204	153	234	175
146	110	176	132	206	154	236	177
148	111	178	133	208	156	238	178
150	113	180	135	210	157	240	180
152	114	182	136	212	158	242	181
154	115	184	138	214	160	244	183
156	117	186	140	216	162	246	184
158	118	188	141	218	163	248	186
160	120	190	142	220	165	250	187
162	121	192	144	222	166		

CA5015-B



**DIAGNOSIS AND TESTING (Continued)****Static Engine Off Valve Train Analysis  
(Rocker Arm Cover Removed)****Rocker Arm Cover****Removal**

1. Remove air cleaner.
2. Disconnect and remove any hoses, wires, spark plug leads and components that would interfere with removal of rocker arm cover.
3. Remove rocker arm cover bolts.
4. Remove rocker arm cover.

Check for damaged and/or severely worn parts for correct assembly and ensure use of correct parts by proceeding, as follows, with the static engine analysis.

**Rocker Arm Assemblies, Individually Mounted**

- Check for loose mounting stud and nut or bolt.

**Push Rods**

- Check for bent push rods.

**Valve Spring Assembly, With or Without Damper Spring**

- Check for broken or damaged parts.

**Retainer and Keys, Both Two-Piece and One-Piece Retainers**

- Check for proper seating of keys on valve stem.

**Valves and Cylinder Head**

- Check cylinder head gasket for proper installation.
- Check for plugged oil drain back holes.
- Check for worn or damaged valve tips.
- Check for missing or damaged valve stem oil seals.
- Check collapsed tappet gap.
- Check collapsed tappet gap, hydraulic tappet application.
- Check installed spring height.

Static checks (engine off) are to be made on the engine prior to the following dynamic procedure.

**Dynamic Valve Train Analysis**

Start the engine and while running at idle, check for proper operation of all parts. Check the following under firing engine operating conditions:

**Rocker Arm Assemblies, Individually Mounted**

- Check for plugged oil feed in rocker arm.

**Push Rods**

- Check for bent push rods.
- Check for proper operation of positive rotation.

**Valves and Cylinder Head**

- Check for plugged oil drain back holes.
- Check for missing or damaged valve stem oil seals or guide mounted oil seals.

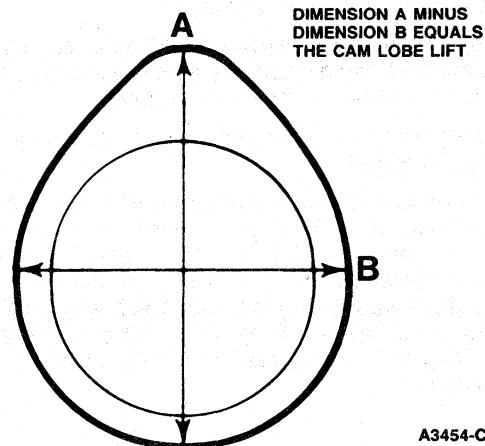
**Rocker Arm Cover****Installation**

1. Remove old gasket from cover and apply a small bead of RTV at split rail joint.
2. Install new gasket and replace cover on engine.
3. Install rocker arm cover bolts. Tighten in sequence to specification.
4. Connect all hoses, wires, spark plug leads, and components.

**Camshaft Lobe Lift****2.5L I-4 Engine**

Check the lift of each lobe in consecutive order and make a note of the readings.

1. Remove air cleaner and valve rocker arm cover.
2. Measure distance between major (A—A) and minor (B—B) diameters of each cam lobe with a Vernier caliper and record readings. The difference in readings on each cam diameter is lobe lift.



3. If readings do not meet specification, replace camshaft and all tappets.
4. Install valve rocker arm cover and air cleaner.

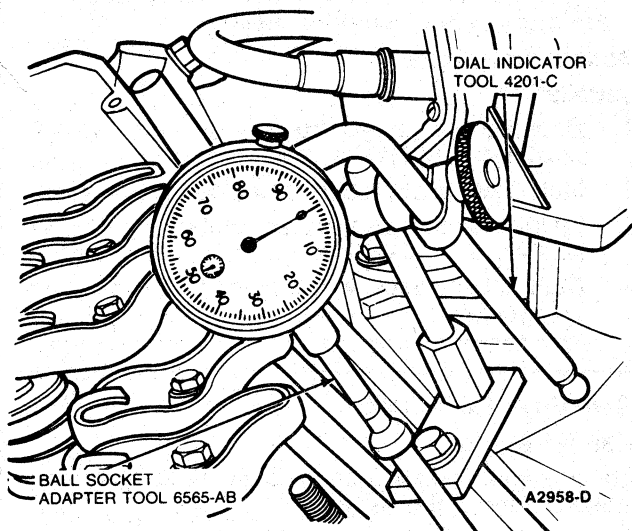
**3.0L Engine**

Check the lift of each lobe in consecutive order and make a note of the readings.

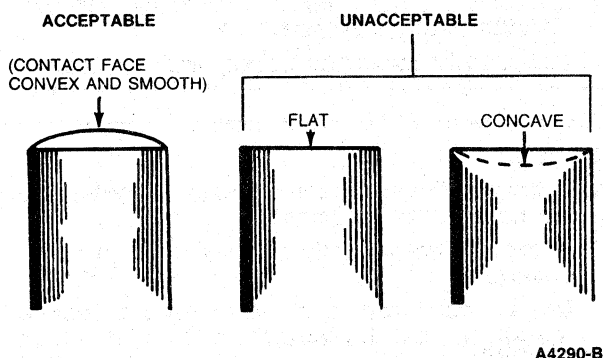
1. Remove throttle body and valve rocker arm cover(s).
2. Ensure push rod is in valve tappet socket. Install a Dial Indicator TOOL-4201-C or equivalent, in such a manner as to have Ball Socket Adapter TOOL-6565-AB or equivalent, of indicator on end of push rod and in same plane as push rod movement.

## DIAGNOSIS AND TESTING (Continued)

## Rocker Arms, Pedestal-Mounted



3. Connect an auxiliary starter switch in starting circuit. Crank engine with ignition switch off. "Bump" crankshaft over until tappet is on base circle of camshaft lobe. At this point, push rod will be in its lowest position.
4. Zero dial indicator. Continue to rotate crankshaft slowly until push rod is in fully raised position (highest indicator reading).
5. Compare total lift recorded on indicator with specifications.
6. To check accuracy of original indicator reading, continue to rotate crankshaft until indicator reads zero. **If lift on any lobe is below specified service limits, camshaft and tappets operating on worn lobe(s) must be replaced, as well as any tappet showing pitting or having contact face worn flat or concave.**



7. Remove dial indicator and auxiliary starter switch.

Install the pedestal-mounted rocker arms as detailed in the applicable engine Section.

**After installing the rocker arms, do not rotate the crankshaft until the tappets have had sufficient time to bleed down. To do otherwise may cause serious valve damage. Manually bleeding down will reduce the waiting time.**

8. Install valve rocker arm cover(s), throttle body and air cleaner.

## Hydraulic Tappet

The hydraulic tappets used in the 2.5L I-4 engine are the same in construction and operation as any hydraulic tappets used on push rod engines. They are cleaned, inspected and checked in the same manner. Leakdown rates for the hydraulic tappet are in Specifications.

Hydraulic tappet noise may be caused by any of the following:

- Excessive collapsed tappet gap.
- Sticking tappet plunger.
- Tappet check valve not functioning properly.
- Air in lubrication system.
- Leakdown rate too rapid.
- Excessive valve guide wear.

Excessive collapsed tappet gap may be caused by loose rocker arm fulcrum bolts, incorrect initial adjustment, or wear of tappet face, push rod, rocker arm, rocker arm fulcrum, or valve tip. With tappet collapsed, check gap between valve tip and rocker arm to determine if any other valve train parts are damaged, worn, or out of adjustment.

A sticking tappet plunger may be caused by dirt, chips, or varnish inside the tappet. The sticking can be corrected by disassembling the tappet and removing the dirt, chips, or varnish causing the condition.

A tappet check valve that is not functional may be caused by an obstruction such as dirt or chips preventing it from closing when the cam lobe is lifting the tappet, or it may be caused by a broken check valve spring.

Air bubbles in the lubrication system will prevent the tappet from supporting the valve spring load and may be caused by too high or too low an oil level in the oil pan, or by air being drawn into the system through a hole, crack, or leaking gasket on the oil pump pickup tube.

If the leakdown time is below the specified time for used tappets, noisy operation may result. If no other cause for noisy tappets can be found, the leakdown rate should be checked and any outside the specification should be replaced.

**DIAGNOSIS AND TESTING (Continued)**

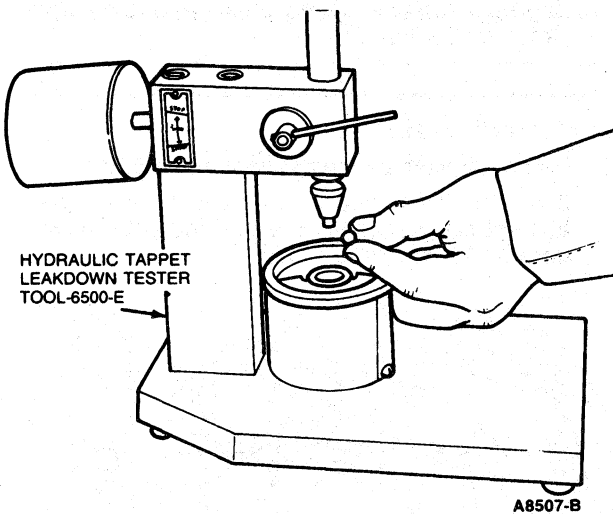
Assembled tappets can be tested with Hydraulic Tappet Leakdown Tester TOOL-6500-E or equivalent to check the leakdown rate. The leakdown rate specification is the time in seconds for the plunger to move a specified distance of its travel while under a 22.7kg (50 lb) load. Test the tappets as follows:

1. Disassemble and clean the tappet to remove all traces of engine oil.

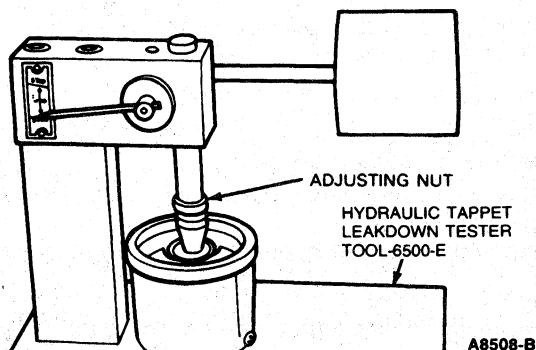
**NOTE:** Do not mix parts from different tappets. Parts are select-fitted and are not interchangeable.

Tappets cannot be checked with engine oil in them. Only the testing fluid can be used.

2. Place tappet in tester, with plunger facing upward. Pour hydraulic tester fluid into cup to a level that will cover tappet assembly. The fluid can be purchased from manufacturer of tester. Using kerosene or any other fluid will not provide an accurate test.
3. Place 7.94mm (5/16-inch) steel ball provided with tester in plunger cap.



4. Adjust length of ram so pointer is 1.59mm (1/16-inch) below starting mark when ram contacts tappet plunger, to facilitate timing as pointer passes the Start Timing mark.

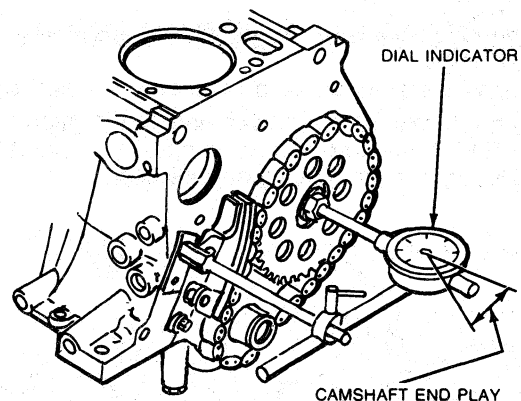


Use the center mark on the pointer scale as Stop Timing point instead of the original Stop Timing mark at top of scale.

5. Work tappet plunger up and down until tappet fills with fluid and all traces of air bubbles have disappeared.
6. Allow ram and weight to force tappet plunger downward. Measure exact time it takes for pointer to travel from Start Timing to the Stop Timing marks of tester.
7. A tappet that is satisfactory must have a leakdown rate (time in seconds) within minimum and maximum limits specified.
8. If tappet is not within specification, replace it with new tappet. It is not necessary to disassemble and clean new tappets before testing, because oil contained in new tappets is test fluid.
9. Remove fluid from cup and bleed fluid from tappet by working plunger up and down. This step will aid in depressing tappet plungers when checking valve clearance.

**Camshaft End Play****2.5L I-4 Engine**

Remove the camshaft (timing) chain cover. Push the camshaft toward the rear of the engine. Install a dial indicator so that the indicator point is on the camshaft sprocket attaching screw or gear hub. Zero the dial indicator. Position a large screwdriver between the camshaft sprocket or gear and the cylinder block. Pull the camshaft forward and release it. Compare the dial indicator reading with specifications. If the end play is excessive, replace the thrust plate behind the camshaft sprocket. Refer to Section 21-10. Remove the dial indicator and install the camshaft timing chain cover.



A9331-A

**3.0L Engine**

The camshaft end play procedures and illustration for the 2.5L engine are typical of all in-block cam engines, except that on V-block engines.

## DIAGNOSIS AND TESTING (Continued)

Prying against the powdered metal camshaft sprocket, **with the valve train load on the camshaft**, can break or damage the sprocket.

Therefore, the rocker arm adjusting bolts must be backed off, or the rocker arm and shaft assembly must be loosened sufficiently to free the camshaft. After checking the camshaft end play, adjust the valve clearance.

Push the camshaft toward the rear of the engine. Install Dial Indicator TOOL-4201-C or equivalent, so that the indicator point is on the camshaft sprocket attaching screw. Zero the dial indicator. Position a large screwdriver between the camshaft sprocket or gear and the block. Pull the camshaft forward and release it. Compare the dial indicator reading with specifications. If the end play is excessive, replace the thrust plate. Refer to Section 21-15.

Remove the dial indicator.

### Timing Chain Deflection

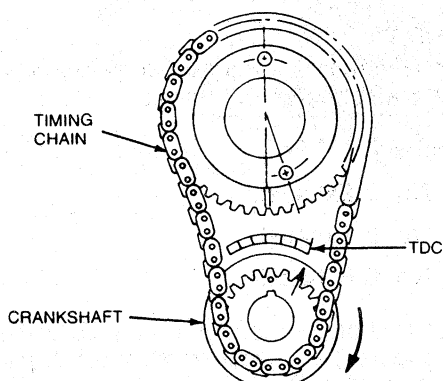
#### 2.5L Engine

1. Rotate crankshaft in counterclockwise direction (as viewed from the front) to take up slack on LH side of chain.
2. Establish reference point on block and measure from this point to chain.
3. Rotate crankshaft in opposite direction to take up slack on RH side of chain. Force LH side of chain out with fingers and measure distance between reference point and chain. The deflection is the difference between two measurements.

If deflection exceeds 12.7mm (1/2-inch), replace timing chain and sprockets.

#### 3.0L V-6 Engine

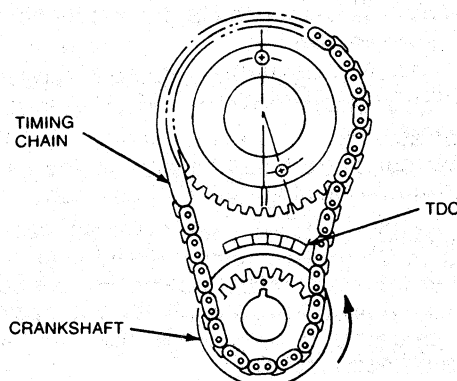
1. Remove LH valve rocker arm cover. Refer to Section 21-15.
2. Loosen No. 5 exhaust rocker arm and rotate to one side.
3. Install a dial indicator on the end of push rod.
4. Turn crankshaft clockwise until No. 1 piston is at TDC. The damper timing mark should point to TDC on the timing degree indicator.



A9332-A

This will also take up slack on RH side of chain.

5. Zero dial indicator.
6. Slowly turn crankshaft counterclockwise until the slightest movement is seen on dial indicator. Stop, and observe damper timing mark for number of degrees of travel from TDC.

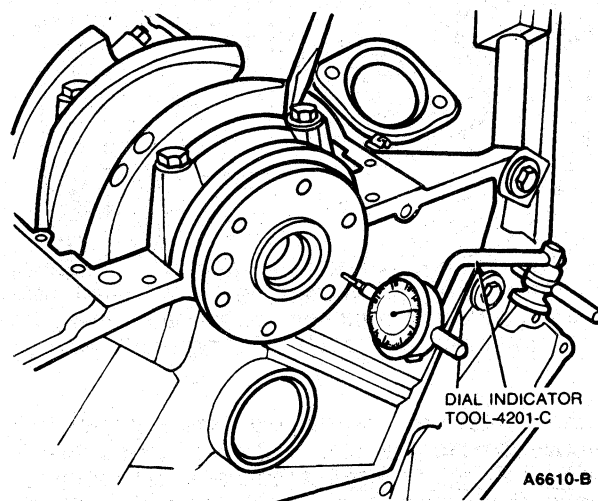


A9333-A

7. If reading on timing degree indicator exceeds 6 degrees, replace timing chain and sprockets. Refer to Section 21-15.

### Crankshaft End Play

1. Force crankshaft toward rear of engine.
2. Install a dial indicator so contact point rests against crankshaft flange and indicator axis is parallel to crankshaft axis.



A6610-B

3. Zero dial indicator. Push crankshaft forward and note reading on dial.
4. If end play exceeds service limit, replace thrust bearing and crankshaft, if they are worn beyond service limits. If end play is less than minimum limit, inspect thrust bearing faces for scratches, burrs, nicks or dirt. If thrust faces are aligned properly, install thrust bearing and align faces following procedure recommended under Main Bearing Replacement. Recheck end play.

**DIAGNOSIS AND TESTING (Continued)****Flywheel Runout****Automatic Transmission**

Remove the spark plugs.

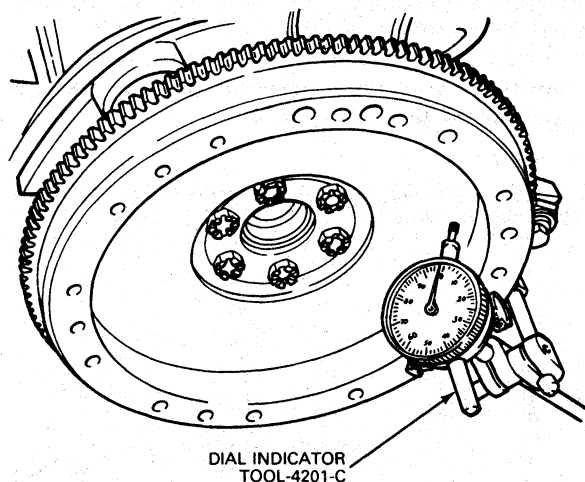
Install Dial Indicator TOOL-4201-C or equivalent so that the indicator point rests on the face of the ring gear adjacent to the gear teeth.

Hold the flywheel and crankshaft forward or backward as far as possible to prevent crankshaft end play from being indicated as flywheel runout.

Set the indicator dial on the zero mark. Turn the flywheel one complete revolution while observing the total indicator reading (TIR). If the TIR exceeds specification, the flywheel and ring gear assembly must be replaced.

**Flywheel Clutch Face Runout****Manual-Shift Transmission**

Install Dial Indicator TOOL-4201-C or equivalent so that the indicator point bears against the flywheel face. Turn the flywheel ensuring to hold it in the full forward or rearward position so that crankshaft end play will not be indicated as flywheel runout.



A8221-B

If the clutch face runout exceeds specification, remove the flywheel and check for burrs between the flywheel and the face of the crankshaft mounting flange. If no burrs exist, check the runout of the crankshaft mounting flange. Replace the flywheel or machine the crankshaft flywheel mounting face sufficiently to true-up the surface if the mounting flange runout exceeds specification. Replace it or install it on the flywheel. Refer to Ring Gear Replacement for procedure.

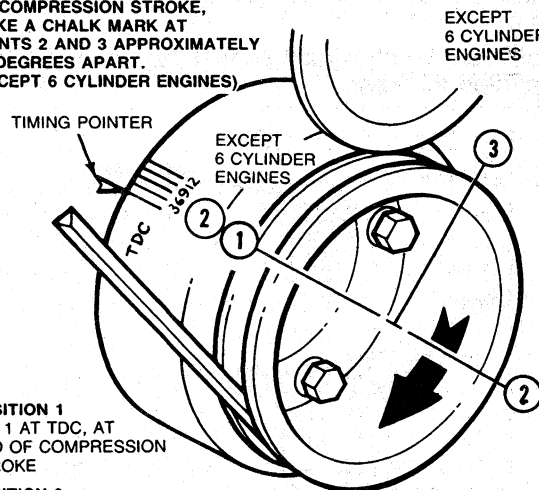
**ADJUSTMENTS****Hydraulic Valve Clearance****2.5L I-4 Engine**

The 2.5L I-4 engine is an in-block cam engine with hydraulic tappets. Refer to Section 21-10 for adjustment procedures.

**Six-Cylinder Check**

1. With No. 1 piston on TDC at the end of compression stroke (Position No. 1 in the illustration) check the following valves:

WITH NO. 1 AT TDC, AT END OF COMPRESSION STROKE, MAKE A CHALK MARK AT POINTS 2 AND 3 APPROXIMATELY 90 DEGREES APART. (EXCEPT 6 CYLINDER ENGINES)



**POSITION 1**  
NO. 1 AT TDC, AT  
END OF COMPRESSION  
STROKE

**POSITION 2**  
ROTATE CRANKSHAFT  
180 DEGREES (ONE-HALF  
REVOLUTION) CLOCKWISE,  
FROM POSITION 1  
(ONE REVOLUTION — 360 DEGREES  
ON 6 CYLINDER ENGINES)

**POSITION 3 (EXCEPT 6 CYLINDER ENGINES)**  
ROTATE CRANKSHAFT  
270 DEGREES (THREE-QUARTER  
REVOLUTION) CLOCKWISE,  
FROM POSITION 2

A6606-C

**3.0L V-6 Engines**

No. 1 Intake No. 1 Exhaust.

No. 3 Intake No. 2 Exhaust.

No. 6 Intake No. 4 Exhaust.

2. Rotate crankshaft 360 degrees to position No. 2 and check the following valves:

**3.0L V-6 Engines**

No. 2 Intake No. 3 Exhaust.

No. 4 Intake No. 5 Exhaust.

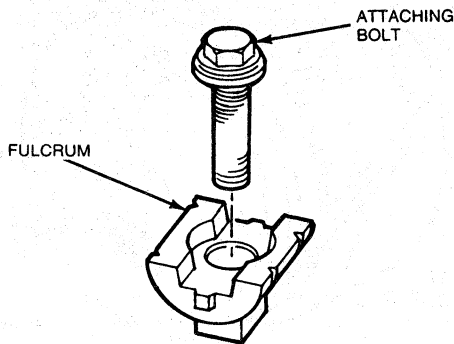
No. 5 Intake No. 6 Exhaust.

## ADJUSTMENTS (Continued)

- When compressing valve spring to remove push rods, ensure piston in individual cylinder is below TDC to avoid contact between valve and piston. To replace a push rod, it will be necessary to loosen the valve rocker arm shaft assembly and rotate rocker arm to the side. Upon replacement of a valve push rod, valve rocker arm assembly or hydraulic valve tappet, the engine should not be cranked or rotated until tappets have an opportunity to leak down to their normal operating position. The leakdown rate can be accelerated by using a tappet bleed-down wrench on valve rocker arm and applying pressure in a direction to collapse lifter.

### Engines with Pedestal-Mounted Rocker Arm Bolts

Each bolt and fulcrum should be removed and inspected for wear.



A4668-D

## REMOVAL AND INSTALLATION

### Core Plugs

#### Removal

To remove a large core plug, drill a 12.7mm (1/2-inch) hole in the center of the plug and remove with a Universal Impact Slide Hammer T59L-100-B, D79P-100-A, T50T-100-A or equivalent, or pry it out with a large drift punch. Clean and inspect the plug bore.

Prior to installing a core plug, the plug bore should be inspected for any damage that would interfere with the proper sealing of the plug. If the bore is damaged, it will be necessary to true-up the surface by boring for the next specified oversize plug.

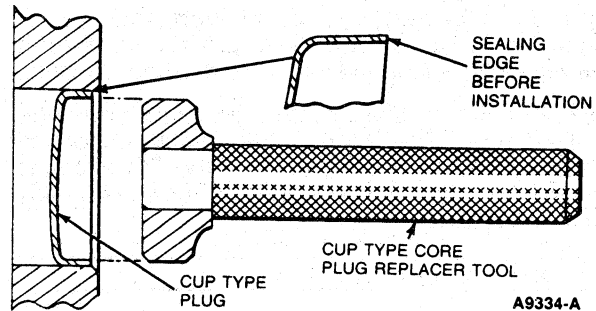
Oversize (OS) plugs are identified by the OS stamped in the flat located on the cup side of the plug.

Coat the plug and/or bore lightly with Perfect Seal Sealing Compound B5A-19554-A (ESR-M18P2-A and ESE-M4G115-A) or equivalent oil resistant (oil galley) or water resistant (cooling jacket) sealer, and install it following the procedure for cup-type or expansion-type.

### Cup-Type

#### Installation

Cup-type core plugs are installed with the flanged edge outward. The maximum diameter of this plug is located at the outer edge of the flange. The flange on cup-type plugs flares outward with the largest diameter at the outer (sealing) edge.



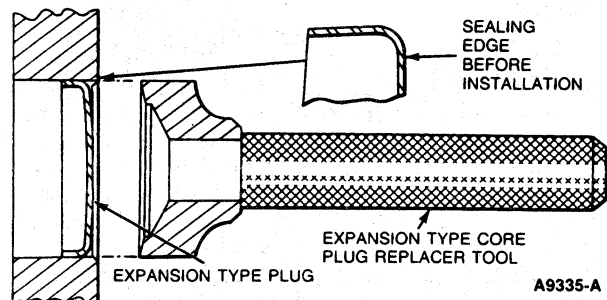
A9334-A

It is imperative to install the plug in the machined bore using a properly designed tool. Under no circumstances is the plug to be driven into the bore using a tool that contacts the flange. This method will damage the sealing edge and will result in leakage and/or plug blow-out. The flanged (trailing) edge must be below the chamfered edge of the bore to effectively seal the plugged bore. If the core plug replacing tool has a depth seating surface, do not seat the tool against a non-machined (casting) surface.

### Expansion-Type

#### Installation

Expansion-type core plugs are installed with the flanged edge inward. The maximum diameter of this plug is located at the base of the flange with the flange flaring inward.



A9335-A

It is imperative to push or drive the plug into the machined bore by using a properly designed tool. Under no circumstances is the plug to be driven using a tool that contacts the crowned portion of the plug. This method will expand the plug prior to installation and may damage the plug and/or plug bore. When installed, the trailing (maximum) diameter must be below the chamfered edge of the bore to effectively seal the plugged bore. If the core plug replacing tool has a depth seating surface, do not seat the tool against a non-machined (casting) surface.



## REMOVAL AND INSTALLATION (Continued)

**Flywheel Ring Gear****2.5L Engine****Manual-Shift Transmission****Removal**

To replace a damaged or worn ring gear, heat the ring gear with a blow torch on the engine side of the gear, and knock it off the flywheel. Do not hit the flywheel when removing the ring gear.

**Installation**

Heat the new ring gear evenly until the gear expands enough to slip onto the flywheel. Ensure the gear is seated properly against the shoulder. **Do not heat any portion of the gear to a temperature higher than 260°C (500°F). If this limit is exceeded, the temper will be removed from the ring gear teeth.**

**Crankshaft Rear Oil Seal****2.5L and 3.0L Engines**

A one-piece crankshaft rear main oil seal is used on these engines.

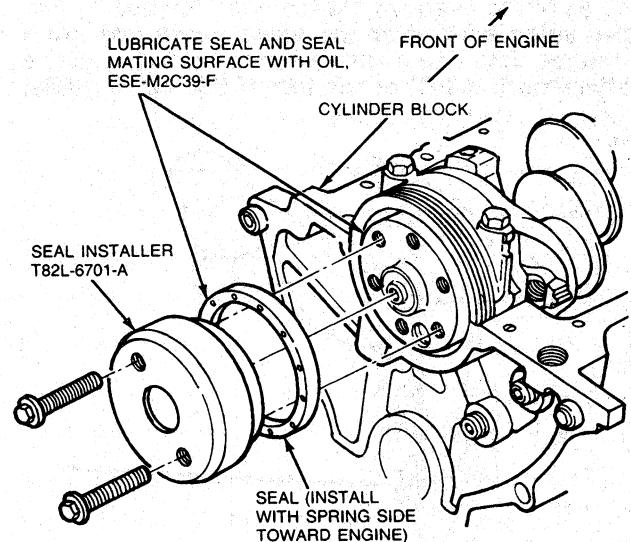
**Removal**

1. Using sharp awl, punch one hole into seal metal surface between the seal lip and the engine block.
2. Screw in the threaded end of Slide Hammer T77L-9533-B1 or equivalent. Use the slide hammer to remove the seal. Use caution to avoid scratching or damaging the oil seal surface.

**Installation**

1. Lubricate seal with engine oil.
2. Position oil seal on Rear Oil Seal Installer T82L-6701-A or equivalent. Position tool and seal on

rear of engine. Alternate bolt tightening to properly seat seal. (Two bolts are supplied with Rear Oil Seal Installer T82L-6701-A. Engine flywheel bolts may also be used.)



**NOTE: REAR FACE OF SEAL MUST BE WITHIN 0.127mm (0.005-INCH) OF THE REAR FACE OF THE BLOCK**

A6609-E

## OVERHAUL

**Service Limit Specifications**

**Service limit specifications are intended to be a guide, to be used when overhauling or reconditioning an engine or engine component. A determination can be made whether a component is suitable for continued service while the engine is disassembled.**

In the case of valve stem-to-valve guide clearance, the "service clearance" is intended as an aid in engine noise diagnosis, and does not constitute a failure or indicate need for service. However, when

overhauling or reconditioning a cylinder head, the service clearance should be regarded as a practical working value, and used as a determinant for installing the next oversize valve to ensure extended service life.

**Cylinder Head**

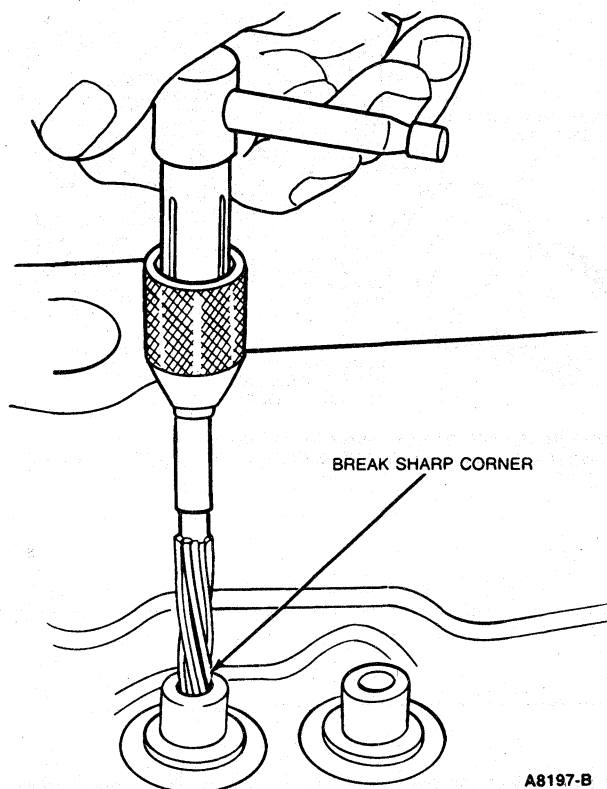
Replace the head if it is cracked. **Do not plane or grind more than 0.25mm (0.010 inch) from the original cylinder head gasket surface.** Remove all burrs or scratches with an oil stone.

## OVERHAUL (Continued)

## Valve Guides, Reaming

If it becomes necessary to ream a valve guide to install a valve with an oversize stem, a reaming kit is available which contains the following reamer and pilot combinations: 0.38mm (0.015-inch) OS reamer with 0.076mm (0.003-inch) OS pilot, and a 0.76mm (0.030-inch) reamer with a 0.38mm (0.015-inch) OS pilot.

When replacing a standard size valve with an oversize valve always use the reamer in sequence (smallest oversize first, and then next smallest, etc.) so as not to overload the reamers. **Always reface the valve seat after the valve guide has been reamed, and use a suitable scraper to break the sharp corner (ID) at the top of the valve guide.**



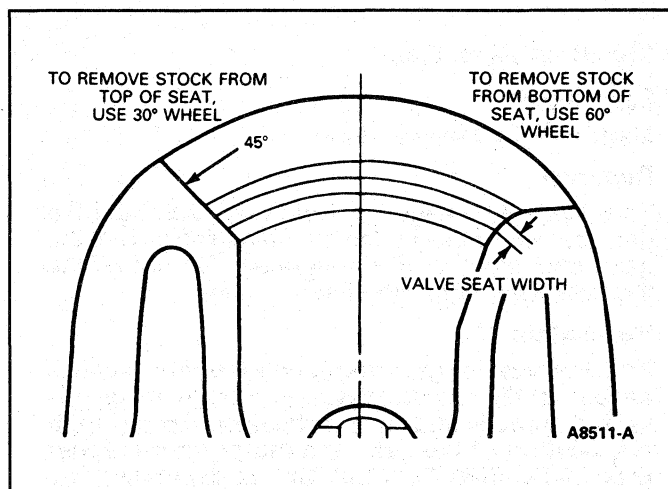
A8197-B

## Valve Seats, Refacing

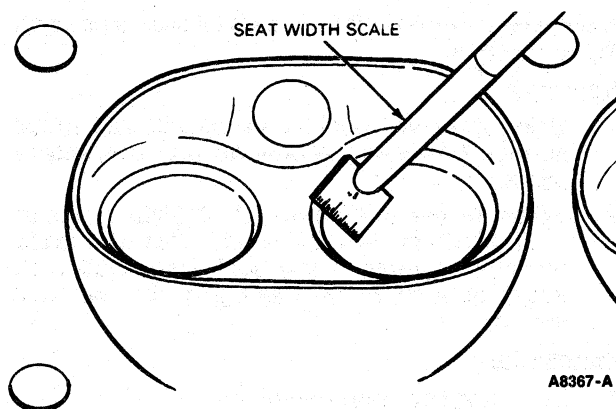
Refer to Engine Service in the Rotunda catalog for a description of the various types of valve seat grinders and cutters available.

Refacing of the valve seat should be closely coordinated with the refacing of the valve face so that the finished seat and valve face will be concentric and the specified interference angle will be maintained. This is important so that the valve and seat will have a compression-tight fit. Ensure refacer grinding wheels are properly dressed.

Grind the valve seats of all engines to a true 45 degree angle. Remove only enough stock to clean up pits and grooves or to correct the valve seat runout. After the seat has been refaced, use a seat width scale or a machinist scale to measure the seat width. Narrow the seat, if necessary, to bring it within specification.



## Valve Seat Width Check



A8367-A

If the valve seat width exceeds the maximum limit, remove enough stock from the top edge and/or bottom edge of seat to reduce the width to specification.

On the valve seats of all engines, use a 60 degree angle grinding wheel to remove stock from the bottom of the seats (raise the seats) and use a 30 degree angle wheel to remove stock from the top of the seats (lower the seats).

The finished valve seat should contact the approximate center of the valve face. It is good practice to determine where the valve seat contacts the face. To do this, coat the seat with Prussian Blue and set the valve in place. Rotate the valve with light pressure. If the blue is transferred to the center of the valve face, the contact is satisfactory. If the blue is transferred to the top edge of the valve face, lower the valve seat. If the blue is transferred to the bottom edge of the valve face, raise the valve seat.

## Valves

Minor pits, grooves, etc., may be removed. Discard valves that are severely damaged if the face runout cannot be corrected by refinishing or stem clearance exceeds specification. **Discard any excessively worn or damaged valve train parts.**



## OVERHAUL (Continued)

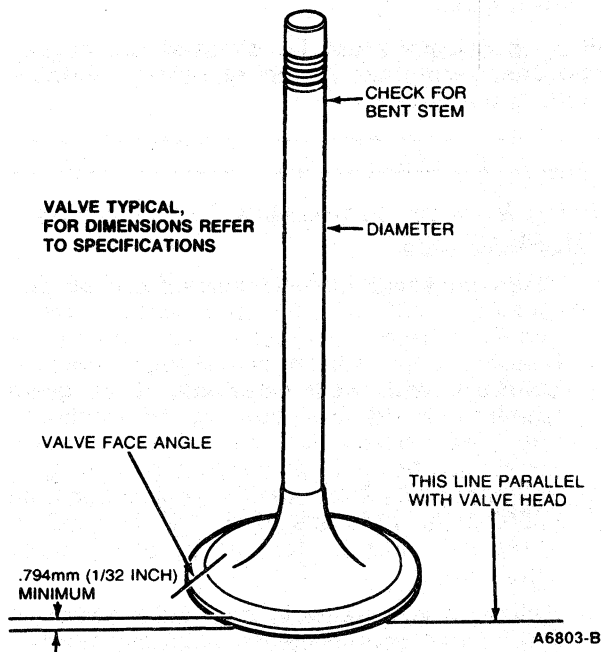
**Valves, Refacing**

Refer to Engine Service in the Rotunda catalog for a description of the various types of valve resurfacing equipment available.

The valve refacing operation should be closely coordinated with the valve seat refacing operations so that the finished angles of the valve face and of the valve seat will be to specifications and provide a compression-tight fit. Ensure refacer grinding wheels are properly dressed.

If the valve face runout is excessive and/or to remove pits and grooves, reface the valve to a true 44 degree angle. Remove only enough stock to correct the runout or to clean up the pits and grooves. If the edge of the valve head is less than 0.79mm (1/32-inch) thick after grinding, replace the valve as the valve will run too hot in the engine. **The interference angle of the valve and seat should not be lapped out. Remove all grooves or score marks from the end of the valve stem, and chamfer it as necessary. Do not remove more than .25mm (0.010-inch) from the end of the valve stem.**

If the valve and/or valve seat has been refaced, it will be necessary to check the clearance between the rocker arm pad and the valve stem with the valve train assembly installed in the engine.

**Valves, Select Fitting**

If the valve stem-to-valve guide clearance exceeds the service clearance, ream the valve guide for the next oversize valve stem. Valves with oversize stem diameters of 0.38mm (0.015-inch) and 0.76mm (0.030-inch) are available for service for all engines. **Always reface the valve seat after the valve guide has been reamed.** Refer to Reaming Valve Guides.

**Camshaft Service**

Clean and inspect camshaft as outlined under Cleaning and Inspection.

Remove light scuffs, scores or nicks from the camshaft machined surfaces with a smooth oil stone. Camshaft journals can be refinished to accommodate 0.38mm (0.015-inch) undersize service bearings. If the journals will not clean up to 0.38mm (0.015-inch) undersize, the camshaft must be replaced.

**Pistons, Pins and Rings****Fitting Pistons**

Pistons are available for service in standard size and the oversizes shown in Specifications.

The standard size pistons are color-coded red or blue, or have 0.003 OS stamped on the dome, (color-coded yellow on some applications). Refer to Specifications for standard size piston dimensions.

Measure the cylinder bore and select the piston to ensure the proper clearance. When the bore diameter is in the lower one third of the specified range, a red piston should be used. When the bore diameter is in the middle one third, a blue piston should be used. When the bore diameter is in the upper one third, the 0.003 OS (or yellow) piston should be used.

Measure the piston diameter to ensure the specified clearance is obtained. It may be necessary periodically to use another piston (within the same grade size) that is either slightly larger, or smaller to achieve the specified clearance.

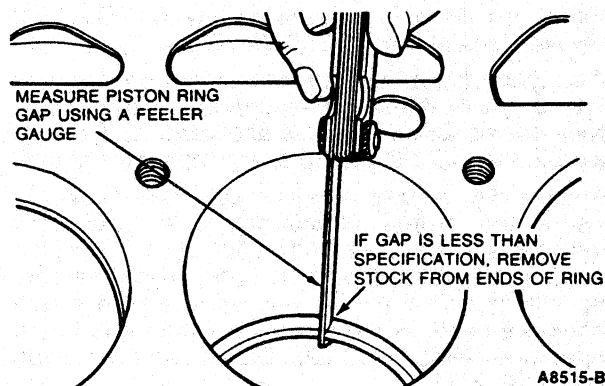
**If none can be fitted, refinish the cylinder to provide the proper clearance for the piston. When a piston has been fitted, mark it for assembly in the cylinder to which it was fitted. If the taper, out-of-round and piston-to-cylinder bore clearance conditions of the cylinder bore are within specified limits, new piston rings will give satisfactory service. If new rings are to be installed in a used cylinder that has not been refinished, remove the cylinder wall glaze using only a spring-loaded Engine Cylinder Hone Set T73L-6011-A or equivalent, and only if there is not a visible sign of cross-hatch markings on the cylinder walls. (Refer to Cylinder Block, Cylinder Walls, Refinishing.) Always clean the cylinder bore thoroughly with detergent and water.**

1. Calculate the size piston to be used by taking a cylinder bore check. Follow procedures outlined under Cleaning and Inspection.
2. Select proper size piston to provide desired clearance (refer to Specifications). Measure piston diameter in line with centerline of piston pin and at 90 degrees to piston pin axis.
3. Ensure piston and cylinder block are at room temperature, 21°C (70°F). **After any refinishing operation, allow cylinder bore to cool, and ensure piston and bore are clean and dry before piston fit is checked.**

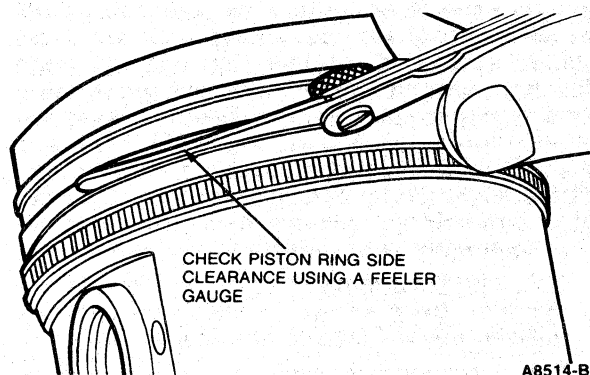
## OVERHAUL (Continued)

## Fitting Piston Rings

1. Select proper ring set for the size cylinder bore.
2. Position ring in cylinder bore in which it is going to be used.
3. Push ring down into bore area where normal ring wear is not encountered.
4. Use head of a piston to position ring in bore so that ring is square with cylinder wall. Use caution to avoid damage to ring or cylinder bore.
5. Measure gap between ends of ring with a feeler gauge. If ring gap is less or greater than specified limits, try another ring set.



6. With ring installed on piston, check ring-side clearance of compression rings with a feeler gauge inserted between ring and its lower land. The gauge should slide freely around entire ring circumference without binding. Any wear that occurs will form a step at inner portion of lower land. **If lower lands have high steps, piston should be replaced.**



## Fitting Piston Pins

Install the piston pin, following the procedure under Piston Assembly in the applicable engine Section.

## Crankshaft

Dress minor scores with an oil stone. If the journals are severely marred or exceed the service limit, they should be refinished to size for the next undersize bearing.

## Journals, Refinishing

Refinish the journals to give the proper clearance with the next undersize bearing. If the journal will not clean up to maximum undersize bearing available, replace the crankshaft.

Always reproduce the same journal shoulder radius that existed originally. Too small a radius will result in fatigue failure of the crankshaft. Too large a radius will result in bearing failure due to radius ride of the bearing.

**CAUTION:** Because the 3.0L V-6 engine crankshaft incorporates deep rolling of the main journal fillets, journal refinishing is limited to 0.25mm (0.010-inch) undersize of standard journal dimensions. Further main journal refinishing may result in fatigue failure of the crankshaft.

After refinishing the journals, chamfer the oil holes. Polish the journal with a No. 320 grit polishing cloth and engine oil. Crocus cloth may also be used as a polishing agent.

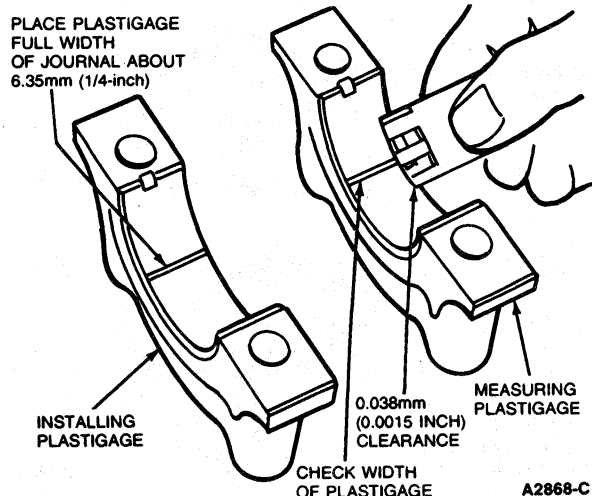
**All oil passages must be cleaned thoroughly after chamfering and polishing, using a suitable bristle brush and solvent.**

## Fitting Main or Connecting Rod Bearings with Plastigage

1. Clean crankshaft journals. Inspect journals and thrust faces (thrust bearing) for nicks, burrs or bearing pickup that would cause premature bearing wear. **When replacing standard bearings with new bearings, it is good practice to fit the bearing to minimum specified clearance.** If the desired clearance cannot be obtained with a standard bearing, try one-half of a 0.025mm (0.001-inch) or 0.051mm (0.002-inch) undersize in combination with a standard bearing to obtain the proper clearance.
2. If fitting a main bearing in the vehicle, position a jack under counterweight adjoining bearing which is being checked. Support crankshaft with jack so its weight will not compress Plastigage D81L-6002-B or equivalent, and provide an erroneous reading.
3. Place a piece of Plastigage D81L-6002-B or equivalent on bearing surface across full width of bearing cup and about 6.35mm (1/4-inch) off center.
4. Install cap and tighten bolts to specifications. Do not turn crankshaft while Plastigage D81L-6002-B or equivalent is in place.

## OVERHAUL (Continued)

5. Remove cap. Using Plastigage scale, check width of Plastigage D81L-6002-B or equivalent, at widest point to get minimum clearance. Check at narrowest point to get maximum clearance. Difference between readings is taper of journals.



6. If clearance exceeds specified limits, try 0.025mm (0.001-inch) or 0.051mm (0.002-inch) undersize bearings in combination with the standard bearings. Bearing clearance must be within specified limits. If 0.051mm (0.002-inch) undersize main bearings are used on more than one journal, ensure they are installed in cylinder block side of bearing. If 0.051mm (0.002-inch) undersize bearings do not bring clearance within desired limits, refinish crankshaft journal, then install undersize bearings.
7. After bearing has been fitted, apply light coat of engine oil to journal and bearings. Install bearing cap. Tighten cap bolts to specification.
8. Repeat procedure for remaining bearings that require replacement.

### Cylinder Block

#### Cylinder Walls, Refinishing

Honing is recommended for refinishing cylinder walls only when no cross-hatch pattern is visible on cylinder walls, or for fitting pistons to the specified clearance. The grade of hone to be used is determined by the amount of metal to be removed. Follow the instructions of the hone manufacturer. If coarse stones are used to start the honing operation, leave enough material so that all hone marks can be removed with the finishing hone which is used to obtain the proper piston clearance. After honing, thoroughly clean cylinder bores with a detergent and water solution.

Cylinder walls that are severely marred and/or worn beyond the specified limits should be refinished. **Before any cylinder is refinished, all main bearing caps must be in place and tightened to the proper torque so that the crankshaft bearing bores will not become distorted from the refinishing operation.** Refinish only the cylinder or cylinders that require it. All pistons are the same weight, both standard and oversize; therefore, various sizes of pistons can be used without upsetting engine balance. Refinish the cylinder with the most wear first to determine the maximum oversize. If the cylinder will not clean up when refinished for the maximum oversize piston recommended, replace the block.

Refinish the cylinder to within approximately 0.038mm (0.0015-inch) of the required oversize diameter. This will allow enough stock for the final step of honing so that the correct surface finish and pattern are obtained. For the proper use of the refinishing equipment, follow the instructions of the manufacturer. **Only experienced personnel should be allowed to perform this work.** Use a motor-driven, spring pressure-type Hone Set T73L-6011-A or equivalent at a speed of 300-500 rpm. Hones of grit sizes 180-220 will normally provide the desired bore surface finish of 0.20-0.60  $\mu$ m (millimicron) per cylinder in production and 0.30-0.51  $\mu$ m (millimicron) average for all cylinders.

When honing the cylinder bores, use a lubricant mixture of equal parts of kerosene and SAE No. 20 motor oil. Operate the hone in such a way as to produce a cross-hatch finish on the cylinder bore. The cross-hatch pattern should be at an angle of approximately 30 degrees to the cylinder bore. **After the final operation in either of the two refinishing methods described and prior to checking the piston fit, thoroughly clean with a detergent and water solution and oil the cylinder walls.** Mark the pistons to correspond to the cylinders in which they are to be installed. When the refinishing of all cylinders that require it has been completed and all pistons are fitted, thoroughly clean the entire block and oil the cylinder walls.

#### Servicing Sand Holes or Porous Engine Castings

Porosity or sand hole(s) which will cause oil seepage or leakage can occur with modern casting processes. A complete inspection of engine and transmission should be made. If the leak is attributed to the porous condition of the cylinder block or sand hole(s), service can be made with Ford Metallic Plastic C6AZ-19544-A (M3D35-A (E)) or equivalent. **Do not service cracks with this material.** Service with this metallic plastic epoxy resin must be confined to those cast iron engine component surfaces where the inner wall surface is not exposed to engine coolant pressure or oil pressure, for example:

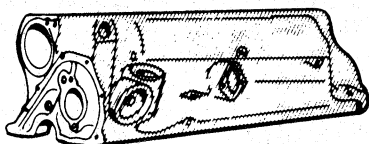
1. Cylinder block surfaces extending along the length of the block, upward from the oil pan rail to the cylinder water jacket but not including machined areas.

## OVERHAUL (Continued)

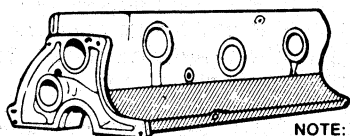
2. Lower rear face of the cylinder block.
3. Intake manifold casting -2.5L. **Service is not recommended to the intake manifold exhaust crossover section, since temperatures can exceed the recommended temperature limit of 260°C (500°F).**

SHADED AREAS MAY BE REPAIRED WITH METALLIC PLASTIC

TYPICAL FOR 4-CYLINDER ENGINE



FRONT AND LEFT SIDE

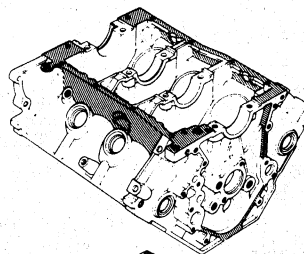


REAR AND RIGHT SIDE

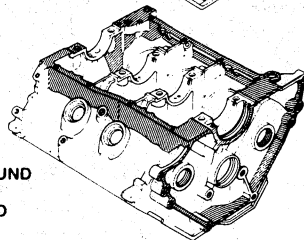
NOTE: THE METALLIC PLASTIC MUST NOT BE APPLIED AROUND BOLT HOLES BORES IN THE CYLINDER BLOCK. MAINTAIN A MINIMUM 3.1MM (5/16 INCH) GAP BETWEEN THE SEALER AND ANY SUCH CYLINDER BLOCK HOLES.

4. Cylinder front cover on engines using cast iron material.
5. Cylinder head, along the rocker arm cover gasket surface.

FRONT AND LEFT SIDE  
VIEW TYPICAL V-6 ENGINE



REAR AND RIGHT SIDE  
VIEW TYPICAL V-6 ENGINE



A9336-A

Use the following procedure to service porous areas or sand holes in cast iron:

1. Clean the surface to be serviced by grinding or rotary filing to a clean bright metal surface. Chamfer or undercut the hole or porosity to a greater depth than the rest of the cleaned surface. Solid metal must surround the hole. Openings larger than 6.35mm (1/4-inch) should not be serviced using metallic plastic (epoxy resin). Openings in excess of 6.35mm (1/4-inch) can be drilled, tapped and plugged using common tools. Clean the service area thoroughly. Metallic plastic (epoxy resin) will not stick to a dirty or oily surface.
2. Mix the metallic plastic (epoxy resin) base and hardener as directed on the container. Stir thoroughly until uniform.
3. Apply the service mixture with a suitable clean tool (putty knife, wood spoon, etc.), forcing the epoxy into the hole or porosity.
4. Allow the service mixture to harden. This can be accomplished by two methods. Heat cure with a 250 watt lamp placed 254mm (10 inches) from the serviced surface, or air dry for 10-12 hours at temperatures above 10°C (50°F).
5. Sand or grind the serviced area to blend with the general contour of the surrounding surface.
6. Paint the surface to match the rest of the block.

## CLEANING AND INSPECTION

The cleaning and inspection procedures are for a complete engine overhaul; therefore, for partial engine overhauls or parts replacement, follow the pertinent cleaning or inspection procedure.

## Intake Manifold

## Cleaning

Remove all gasket material from the machined surfaces of the manifold. Clean the manifold in a suitable solvent and dry it with compressed air.

## Inspection

Inspect the manifold for cracks, damaged gasket surfaces, or other conditions that would make it unfit for further service. Replace all studs that are stripped or otherwise damaged. Clean the EGR exhaust passages. **Remove all filings and foreign matter that may have entered the manifold as a result of service. Check the baffle plate on the underside of the manifold, if so equipped. The baffle should be securely fastened.**

## Exhaust Manifolds

## Inspection

Inspect the cylinder head joining flanges of the exhaust manifold(s) for evidence of exhaust gas leaks.

Inspect the manifolds for cracks, damaged sealing surfaces, or other damage that would make them unfit for further service. Warped or cracked exhaust manifolds must be replaced.

## CLEANING AND INSPECTION (Continued)

### Valve Rocker Arm and/or Shaft Assembly Cleaning

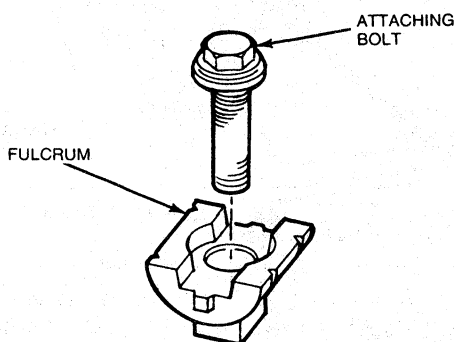
Clean all parts thoroughly. Ensure all oil passages are open.

Ensure oil passage in the push rod end of the rocker arm is open.

#### Inspection

Inspect the shaft and the rocker arm bore for nicks, scratches, scores or scuffs. Replace any damaged parts.

Inspect the pad at the valve end of the rocker arm for indications of scuffing or abnormal wear. If the pad is grooved, replace the rocker arm. **Do not attempt to true-up this surface by grinding. On pedestal mounted rocker arms, check the rocker arm pad, side rails and fulcrum seat for excessive wear, cracks, nicks or burrs. Check the rocker arm bolt for stripped or broken threads.**



A4668-D

### Push Rods

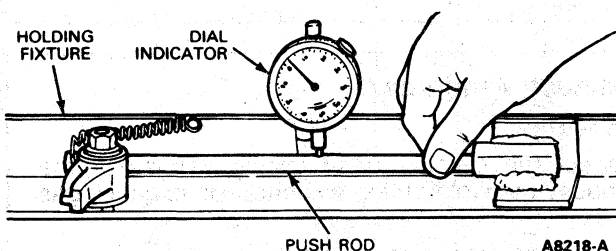
#### Cleaning

Clean the push rods in a suitable solvent. Blow out the oil passage in the push rods with compressed air.

#### Inspection

Check the ends of the push rods for nicks, grooves, roughness or excessive wear. Replace damaged push rods.

The push rods can be visually checked for straightness while they are installed in the engine by rotating them with the valve closed. They also can be checked with a dial indicator.



A8218-A

If the push rod is bent beyond specification, it should be replaced. **Do not attempt to straighten push rods.**

### Cylinder Heads

#### Cleaning

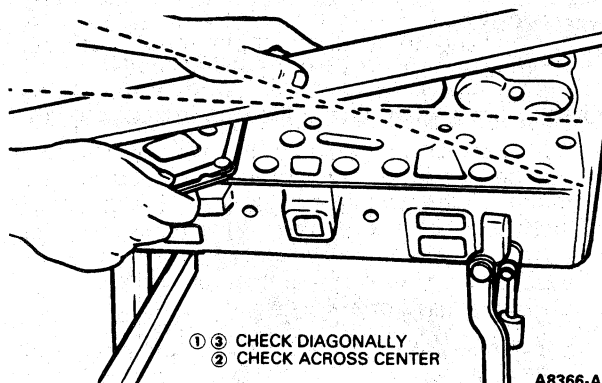
**With the valves installed to protect the valve seats, remove deposits from the combustion chambers and valve heads with a scraper and a wire brush. Be careful not to damage the cylinder head gasket surface.** After the valves are removed, clean the valve guide bores. Use cleaning solvent to remove dirt, grease and other deposits. Clean all bolt holes. Remove all deposits from the valve with a fine wire brush or buffing wheel.

#### Inspection

Check the cylinder head for cracks and inspect the gasket surface for burrs and nicks. Replace the head if it is cracked.

The following inspection procedures are for a cylinder head that is to be completely overhauled. For individual service operations, use only the pertinent inspection procedure.

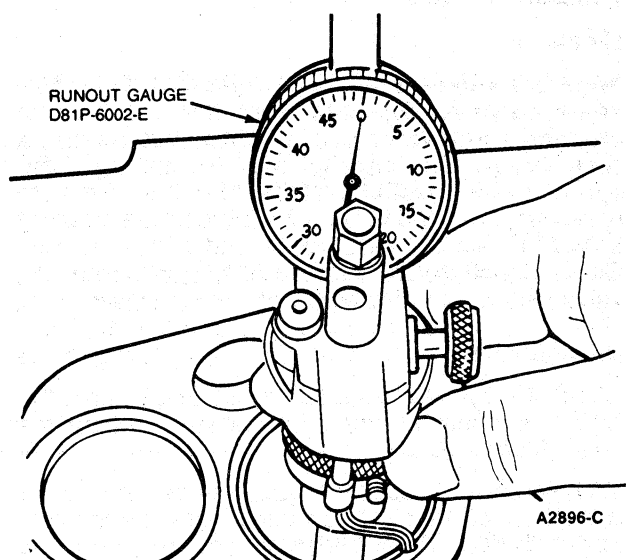
When a cylinder head is removed because of gasket leaks, check the flatness of the cylinder head gasket surface for conformance to specifications. If necessary to refinish the cylinder head gasket surface, **do not plane or grind off more than 0.254mm (0.010 inch).**



A8366-A

Check the valve seat runout with an accurate Valve Seat Runout Gauge D81P-6002-E or equivalent. Follow the instructions of the gauge manufacturer. If the runout exceeds the wear limit, reface the valve and valve seat. Measure the valve seat width. **Reface any valve seat whose width is not within specification.**

## CLEANING AND INSPECTION (Continued)

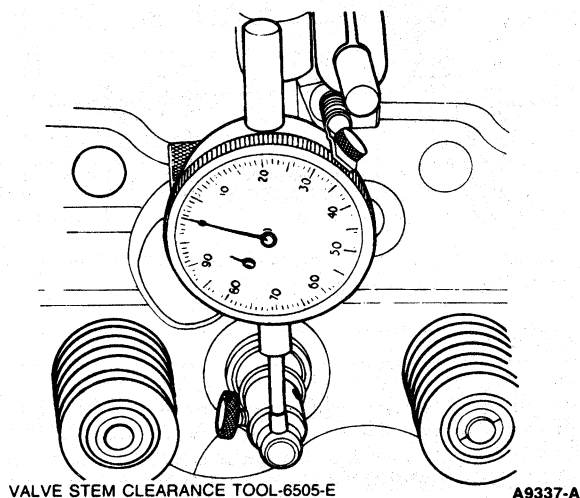


Critical valve inspection points have been shown. Refer to Specifications for service limits.

Inspect the stem for bends and the end of the stem for grooves or scores. Check the valve head for burning, erosion, warpage and cracking. Minor pits, grooves etc., may be removed. Discard valves that are severely damaged.

Inspect the valve spring, valve spring retainers, locks and sleeves for wear or damage. Discard any damaged parts.

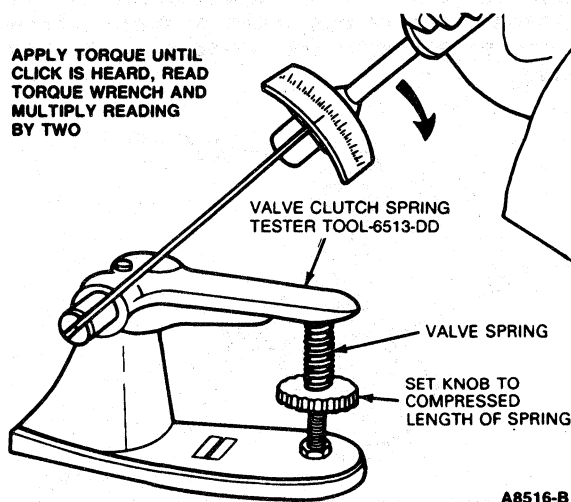
Check the valve stem-to-valve guide clearance of each valve in its respective valve guide with the tool shown or equivalent. Use a flat end indicator point.



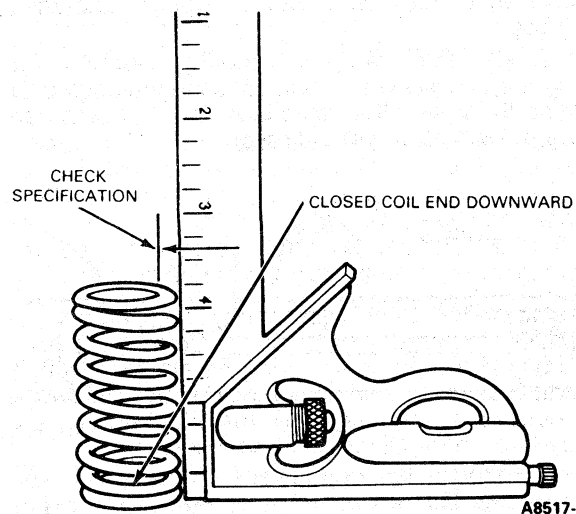
Install the tool on the valve stem until it is fully seated. Tighten the knurled setscrew firmly. Permit the valve to drop away from its seat until the tool contacts the upper surface of the valve guide.

Position the dial indicator with its flat tip against the center portion of the tool's spherical section at approximately 90 degrees to the valve stem axis. Move the tool back and forth in line with the indicator stem. Take a reading on the dial indicator without removing the tool from the valve guide upper surface. Divide the reading by two, the division factor for the tool. The resulting measurement is the valve stem clearance.

Check springs for proper pressure at the specified spring lengths using Valve Clutch Spring Tester TOOL-6513-DD or equivalent. Weak valve springs cause poor engine performance. Replace any spring not within specification. Manually rotating the valve spring assemblies while installed in the engine will not determine condition of valve springs.



Check each spring for squareness, using a steel square and a flat surface. Stand the spring and square on end on the flat surface. Slide the spring up to the square. Revolve the spring slowly and observe the space between the top coil of the spring and the square.



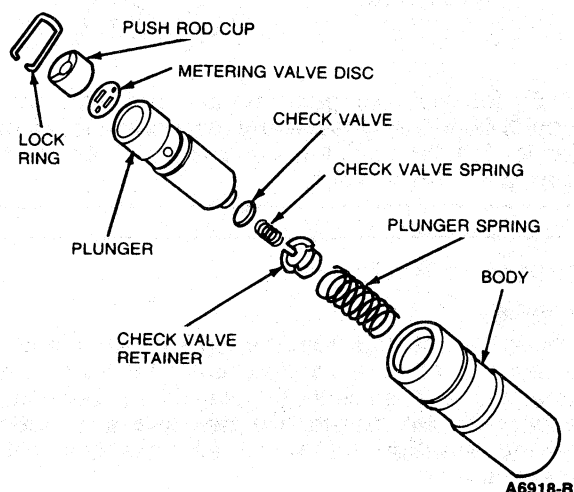


**CLEANING AND INSPECTION (Continued)**

Refer to Specifications for out-of-square limits. Follow the same procedure to check new valve springs before installation.

**Hydraulic Tappets and Hydraulic Lash Adjusters**

The tappet (or lash adjuster) assemblies should be kept in proper sequence so that they can be installed in their original position. Inspect and test each tappet separately so as not to intermix the internal parts. **If any part of the tappet assembly needs replacing, replace the entire assembly.**



**NOTE:** If the 2.5L damper/spring assembly is disassembled, the same spring and damper must be put back together. Do not interchange parts.

**Cleaning**

Thoroughly clean all the parts in clean solvent and wipe them with a clean, lint-free cloth.

**Inspection**

Inspect the parts and discard the entire tappet assembly if any part shows pitting, scoring, galling, excessive wear or evidence of non-rotation. Replace the entire assembly if the plunger is not free in the body. The plunger should drop to the bottom of the body by its own weight when assembled dry.

Assemble the tappet assembly and check for freeness of operation by pressing down on the push rod cup. The tappets can also be checked with a hydraulic tester to test the leakdown rate. Follow the instructions of the test unit manufacturer or the procedure under Diagnosis and Testing.

**Timing Chain and Sprockets****Cleaning**

Clean all parts in solvent and dry them with compressed air.

Lubricate the timing chain with engine oil before installing it on the sprockets.

**Inspection**

Inspect the chain for broken links. Inspect the sprockets for cracks and worn or damaged teeth. Replace all the components of the timing chain and sprocket assembly, if any one item needs replacement.

**Camshaft****Cleaning and Inspection**

Clean the camshaft in solvent and wipe it dry. Inspect the camshaft lobes for scoring and signs of abnormal wear. Lobe pitting in the general area of the lobe toe is not detrimental to the operation of the camshaft; therefore, the camshaft should not be replaced unless the lobe lift loss has exceeded specification.

The lift of the camshaft lobes can be checked with the camshaft installed in the engine or on centers. Refer to Camshaft Lobe Lift.

Replace the camshaft if distributor drive gear has chipped or broken teeth. On 2.5L engines, replace camshaft if distributor has broken or chipped teeth.

**Oil Pan****Cleaning**

Scrape any dirt or metal particles from the inside of the pan. Scrape all old gasket material from the gasket surface. Wash the pan in a solvent and dry it thoroughly. Ensure all foreign particles are removed from below the baffle plate.

**CAUTION: Do not damage the oil level sensor during the cleaning process.**

**Inspection**

Check the pan for cracks, holes, damaged drain plug threads, and a loose baffle or a damaged gasket surface.

Inspect for damage (uneven surface) at the bolt holes caused by over-tightening the bolts. Straighten surfaces as required. Service any damage, or replace the pan if services cannot be made satisfactorily.

## CLEANING AND INSPECTION (Continued)

### Oil Pump

#### Cleaning

Refer to Section 21-12 for inspection procedures on the 3.0L engine oil pump.

Wash all parts in a solvent and dry them thoroughly with compressed air. Use a brush to clean the inside of the pump housing and the pressure relief valve chamber. Ensure all dirt and metal particles are removed.

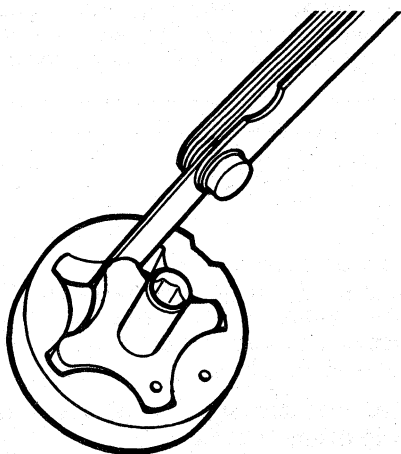
#### Inspection

Refer to Specification for clearances and service limits.

Check the inside of the pump housing and the outer race and rotor damage for excessive wear.

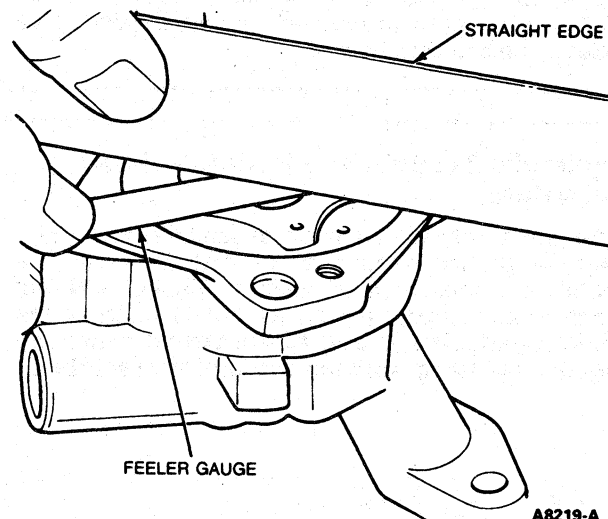
Check the mating surface of the pump cover for wear. Minor scuff marks are normal, but if the cover mating surface is worn, scored, or grooved, replace the pump (except 3.0L V-6 engines). Inspect the rotor for nicks, burrs or score marks. Remove all high points by stoning.

Measure the inner rotor tip clearance. Inner to outer rotor tip clearance must not exceed 0.254mm (0.010 inch) with the feeler gauge inserted 12.7mm (1/2-inch) minimum and rotors removed from pump housing.



A5602-C

With the rotor assembly installed in the housing, place a straightedge over the rotor assembly and the housing. Measure the clearance (rotor end play) between the straightedge and the rotor and outer race. Inspect the relief valve spring to see if it is collapsed or worn. Check the relief valve spring tension. If the spring tension is not within specification and/or the spring is worn or damaged, replace the pump. Check the relief valve piston for free operation in the bore.



A8219-A

NOTE: Internal components are not serviced, except 3.0L V-6 engines. If any component is out of specification, the complete pump must be replaced, except 3.0L V-6 engines.

### Connecting Rods

#### Cleaning

Remove the bearings from the rod and cap. Identify the bearings if they are to be used again. Clean the connecting rod in solvent, including the rod bore and the back of the inserts. **Do not use a caustic cleaning solution.** Blow out all passages with compressed air.

#### Inspection

The connecting rods and related parts should be carefully inspected and checked for conformance to specifications. Various forms of engine wear caused by these parts can be readily identified.

A shiny surface on either pin boss side of the piston usually indicates that a connecting rod is bent.

Abnormal connecting rod bearing wear can be caused by either a bent connecting rod, worn or damaged crankpin, or a tapered connecting rod bore.

Twisted connecting rods will not create an identifiable wear pattern, but badly twisted rods will disturb the action of the entire piston, rings and connecting rod assembly and may be the cause of excessive oil consumption.

Inspect the connecting rods for signs of fractures and the bearing bores for out-of-round and taper. If the bore exceeds the recommended limits and/or if the connecting rod is fractured, it should be replaced. Check the ID of the connecting rod piston pin bore. If the pin bore in the connecting rod is larger than specifications, install a 0.03mm (0.0012-inch) oversize piston pin. First, prefit the oversize piston pin to the piston pin bore by reaming or honing the piston to provide 0.005mm (0.0002-inch)—0.012mm (0.00048-inch) clearance (light slip fit).



## CLEANING AND INSPECTION (Continued)

Then, assemble the piston, piston pin and connecting rod following the procedures for the specific engine being worked on. **It is not necessary to ream or hone the pin bore in the connecting rod. Replace damaged connecting rod nuts and bolts. Check the connecting rods for bend or twist on a suitable alignment fixture. Follow the instructions of the fixture manufacturer. If the bend and/or twist exceeds specifications, the connecting rod must be replaced.**

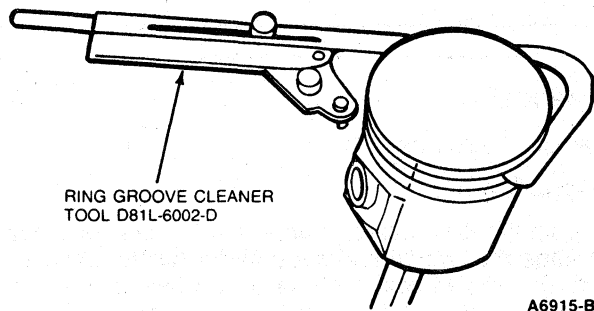
### Pistons, Pins and Rings

#### Cleaning

NOTE: Always remove and replace piston rings with proper tool.

Remove deposits from the piston surfaces. Clean gum or varnish from the piston skirt, piston pins, and rings with solvent. **Do not use a caustic cleaning solution or a wire brush to clean pistons.**

Clean the ring grooves with Ring Groove Cleaner D81L-6002-D or equivalent. Ensure the oil ring slots (or holes) are clean.



#### Inspection

Carefully inspect the pistons for fractures at the ring lands, skirts and pin bosses, and for scuffed, rough or scored skirts. If the lower inner portion of the ring grooves has a high step, replace the piston. The step will interfere with ring operation and cause excessive ring-side clearance.

Spongy, eroded areas near the edge of the top of the piston are usually caused by detonation or pre-ignition. A shiny surface on the thrust surface of the piston, offset from the centerline between the piston pin holes, can be caused by a bent connecting rod. Replace pistons that show signs of excessive wear, wavy ring lands or fractures or damage from detonation or pre-ignition.

Check the piston-to-cylinder bore clearance by measuring the piston and bore diameters. Refer to the specifications for the proper clearance. Refer to Cylinder Block Inspection for the bore measurement procedure. **Measure the OD of the piston with micrometers at the centerline of the piston pin bore and at 90 degrees to the pin bore axis.** Check the ring-side clearance following the procedure under Fitting Piston Rings.

Replace piston showing signs of fracture, etching or wear. Check the piston pin fit in the piston and rod. Refer to Piston and Connecting Rod Assembly in the pertinent engine Section.

Check the OD of the position pin and the ID of the pin bore in the piston. Replace any piston pin or piston that is not within specifications.

Replace all rings that are scored, broken, chipped or cracked. Check the end gap and side clearance. **Rings should not be transferred from one piston to another, regardless of mileage.**

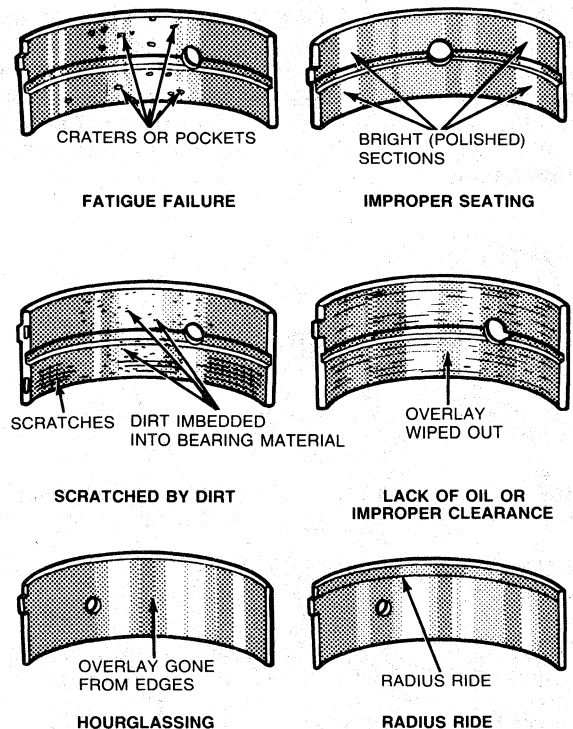
### Main and Connecting Rod Bearings

#### Cleaning

Clean the bearing inserts and caps thoroughly in solvent, and dry them with compressed air. **Do not scrape gum or varnish deposits from the bearing shells.**

#### Inspection

Inspect each bearing carefully. Bearings that have a scored, chipped or worn surface should be replaced. Typical examples of unsatisfactory bearings and their causes are shown in the illustration. The copper lead bearing base may be visible through the bearing overlay. If the base showing is less than 20 percent of the total area, the bearing is not excessively worn. It is not necessary to replace the bearing if the bearing clearance is within recommended limits. Check the clearance of bearings that appear to be satisfactory with Plastigage as outlined.



**CLEANING AND INSPECTION (Continued)****Crankshaft****Cleaning**

Handle the crankshaft with care to avoid possible fractures or damage to the finished surfaces. Clean the crankshaft with solvent, then blow out all oil passages with compressed air.

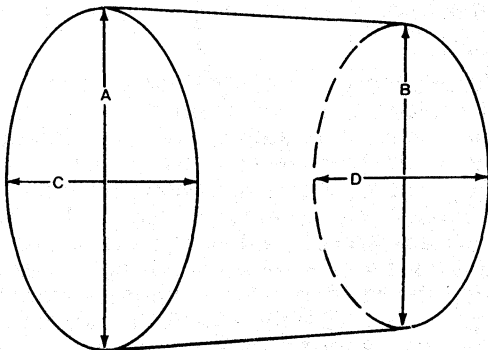
**Inspection**

Inspect the main and connecting rod journals for cracks, scratches, grooves or scores. Inspect the crankshaft oil seal surface for nicks, sharp edges or burrs that might damage the oil seal during installation or cause premature seal wear.

Measure the diameter of each journal in at least four places to determine an out-of-round, taper or undersize condition.

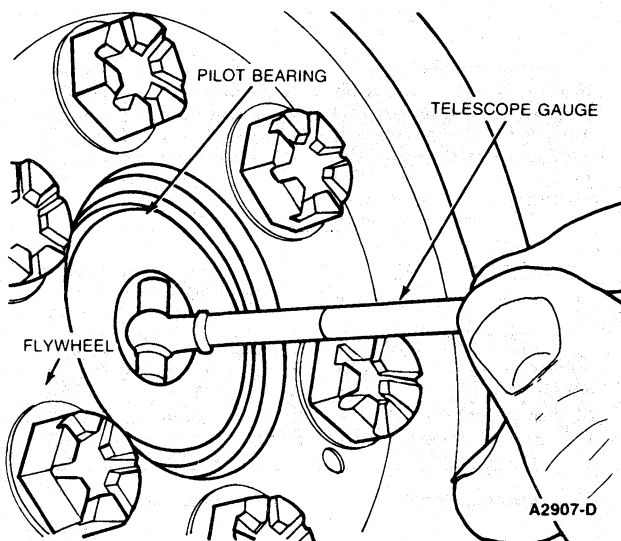
A VS B = VERTICAL TAPER  
C VS D = HORIZONTAL TAPER  
A VS C AND B VS D = OUT OF ROUND

CHECK FOR OUT-OF-ROUND AT EACH END OF JOURNAL



A7267-B

On engines with a manual transmission, check the fit of the clutch pilot bushing in the bore of the crankshaft. The bushing is pressed into the crankshaft and should not be loose. Inspect the inner surface of the bushing for wear or a bell-mounted condition. Check the ID of the bushing if it is worn or damaged, or the ID is not within specification.



A2907-D

Inspect the pilot bearing (roller bearing), if so equipped, for roughness, evidence of overheating or loss of lubricant. Replace it if any of these conditions are found.

**Crankshaft Vibration Damper and Sleeve****Cleaning**

Clean the oil seal contact surface on the crankshaft damper or sleeve with solvent to remove any corrosion, sludge or varnish deposits. Excess deposits that are not readily removed with solvent may be removed with crocus cloth. Use crocus cloth to remove any sharp edges or burrs which might damage the oil seal during installation or cause premature seal wear. **Do not use crocus cloth to the extent that the seal surface becomes polished. A finely polished surface may produce poor sealing or cause premature seal wear.**

**Inspection**

Inspect the crankshaft damper seal surface for nicks, sharp edges, or burrs that might damage the oil seal during installation or cause premature seal wear.

**Flywheel****Manual Transmission****Inspection**

Inspect the flywheel for cracks, heat check, or other damage that would make it unfit for further service. Machine the friction surface of the flywheel if it is scored or worn. If it is necessary to remove more than 1.14mm (0.045 inch) of stock from the original thickness, replace the flywheel.

Inspect the ring gear for worn, chipped, or cracked teeth. If the teeth are damaged, replace the ring gear.

With the flywheel installed on the crankshaft, check the flywheel face runout following the procedure under Diagnosis and Testing.

**Automatic Transmission****Inspection**

Inspect the flywheel for cracks or other indications that would make it unfit for further service. Inspect the flywheel ring gear for worn, chipped or cracked teeth. If the teeth are damaged, replace the ring gear and flywheel assembly.

With the flywheel installed on the crankshaft, check the gear face runout.

**CLEANING AND INSPECTION (Continued)****Cylinder Block****Cleaning**

After any cylinder bore service operation, such as honing or deglazing, clean the bore(s) with soap or detergent and water. Then, thoroughly rinse the bore(s) with clean water to remove the soap or detergent, and wipe the bore(s) dry with a clean, lint-free cloth. Finally wipe the bore(s) with a clean cloth dipped in engine oil. **If these procedures are not followed, rusting of the cylinder bore(s) may occur.**

If the engine is disassembled, thoroughly clean the block with solvent. Remove old gasket material from all machined surfaces. Remove all pipe plugs that seal oil passages, then clean out all the passages. Blow out all passages or bolt holes with compressed air. Make sure the threads in the cylinder head bolt holes are clean. Dirt in the threads may cause binding and result in a false torque reading. Use a tap to true-up threads and to remove all deposits. Thoroughly clean the grooves in the crankshaft bearings and bearing retainers.

**Inspection**

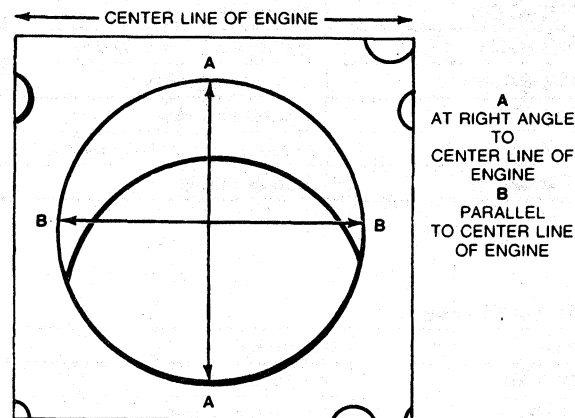
After the block has been thoroughly cleaned, check it for cracks. Tiny cracks not visible to the naked eye may be detected by coating the suspected area with a mixture of 25 percent kerosene and 75 percent light engine oil. Wipe the part dry and immediately apply a coating of zinc oxide dissolved in wood alcohol. If cracks are present, the coating will become discolored at the defective area. Replace the block if it is cracked.

Check all machined gasket surfaces for burrs, nicks, scratches and scores. Remove minor imperfections with an oil stone.

Replace all expansion-type plugs that show evidence of leakage.

Inspect the cylinder walls for scoring, roughness, or other signs of wear. Check the cylinder bore for out-

of-round and taper. Measure the bore with an accurate bore gauge following the instructions of the manufacturer. Measure the diameter of each cylinder bore at the top, middle and bottom with the gauge placed at right angles and parallel to the centerline of the engine. **Use only measurements obtained at 90 degrees to the engine centerline when calculating the piston-to-cylinder bore clearance.**



1. OUT-OF-ROUND = DIFFERENCE BETWEEN A AND B
2. TAPER = DIFFERENCE BETWEEN THE A MEASUREMENT AT TOP OF CYLINDER BORE AND THE A MEASUREMENT AT BOTTOM OF CYLINDER BORE.

A2905-B

Refinish cylinders that are deeply scored and/or when out-of-round and/or taper exceed the service limits. If the cylinder walls have minor surface imperfections, but the out-of-round and taper are within limits, it may be possible to remove the imperfections by honing the cylinder walls and installing new service piston rings providing the piston clearance is within specified limits.

**SPECIFICATIONS****TORQUE SPECIFICATIONS\***

Metric Thread Sizes (Property Class 9.8)	N·m	Lb·Ft	U.S. Thread Sizes — Grade 5	N·m	Lb·Ft
M-6	8-12	6-9	1/4-18	11-16	8-12
M-8	20-30	14-21	1/4-20	9-12	6-9
M-10	40-55	28-40	5/16-18	17-24	12-18
M-12	79-95	58-70	5/16-24	19-27	14-20
M-14	110-155	80-114	3/8-16	30-43	22-32
<b>Pipe Thread Sizes</b>			3/8-18	16-24	12-17
1/8	7-11	6-8	3/8-24	37-51	27-38
1/4	11-16	9-11	7/16-14	55-74	40-55
3/8	16-24	11-17	7/16-20	55-81	40-60
1/2	34-47	25-35	1/2-13	75-108	55-80

\*Refer to charts at end of each engine section for specific application.

CA5018-G

**SPECIAL SERVICE TOOLS**

Tool Number	Description	Tool Number	Description
D79P-100-A	Impact Slide Hammer	D81P-6002-E	Valve Seat Runout Gauge
T50T-100-A	Impact Slide Hammer	D79L-6250-C	Ratchet Adapter
T59L-100-B	Impact Slide Hammer	D79L-6250-D	Ratchet Adapter
T58L-101-A	Puller Attachment	TOOL-6500-E	Hydraulic Tappet Leakdown Tester
D78P-4201-B	Dial Indicator Mag. Base	TOOL-6505-E	Valve Stem Clearance Tool
TOOL-4201-C	Dial Indicator With Bracketry	TOOL-6513-DD	Valve Clutch Spring Tester
T70P-6000	Engine Lifting Brackets	TOOL-6565-AB	Cup-Shaped Adapter
D81L-6002-A	Oil Stone	T73L-6600-A	Pressure Gauge
D81L-6002-B	Plastigauge	D79P-6666-A	Spark Plug Boot Puller
D81L-6002-D	Piston Ring Groove Cleaner	D81P-6666-A	Spark Tester
T64L-6011-EA	Cylinder Ridge Reamer	T74P-6666-A	Spark Plug Wire Remover
T73L-6011-A	Cylinder Hone Set	T75L-6666-A	Plug Boot Installation Tool
D79L-6250-A	Heavy Duty Reversible Ratchet	T82L-6701-A	Rear Oil Seal Installer
D79L-6250-B	Ratchet Handle	T77L-9533-B1	Slide Hammer

CA5603-F

**ROTUNDA EQUIPMENT**

Model	Description
112-00001	Oil Leak Detector
059-00009	Compression Tester

CA8524-B

# SECTION 21-10 Engine, 2.5L

SUBJECT	PAGE	SUBJECT	PAGE
<b>ADJUSTMENTS</b>		<b>SERVICE PROCEDURES (Cont'd.)</b>	
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Collapsed Tappet Gap .....	21-10-3	Engine Mounts .....	21-10-10
Connecting Rod Side Clearance Check .....	21-10-2	Engine Oil Change (With Filter) .....	21-10-5
Crankshaft End Play Check .....	21-10-2	Engine Removed From Vehicle .....	21-10-15
<b>DESCRIPTION AND OPERATION</b> .....	21-10-1	Front Cover, Timing Chain and	
<b>DISASSEMBLY AND ASSEMBLY</b>		Sprockets .....	21-10-16
Cylinder Head .....	21-10-22	Hydraulic Tappets .....	21-10-9
Engine .....	21-10-19	Intake and Exhaust Manifolds .....	21-10-7
Engine .....	21-10-23	Main Bearings .....	21-10-9
Pistons and Connecting Rods .....	21-10-21	Oil Pan .....	21-10-5
Subassemblies .....	21-10-21	Oil Pump .....	21-10-5
<b>REMOVAL AND INSTALLATION</b>		Oil Seal, Front Cover .....	21-10-15
Engine Assembly .....	21-10-3	Oil Seal, Rear Crankshaft .....	21-10-15
<b>SERVICE PROCEDURES</b>		Rocker Arm Cover .....	21-10-6
Camshaft .....	21-10-17	Starter .....	21-10-5
Camshaft Bearings .....	21-10-18	Water Pump .....	21-10-6
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Crankshaft .....	21-10-18	<b>SPECIAL SERVICE TOOLS</b> .....	21-10-33
Cylinder Head .....	21-10-8	<b>SPECIFICATIONS</b> .....	21-10-31
Engine Damper .....	21-10-14	<b>VEHICLE APPLICATION</b> .....	21-10-1

## VEHICLE APPLICATION

Taurus/Sable.

## DESCRIPTION AND OPERATION

The Engine Calibration Label is located on the front of the engine.

**W5J306AA**

**CA9479-A**

Taurus/Sable vehicles are powered by the 2.5L High Swirl Combustion (HSC) engine. This engine is available in combination with a manual or automatic transaxle (MTX or ATX). This compact powerplant was designed to produce high torque in the lower rpm range.

The engine utilizes an overhead valve train with conventional hydraulic valve tappets. The compact combustion chamber in the cylinder head provides a minimum amount of surface area for a given chamber volume. Together with a flat-top piston, this chamber design results in a reduced flame front which shortens the period of combustion. A special masked intake port was designed to create a high swirling, turbulence effect as the air/fuel mixture is

drawn into the combustion chamber; thus, the term High Swirl Combustion (HSC). The central spark plug location in the combustion chamber provides shorter flame travel for faster combustion.

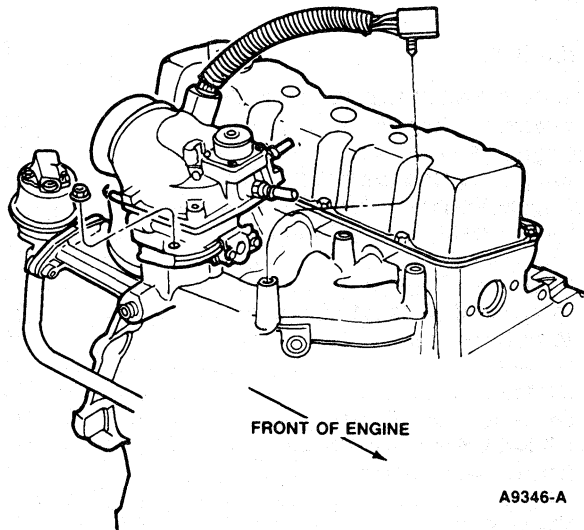
The camshaft is supported by four precision fit bearings which are align bored. To absorb camshaft thrust, a thrust plate is installed over the cam at the front end of the cylinder block, behind the camshaft sprocket hub.

The distributor is geared to the camshaft. An intermediate driveshaft, which connects the distributor to the oil pump (mounted on the underside of the engine block, in the oil pan), supplies turning torque to the oil pump.

The camshaft is driven by a silent design type timing chain which is connected from the camshaft sprocket to the crankshaft sprocket. Tension on the timing chain is maintained by a spring-loaded blade-type tensioner.

The crankshaft is supported in the cylinder block by five precision fit main bearings with the center upper bearing providing the crankshaft thrust surface. The pistons, attached to the crankshaft through connecting rods, are a flat-top design.

**NOTE:** This engine is primarily metric in its dimensions and in its fastening hardware.

**DESCRIPTION AND OPERATION (Continued)****Engine, 2.5L HSC—CFI****ADJUSTMENTS****Crankshaft End Play Check**

1. Force crankshaft toward rear of cylinder block.
2. Install Dial Indicator TOOL-4201-C or equivalent, so contact point rests against crankshaft end and indicator is parallel to crankshaft axis.
3. Zero dial indicator. Pry crankshaft forward and note reading on dial.
4. If end play exceeds specification, replace thrust bearing.  
If end play is less than specification, inspect thrust bearing surfaces for scratches, burrs, nicks or dirt.
5. Recheck end play.

**Connecting Rod Side Clearance Check**

1. Install Dial Indicator TOOL-4201-C or equivalent, so contact point rests against connecting rod cap.
2. Pull cap toward front of engine and zero dial indicator.
3. Push cap toward rear of engine and observe amount of side clearance on dial indicator.
4. If side clearance exceeds specification replace connecting rod and cap.  
If side clearance is less than specification, remove rod and cap and inspect for scratches, burrs, nicks or dirt between crankshaft and connecting rod.

**Camshaft End Play**

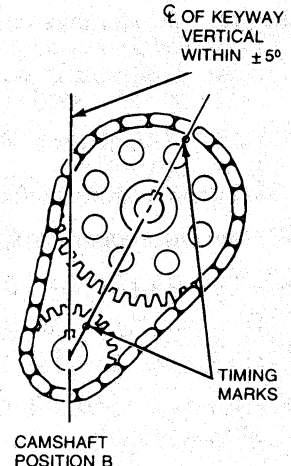
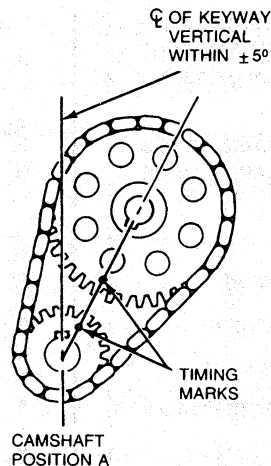
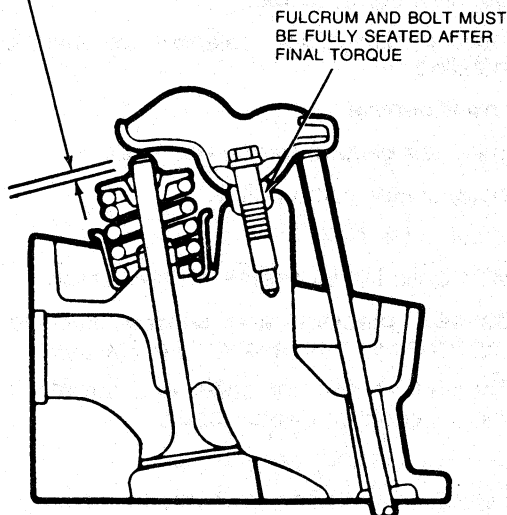
1. With engine mounted in a holding fixture, position Dial Indicator TOOL-4201-C or equivalent on end of camshaft (at sprocket).
2. Using a suitable pry bar, pry on one camshaft lobe with an upward motion. Note dial indicator reading after zeroing out.
3. Compare dial indicator reading with specification. If end play is excessive, replace thrust plate.

**CAUTION: Take care not to nick or scratch camshaft lobe machined surface.**

**ADJUSTMENTS (Continued)****Collapsed Tappet Gap**

1. Rotate camshaft to position A. Check intake and exhaust valves on compression stroke under camshaft position A. Tappet gap should be 1.80-4.34mm (0.072-0.174 inch).
2. Rotate camshaft 180 degrees to position B. Check remaining tappets.

1.80mm-4.34mm  
(0.174 INCH-0.072 INCH) WITH TAPPET FULLY COLLAPSED  
ON BASE CIRCLE AFTER ASSEMBLY.



CYL. NO.	CAMSHAFT POSITION	
	A	B
	TIGHTEN FULCRUM BOLTS AS NOTED	
1	INTAKE-EXHAUST	—
2	INTAKE	EXHAUST
3	EXHAUST	INTAKE
4	—	INTAKE-EXHAUST

A6975-B

**REMOVAL AND INSTALLATION****Engine Assembly****Removal**

1. Relieve fuel system pressure. First, disconnect electrical connector at inertia switch, and then crank engine for 15 seconds.
2. ATX only: Remove timing window cover at transmission and rotate engine until flywheel timing marker is aligned with timing pointer.
3. ATX only: Mark crankshaft pulley at 12 o'clock position (TDC). Rotate crankshaft pulley mark to 6 o'clock (BDC) position.
4. Disconnect battery ground cable.
5. Mark position of hood hinges and remove hood.
6. Remove air cleaner assembly.
7. Position drain pan under radiator and drain radiator. Close drain valve.
8. Disconnect upper radiator hose at engine.
9. Disconnect and mark, for ease of installation, wiring assembly and vacuum lines as necessary.
10. Disconnect crankcase ventilation hose at valve cover and intake manifold.
11. Disconnect fuel lines at throttle body.
12. Disconnect heater hoses at throttle body.
13. Disconnect ground wire at engine.
14. Disconnect accelerator cable and throttle valve control cable at throttle body.
15. Discharge air conditioning system, if so equipped. Remove pressure and suction lines from air conditioning compressor.
16. MTX only: Remove engine damper brace.
17. Remove drive belt.

**REMOVAL AND INSTALLATION (Continued)**

18. Remove water pump pulley.
19. Remove air cleaner-to-canister hose.
20. Raise vehicle on hoist.
21. Drain engine oil.
22. Remove engine oil filter.
23. Disconnect starter cable and remove starter motor.
24. ATX only: Remove converter nuts and position mark, made previously, on crankshaft pulley as close to 6 o'clock position (BDC) as possible with converter stud visible.  
  
NOTE: The flywheel timing marker must be in a 6 o'clock (BDC) position for proper engine removal and installation.
25. Remove engine insulator nuts.
26. Disconnect exhaust pipe from manifold.
27. Disconnect canister bracket from engine.
28. Disconnect halfshaft bracket from engine.
29. Remove lower engine-to-transmission attaching bolts.
30. Disconnect lower radiator hose at tube.
31. Lower hoist and vehicle.
32. Position floor jack under transmission.
33. Disconnect power steering lines at pump.
34. Install lifting eyes and engine support tool.
35. Attach lifting equipment to support engine and remove upper engine-to-transmission attaching bolts.
36. Remove engine from vehicle.
37. Mount on stand and remove lifting equipment.

**Installation**

1. Install lifting eyes and engine support tool, and attaching lifting equipment.  
  
NOTE: The flywheel timing marker must be in a 6 o'clock (BDC) position for proper engine removal and installation (ATX only).
2. Remove engine from stand and position in vehicle.
3. Remove lifting equipment and lifting eyes.
4. Install upper engine-to-transmission bolts. Tighten to specification. Use floor jack under transmission to aid alignment.
5. Connect power steering lines to pump.
6. Raise vehicle.
7. Connect lower radiator hose to tube.
8. Install lower engine-to-transmission attaching bolts. Tighten to specification.

9. Connect halfshaft bracket to engine.
10. Connect canister bracket to engine.
11. Connect exhaust pipe to manifold.
12. Install engine insulator nuts. Tighten to specification.
13. ATX only: Position mark on crankshaft pulley as close to 6 o'clock position (BDC) as possible, and install converter nuts. Tighten to specification.
14. Position starter motor and install attaching bolts. Tighten to specification.
15. Connect starter cable.
16. Install oil filter. Check to ensure oil drainplug is installed.
17. Lower vehicle.
18. Install air cleaner-to-canister hose.
19. Install water pump pulley.
20. Install drive belt.
21. MTX only: Install engine damper brace.
22. Connect pressure and suction lines to air conditioning compressor, if so equipped.
23. Connect accelerator cable and throttle valve control cable at throttle body.
24. Connect ground wire at engine.
25. Connect heater hoses at throttle body.
26. Connect fuel lines at throttle body.
27. Connect crankcase ventilation hose at valve cover and intake manifold.
28. Connect engine control sensor wiring assembly and vacuum lines.
29. Connect upper radiator hose at engine.
30. Install air cleaner assembly.
31. Connect battery ground cable.
32. ATX only: Rotate engine until flywheel timing marker is aligned with timing pointer.
33. Install timing window cover at transmission.
34. Connect electrical connector at inertia switch.
35. Fill cooling system.
36. Fill with proper motor oil to required level.
37. Install hood.
38. Charge air conditioning system, if so equipped.
39. Check all fluid levels (power steering, ATX, MTX).
40. Start vehicle. Check for leaks.



## SERVICE PROCEDURES

### Engine In Vehicle

NOTE: These Removal and Installation procedures can be performed with the engine in vehicle.

### Engine Oil Change (With Filter)

1. Apply parking brake and block wheels. Bring engine to normal operating temperature, and turn off.
2. Remove oil drainplug and inspect gasket. Replace gasket if damaged. Install oil drain plug, and tighten to specification.
3. Remove oil filter and discard. Clean gasket sealing surface at cylinder block or adapter. Coat gasket on filter with a light film of oil. Screw filter onto adapter or cylinder block until gasket contacts sealing surface. Then advance it an additional one-half turn.
4. Remove oil filler cap, and fill crankcase with specified amount, type and grade of oil.

Install oil filler cap. Start engine and inspect for leaks. Correct as required.

### Oil Pump

#### Removal

1. Remove oil pan as outlined.
2. Remove oil pump attaching bolts and remove oil pump and intermediate driveshaft.

#### Installation

1. Prime oil pump by filling inlet port with engine oil. Rotate pump shaft until oil flows from outlet port.
2. If screen and cover assembly has been removed, replace gasket. Clean screen and install screen and cover assembly. Tighten two attaching bolts and one nut to specification.
3. Position intermediate driveshaft into distributor socket.
4. Insert intermediate driveshaft into oil pump. Install pump and shaft as an assembly.

**CAUTION: Do not attempt to force pump into position if it will not seat. The shaft hex may be misaligned with distributor shaft. To align, remove oil pump and rotate intermediate driveshaft into a new position.**

5. Tighten two attaching bolts to specification.
6. Install oil pan and all related parts. Refer to Oil Pan Installation.
7. Fill crankcase to proper level with recommended engine oil. Start engine and check for oil pressure.

Operate engine at fast idle and check for oil leaks.

### Oil Pan

#### Removal

1. Disconnect battery ground cable.
2. Raise vehicle.
3. Drain crankcase.
4. Drain coolant by removing lower radiator hose.
5. Remove roll restrictor (MTX only).
6. Disconnect starter cable.
7. Remove starter.
8. Disconnect exhaust pipe from oil pan.
9. Remove engine coolant tube located at lower radiator hose, at water pump and at tabs on oil pan. Position air conditioner line off to side. Remove oil pan.

#### Installation

1. Clean both mating surfaces of oil pan and cylinder block with Dupont Freon TF or equivalent.
2. Remove and clean oil pump pickup tube and screen assembly. After cleaning, install tube and screen assembly.
3. Insert oil pan gasket into groove in oil pan. Position oil on engine block and install oil pan bolts.
4. Install two oil pan-to-transaxle bolts. Tighten to 40-50 N·m (30-39 lb-ft) to align oil pan with transaxle. Loosen bolts one-half turn.
5. Tighten all oil pan flange bolts to 8-12 N·m (6-9 lb-ft).
6. Tighten two oil pan-to-transaxle bolts to 40-54 N·m (30-39 lb-ft).
7. Install exhaust pipe bracket to oil pan.
8. Install engine coolant tube and air conditioning line.
9. Install starter and cable.
10. Install roll restrictor (MTX only).
11. Lower vehicle.
12. Install engine oil and coolant.
13. Connect battery ground cable.
14. Start engine and check for leaks.

### Starter

#### Removal

1. Disconnect battery ground cable.
2. Raise vehicle.
3. Remove starter cable.
4. Remove roll restrictor (MTX only).
5. Remove three starter attaching nuts and remove starter.

**SERVICE PROCEDURES (Continued)****Installation**

1. Install starter.
2. Install three starter attaching nuts.
3. Install roll restrictor (MTX only).
4. Install starter cable.
5. Lower vehicle.
6. Connect battery ground cable.

**Water Pump Inlet Tube Assembly****Removal**

1. Open and secure hood.
2. Install protective fender covers.
3. Disconnect battery ground cable.
4. Remove radiator cap.
5. Raise vehicle.
6. Position drain pan below radiator under lower radiator hose.
7. Remove one water pump inlet tube screw and washer from bracket located below water pump. Remove two screws securing inlet tube to oil pan.
8. Loosen clamp, disconnect lower radiator hose from radiator, and drain engine coolant.

**Installation**

1. Clean surfaces of inlet tube and water pump where new O-ring gasket is to be installed.  
Carefully position inlet tube with new O-ring gasket to water pump, and secure bracket below water pump.
2. Install lower radiator hose to radiator.
3. Install two screws attaching inlet tube to oil pan. Tighten both screws to 8-11 N·m (6-8 lb-ft).
4. Install heater return hose to water pump inlet tube.
5. Lower vehicle.
6. Connect battery ground cable.
7. Replace engine coolant. Operate engine until normal operating temperature is reached. Check for leaks and check coolant level.

**Water Pump****Removal**

1. Drain engine coolant.
2. Disconnect battery ground cable.

3. Loosen water pump idler pulley and remove belt from water pump pulley.
4. Remove water pump inlet tube as outlined.
5. Remove three water pump retaining bolts.

**Installation**

1. Clean both gasket mating surfaces on water pump and cylinder block.
2. Coat new gasket on both sides with Perfect Seal Sealing Compound B5A-19554-A (ESR-M18P2-A and ESE-M4G115-A) or equivalent and position on cylinder block.
3. Install three water pump retaining bolts and tighten to specification.
4. Connect water pump inlet tube on water pump as outlined.
5. Install water pump belt on pulley and adjust tension to specification.
6. Connect battery ground cable.
7. Replace engine coolant. Operate engine until normal operating temperature is reached. Check for leaks and recheck coolant level.

**Rocker Arm Cover****Removal**

1. Open and secure hood.
2. Position protective fender aprons.
3. Remove oil fill cap, rocker arm filter and set aside.
4. Disconnect PCV hose and set aside.
5. Disconnect throttle linkage cable from top of rocker arm cover.
6. Disconnect speed control cable from top of rocker arm cover, if so equipped.
7. Remove nine rocker arm cover bolts.
8. Clean both cylinder head and rocker arm cover mating surfaces.

**Installation**

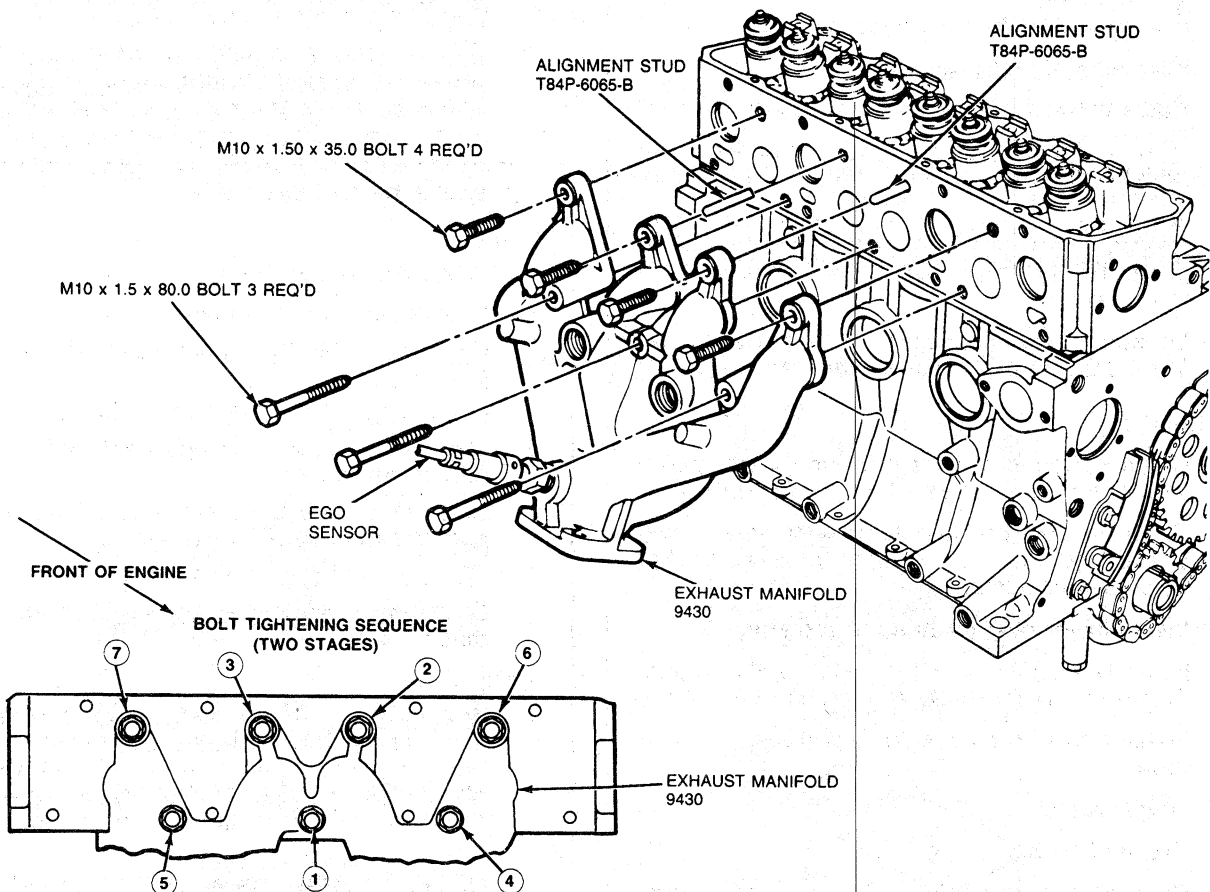
1. Coat gasket contact surfaces of rocker arm cover and UP side of gasket with Gasket and Seal Contact Adhesive D7AZ-19B508-A (ESR-M11P17-A and ESE-M2G52-A) or equivalent. Allow to dry and install gasket in rocker arm cover.  
NOTE: If rubber gasket is used do not apply sealer.
2. Install nine rocker arm cover bolts. Tighten to specification.
3. Connect speed control cable, if so equipped.
4. Connect throttle linkage cable.
5. Connect PCV hose into rocker arm cover.
6. Install oil fill cap and rocker arm filter.
7. Remove aprons.
8. Start engine and run at fast idle. Check for oil leaks.

**SERVICE PROCEDURES (Continued)****Intake and Exhaust Manifolds****Removal**

1. Open and secure hood.
2. Disconnect battery ground cable.
3. Drain cooling system.
4. Remove accelerator cable.
5. Remove air cleaner assembly and heat stove tube at heat shield.
6. Remove required vacuum lines.
7. Disconnect three exhaust pipe-to-exhaust manifold retaining nuts.
8. Disconnect EGO sensor wire at connector.
9. Disconnect Thermactor check valve hose at tube assembly. Remove bracket-to-EGR valve attaching nuts.
10. Disconnect water inlet tube at intake manifold.
11. Disconnect EGR tube at EGR valve.
12. Remove intake manifold.
13. Remove exhaust manifold.

**Installation**

1. Position exhaust manifold to cylinder head using Exhaust Manifold Alignment Studs T84P-6065-B or equivalent in holes 2 and 3.
2. Install attaching bolts in remaining holes.
3. Run down attaching bolts until snug, then remove guide studs. Install attaching bolts in holes 2 and 3.



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4. Tighten all exhaust manifold bolts to specification using standard tightening sequence.
5. Install intake manifold gasket and bolts and tighten to specification.
6. Connect water inlet tube at intake manifold.
7. Connect EGO sensor wire at connector.
8. Connect EGR tube to EGR valve.
9. Install exhaust manifold studs.
10. Connect exhaust pipe to exhaust manifold.
11. Install vacuum lines.
12. Install air cleaner assembly and heat shroud assembly.
13. Install accelerator cable.
14. Connect battery ground cable.
15. Fill cooling system.
16. Start engine and check for leaks.

## SERVICE PROCEDURES (Continued)

## Cylinder Head

## Removal

1. Disconnect battery ground cable.
2. Drain cooling system at lower radiator hose.
3. Disconnect heater hose at fitting located under intake manifold.
4. Disconnect upper radiator hose at cylinder head.
5. Disconnect electric cooling fan switch at plastic connector.
6. Remove air cleaner assembly.
7. Disconnect required vacuum hoses.
8. Remove rocker arm cover.
9. Disconnect all accessory drive belts.
10. Remove distributor cap and spark plug wires as an assembly.
11. Disconnect EGR tube at EGR valve.
12. Disconnect choke cap wire.
13. Disconnect fuel supply and return lines at rubber connector.
14. Disconnect accelerator cable and speed control cable, if so equipped.
15. Disconnect exhaust system at exhaust pipe, and hose at tube. Lower vehicle.

16. Remove cylinder head bolts.
17. Remove cylinder head and gasket with exhaust and intake manifolds attached.

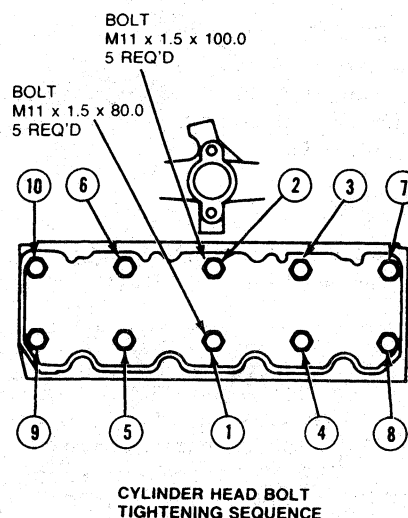
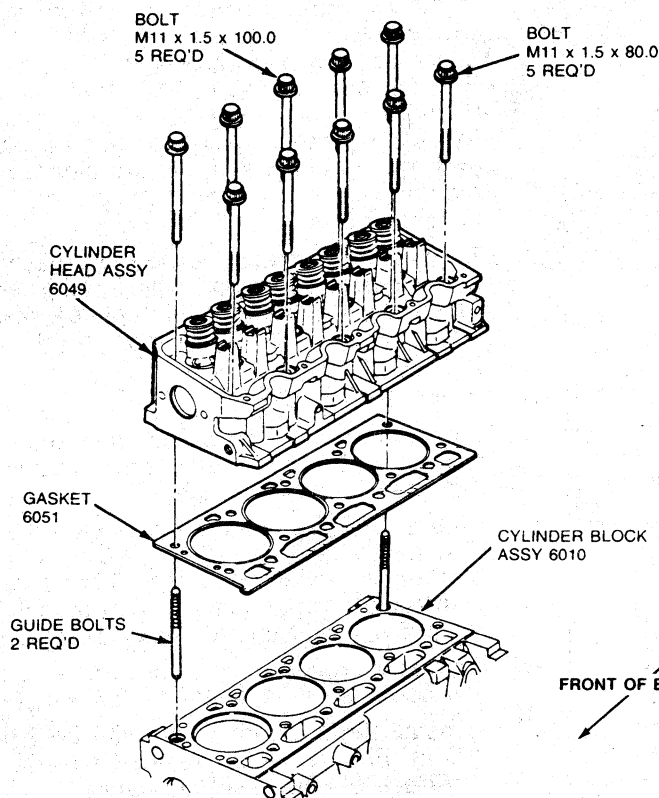
**CAUTION: Do not lay cylinder head flat. Damage to spark plugs or gasket surfaces may result.**

## Installation

1. Clean all gasket material from mating surfaces on cylinder head and block.
2. Position cylinder head gasket on cylinder block using sealer to retain gasket.

**NOTE:** Before installing cylinder head, thread two Cylinder Head Alignment Studs T84P-6065-A or equivalent through head bolt holes in gasket and into block at opposite corners of block.

3. Install cylinder head over Cylinder Head Alignment Studs T84P-6065-A or equivalent onto cylinder block. Start and run down several head bolts until snug. Remove guide studs and install cylinder head bolts. Tighten all bolts in sequence to specification.



FRONT OF ENGINE

A7647-C

**SERVICE PROCEDURES (Continued)**

4. Raise vehicle.
5. Connect exhaust system at exhaust pipe and hose to metal tube.
6. Lower vehicle.
7. Install Thermactor pump drive belt.
8. Connect accelerator cable and speed control cable, if so equipped.
9. Connect fuel supply and return lines.
10. Connect choke cap wire.
11. Connect EGR tube at EGR valve.
12. Install distributor cap and spark plug wires as an assembly.
13. Connect accessory drive belts.
14. Install rocker arm cover.
15. Connect required vacuum hoses.
16. Install air cleaner assembly.
17. Connect electric cooling fan switch at connector.
18. Connect upper radiator hose.
19. Connect heater hose at intake manifold.
20. Fill cooling system.
21. Connect battery ground cable.
22. Start engine. Check for vacuum, coolant and oil leaks.
23. After engine has reached operating temperature, check and, if necessary, add coolant.

**Hydraulic Tappets**

Before replacing a hydraulic tappet for noisy operation, ensure the noise is not caused by improper collapsed tappet gap, worn rocker arms, push rods, or valve tips.

**Removal**

1. Remove cylinder head and related parts.
2. Using a magnet, remove tappets. Place tappets in a rack so they can be installed in original positions.

If tappets are stuck in their bores by excessive varnish or gum, it may be necessary to use Hydraulic Tappet Puller T70L-6500-A or equivalent to remove tappets. Rotate tappet back and forth to loosen any gum and varnish which may have formed. **Keep assemblies intact until they are to be cleaned.**

If tappets are to be tested or disassembled and cleaned, follow procedures in Section 21-01. If a hydraulic tappet has been disassembled and cleaned, **fill it with test fluid before installing it in engine.** New tappets already contain test fluid.

**Installation**

1. Install new (or cleaned) hydraulic tappets through push rod openings with a magnet.
2. Install cylinder head and related parts.

**Main Bearings****Removal**

NOTE: Do not file or lap bearing caps or use bearing shims to obtain the proper bearing clearance. Main bearings are available for service in standard sizes of 0.25, 0.51, 0.76, and 1.02mm (.010, .020, .030, and .040 inch) undersize. Undersize bearings, which are not selective fit, are available for use on journals that have been refinished.

1. Drain crankcase. Remove oil level dipstick. Remove oil pan as outlined.
2. Remove oil pump, screen and cover.
3. Remove main bearing cap to which new bearings are to be replaced.

NOTE: Only remove one bearing at a time, leaving other bearings securely fastened.

4. Remove upper main bearing.

**Installation**

1. Clean crankshaft journals. Inspect journals and thrust faces (thrust bearing) for nicks, burrs, or bearing pickup that would cause premature bearing wear. Replace crankcase, or grind journals to next undersize, if required.

NOTE: When replacing standard bearings with new bearings, fit bearings as close as possible to minimum specified clearance. To determine which size bearing to use, refer to Section 21-01 for fitting main or connecting rod bearings with Plastigage. If desired clearance cannot be obtained with a standard bearing, try one-half of a 0.05mm (0.002 inch) undersize bearing in combination with a standard bearing to obtain proper clearance. Ensure bearings and bore in block and cap are clean. Foreign material under a bearing insert can cause bearing failure.

2. To install upper main bearing, place plain end of bearing over crankshaft with locking tang up. Partially install bearing and rotate crankshaft in opposite direction of engine rotation until bearing seats in block.
3. Install bearing cap.
4. Select fit bearings for proper clearance. Refer to Section 21-01 for fitting main or connecting rod bearings with Plastigage.
5. After bearing has been fitted, apply a light coat of heavy engine oil, SAE 50 weight to journal and bearings, then install cap. Tighten cap bolts to specification. Repeat previous procedure for remaining bearings that require replacement.
6. If thrust bearing cap (No. 3 upper main bearing) has been removed, install as follows:
  - Install thrust bearing cap with bolts finger-tight. Pry crankshaft forward against thrust surface of upper half of bearing.
  - Hold crankcase forward and pry thrust bearing cap to rear. Retain forward pressure on crankshaft and tighten cap bolts to specification.

**SERVICE PROCEDURES (Continued)**

7. Clean oil pump inlet tube screen. Prime oil pump by filling inlet opening with oil and rotating pump shaft until oil emerges from outlet opening. Install oil pump, screen, and cover assembly and tighten to specification.
8. Clean gasket surfaces and seal grooves of engine block and oil pan. Install oil pan. Refer to Oil Pan Installation.
9. Install oil level dipstick. Fill crankcase to proper level with recommended oil. Start engine and check oil pressure and check for possible leaks.

**Connecting Rod Bearings****Removal**

1. Drain crankcase. Remove oil level dipstick. Remove oil pan and related parts as outlined.
2. Remove oil pump and oil pump inlet tube.
3. Turn crankshaft until connecting rod on which new bearings are to be fitted is down. Remove connecting rod cap. Remove bearing inserts from rod and cap.

**Installation**

1. Ensure bearing inserts and bearing bore in connecting rod and cap are clean. Inspect journals for nicks, burrs, or bearing pickup that would cause premature wear. Replace crankshaft or grind journals to next undersize, if required. Foreign material under inserts will distort bearing and cause a failure.

NOTE: When replacing standard bearings with new bearings, fit bearing as close as possible to minimum specified clearance. If desired clearance cannot be obtained with a standard bearing, try any combination of a 0.025mm or 0.05mm (0.001 or 0.002 inch) undersize in combination with a standard bearing to obtain proper clearance.

2. Install bearing inserts in connecting rod and cap with tangs fitted in notches provided. The oil squirt hole in bearing insert must be aligned with squirt hole in connecting rod.
3. Pull connecting rod assembly down firmly onto crankshaft journal. Use care so as not to nick crankshaft journal.
4. Select fit bearings for proper clearance following procedures under Fitting Main and Connecting Rod Bearings in Section 21-01.
5. After bearing has been fitted, clean and apply light coat of heavy engine oil, SAE 50 weight to journal and bearings. Install connecting rod cap. Ensure connecting rod bolt heads are properly seated in connecting rod. Tighten connecting rod nuts to specification.
6. Repeat previous procedure for remaining connecting rods that require new bearings.
7. Install oil pump inlet tube, oil pump, oil pan and oil level dipstick.
8. Fill crankcase to proper level with recommended oil. Start engine. Check oil pressure and check for possible leaks.

**Engine Mounts****Insulator, LH and Support Assembly****ATX****Removal**

1. Raise vehicle on hoist.
2. Remove tire and wheel.
3. Place a jack and wood block in a suitable place under transmission and support transmission.
4. Remove two nuts attaching insulator to support assembly.
5. Remove two through bolts attaching insulator to frame.
6. Raise transmission with jack, enough to unload insulator.
7. Remove bolts attaching support assembly to transmission.
8. Remove insulator and/or transmission support assembly.

**Installation**

1. Loosely install insulator to support assembly and frame.
2. Attach support assembly to transmission. Tighten front and rear bolts to 54-75 N·m (40-55 lb-ft).
3. Attach insulator to frame with two bolts. Tighten bolts to 95-130 N·m (70-96 lb-ft).
4. Lower transmission down enough to load insulator.
5. Attach insulator to support assembly with two nuts. Tighten nuts to 95-130 N·m (70-96 lb-ft).
6. Remove jack.
7. Install tire and wheel.
8. Lower vehicle.

**MTX****Removal**

1. Raise vehicle on hoist.
2. Remove tire and wheel.
3. Place a jack and wood block in a suitable place under transmission and support transmission.
4. Remove two bolts attaching insulator to frame.
5. Raise transmission with jack, enough to unload insulator.
6. Remove bolts attaching insulator to transmission.

**Installation**

1. Attach insulator to transmission with two bolts. Tighten bolts to 95-130 N·m (70-96 lb-ft).
2. Lower transmission down enough to load insulator.
3. Attach insulator to frame with two bolts. Tighten bolts to 95-130 N·m (70-96 lb-ft).
4. Remove jack.
5. Install tire and wheel.
6. Lower vehicle.

**SERVICE PROCEDURES (Continued)****Insulator, RH Front No. 2****Removal**

1. Remove lower damper nut from RH side of engine (MTX only).
2. Raise vehicle on hoist.
3. Place a jack and wood block in a suitable place under engine block.
4. Remove nut attaching RH and front and rear insulators to frame.
5. Raise engine with jack enough to unload insulator.
6. Remove two bolts and remove insulator from engine A/C bracket.

**Installation**

1. Attach insulator to engine A/C bracket with two bolts. Tighten bolts to 54-75 N·m (40-55 lb-ft).
2. Lower engine down onto frame.
3. Install nut attaching RH front and RH rear insulators to frame. Tighten nuts to 75-102 N·m (55-75 lb-ft).
4. Remove jack and lower vehicle.
5. Install nut attaching engine damper to engine (MTX only). Tighten nut to 11-16 N·m (8-12 lb-ft).

**Insulator, RH Rear No. 3****Removal**

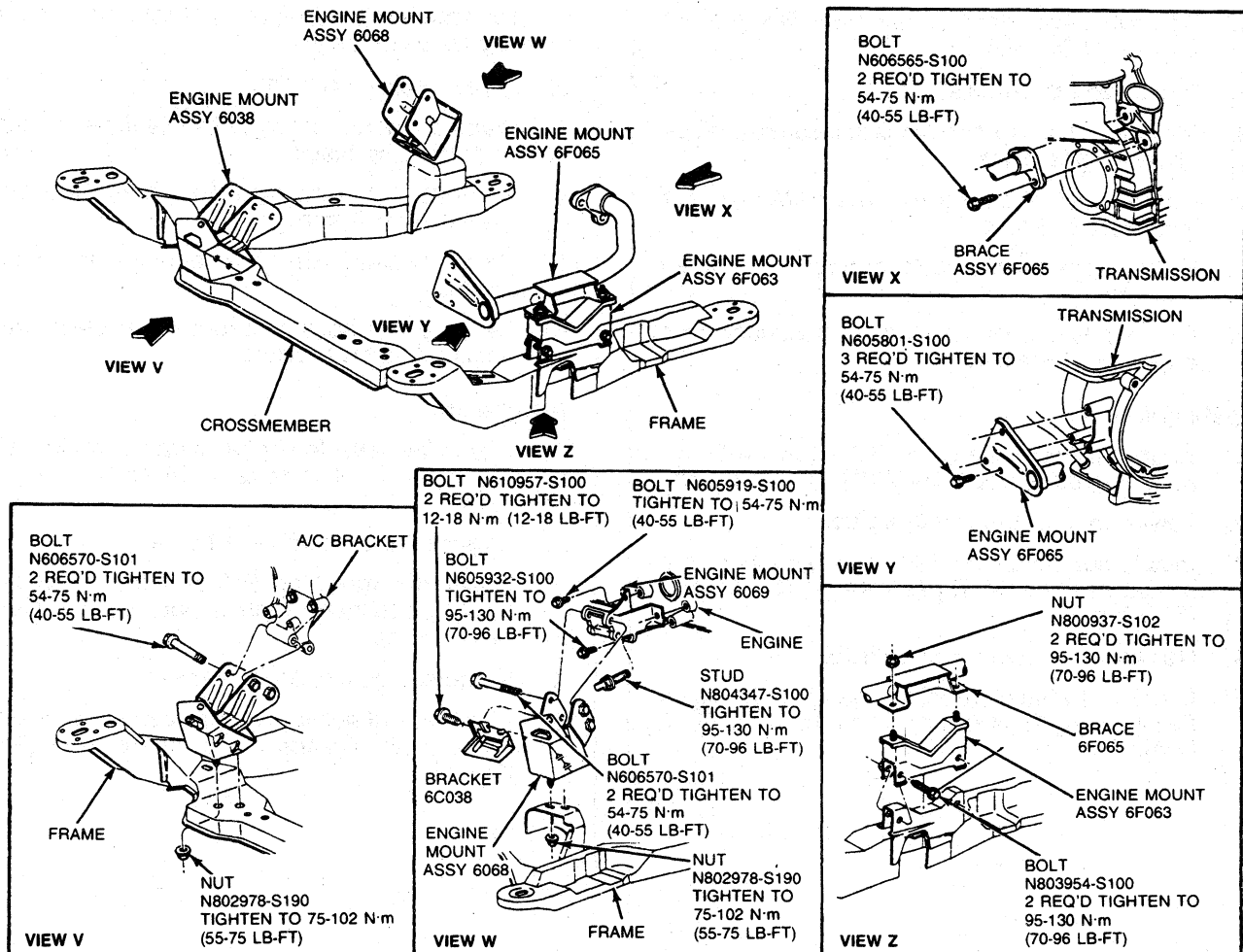
1. Remove lower damper nut from RH side of engine (MTX only).
2. Raise vehicle on hoist.
3. Place a jack and wood block in a suitable place under engine block.
4. Remove nut attaching RH front and rear insulators to frame.
5. Raise engine with jack enough to unload insulator.
6. Remove two bolts and remove insulator from engine support bracket.

**Installation**

1. Attach insulator to engine support bracket with two bolts. Tighten bolts to 54-75 N·m (40-55 lb-ft).
2. Lower engine down onto frame.
3. Install nut attaching RH and front and rear insulators to frame. Tighten nuts to 75-102 N·m (55-75 lb-ft).
4. Remove jack and lower vehicle.
5. Install nut attaching engine damper to engine (MTX only). Tighten nut to 11-16 N·m (8-12 lb-ft).

## SERVICE PROCEDURES (Continued)

## ATX (CLC)

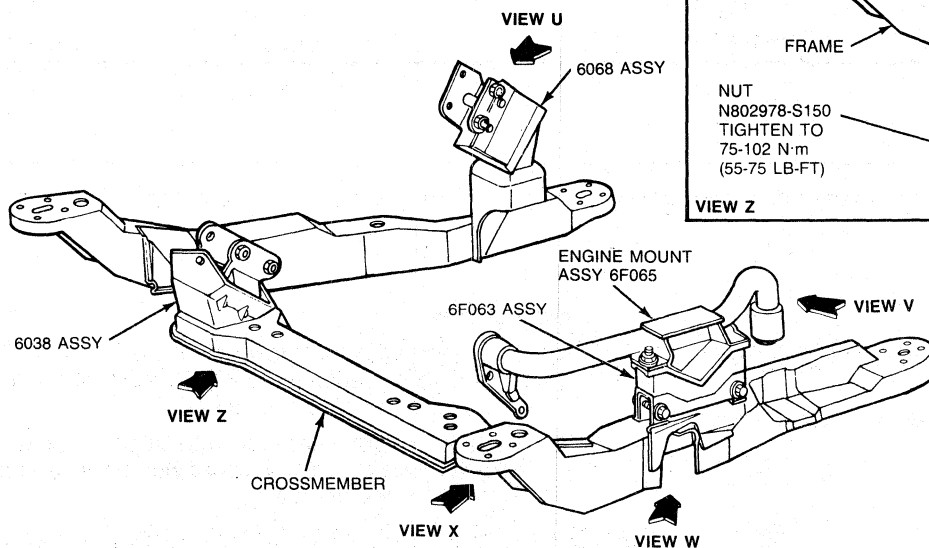
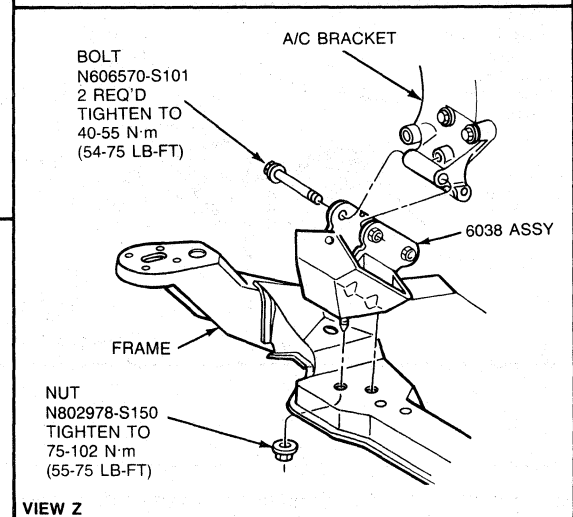
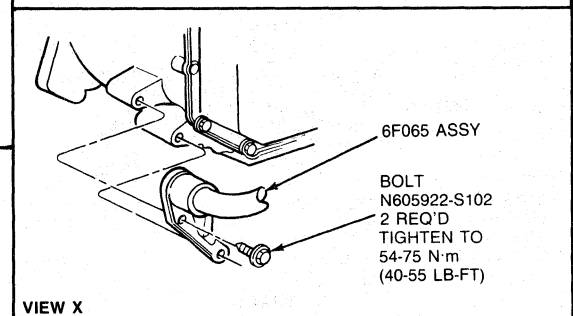
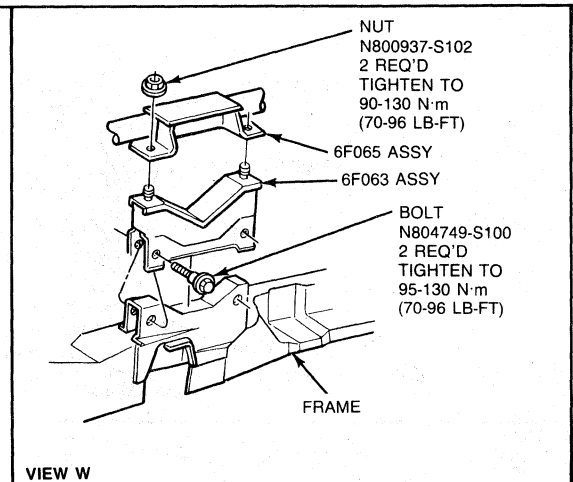
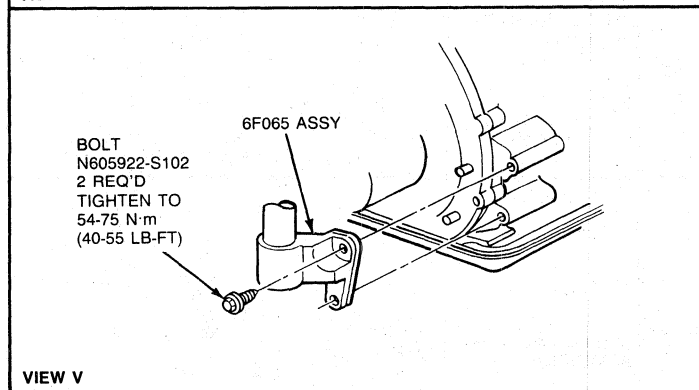
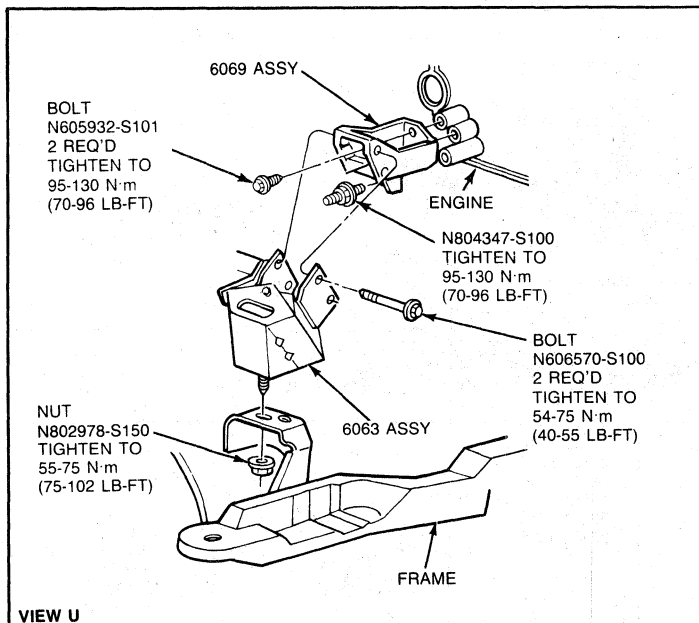


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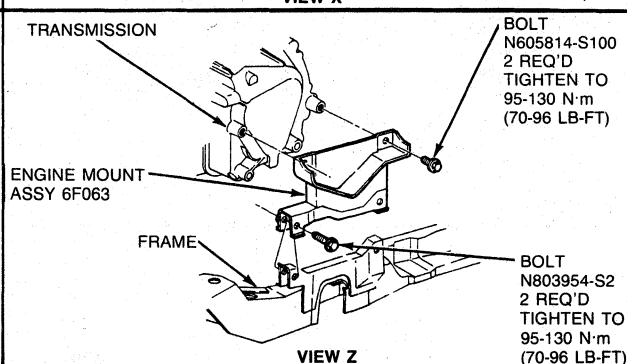
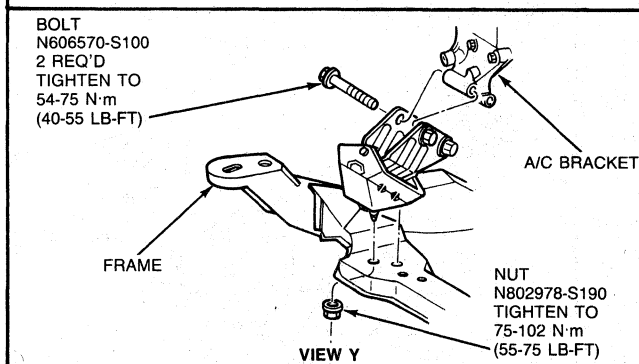
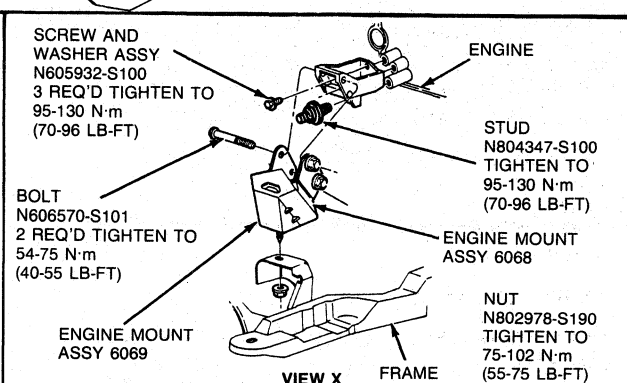
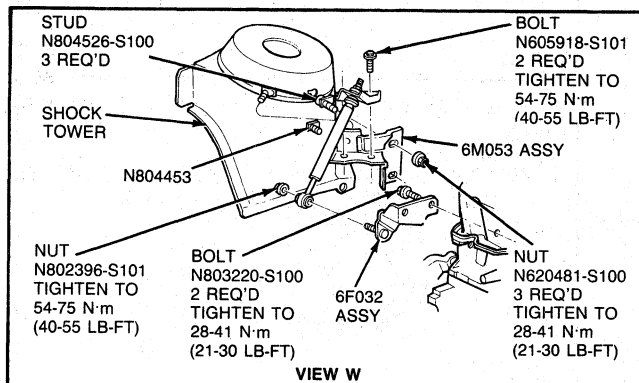
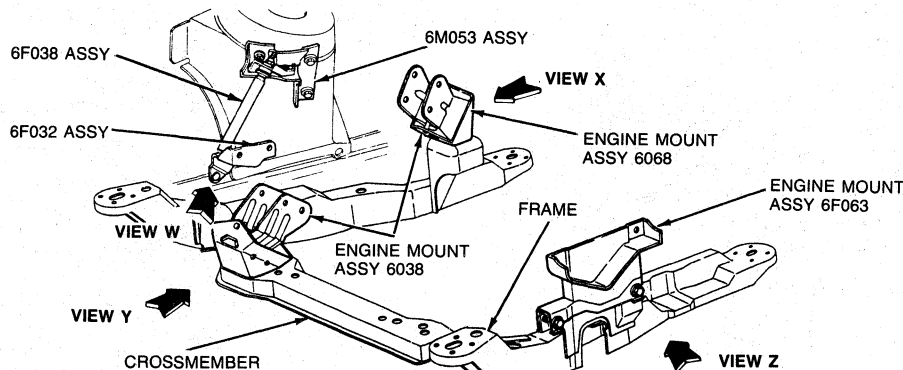
## SERVICE PROCEDURES (Continued)

## AXOD



## SERVICE PROCEDURES (Continued)

## MTX



A8823-B

## Engine Damper

## MTX

## Removal

1. Remove bolt attaching lower end of damper to engine block bracket.
2. Remove bolts attaching upper damper bracket to shock tower bracket.
3. Remove engine damper.

## Installation

1. Position engine damper lower sleeve to line up with engine bracket notch. Secure with a new nut and tighten to specification.
2. Position engine damper with upper bracket to shock tower bracket. Secure with new bolts and tighten to specification.

**SERVICE PROCEDURES (Continued)****Oil Seal, Rear Crankshaft****Removal**

1. Remove transaxle.
2. Remove flywheel.
3. Remove rear cover plate.
4. With a sharp awl, punch a hole into seal metal surface between lip and retainer. Screw in threaded end of Slide Hammer T77L-9533-B or equivalent. Remove seal.

NOTE: Use caution to avoid damaging oil seal surface.

**Installation**

NOTE: Inspect crankshaft flange seal area for any damage which may cause seal to leak. If damage is evident, service crankshaft flange or replace crankshaft as necessary.

1. Coat crankshaft seal area and seal lip with engine oil.
2. Using Seal Installer T81P-6701-A or equivalent, install rear seal.
3. Install rear cover plate and two dowels.
4. Install flywheel. Tighten attaching bolts to specification.
5. Install transaxle.

**Engine Removed From Vehicle**

NOTE: These Removal and Installation procedures can only be performed with the engine removed from the vehicle.

**Oil Seal, Front Cover****Removal**

1. Remove bolt and washer at crankshaft pulley.
2. Using Differential Side Gear Puller T77F-4220-B1 or equivalent, remove front cover oil seal.

**Installation**

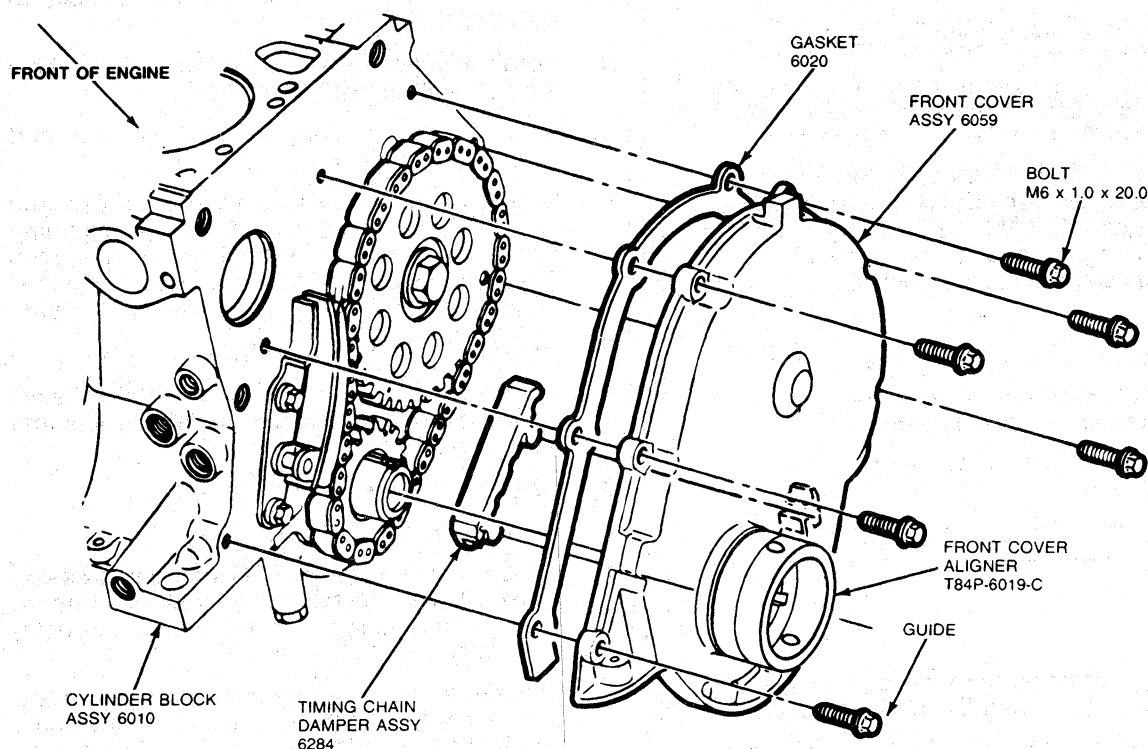
1. Coat a new seal with Multi-Purpose Long-Life Lubricant C1AZ-19859-B (ESA-M1C75-B) or equivalent. Using Pinion Oil Seal Installer T83T-4676-A or equivalent, install seal into cover. Drive seal in until it is fully seated. Check seal after installation to ensure spring is properly positioned in seal.
2. Install crankshaft pulley, attaching bolt and washer. Tighten to specification.

## SERVICE PROCEDURES (Continued)

## Front Cover, Timing Chain and Sprockets

## Removal

1. With engine and transaxle removed from vehicle as an assembly, remove dipstick.
2. Remove accessory drive pulley, if so equipped. Remove crankshaft pulley attaching bolt and washer and remove pulley.
3. Using Front Cover Seal Remover T74P-6700-A or equivalent, remove front cover oil seal.  
NOTE: The front cover oil seal must be removed when front cover is disassembled from engine in order to use Front Cover Aligner T84P-6019-C or equivalent, for proper installation of front cover.
4. Remove front cover attaching bolts from front cover. Pry top of front cover away from block.
5. Clean any gasket material from surfaces.
6. Check timing chain deflection. If deflection exceeds specification, replace timing chain and sprockets. Refer to Section 21-01.
7. Check timing chain tensioner blade for wear depth. If wear depth exceeds specification, replace tensioner.
8. Turn engine over until timing marks are aligned. Remove camshaft sprocket attaching bolt and washer. Slide both sprockets and timing chain forward and remove as an assembly.
9. Check timing chain vibration damper for excessive wear. Replace if necessary. (The damper is located inside front cover.)
10. Remove oil pan.



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**SERVICE PROCEDURES (Continued)****Installation**

1. Clean and inspect all parts before installation. Clean oil pan, cylinder block and front cover of gasket material and dirt.
2. Slide both sprockets and timing chain onto camshaft and crankshaft with timing marks aligned. Install camshaft bolt and washer and tighten to specification. Oil timing chain, sprockets, and tensioner after installation.
3. Apply oil resistant Perfect Seal Sealing Compound B5A-19554-A (ESR-M18P2-A and ESE-M4G115-A) or equivalent to a new front cover gasket and position gasket onto front cover.
4. With front cover oil seal removed, position front cover on engine.
5. Position Front Cover Aligner T84P-6019-C or equivalent onto end of crankshaft, ensuring crank key is aligned with keyway in tool.
6. Bolt front cover to engine and tighten to specification. Remove Front Cover Aligner.
7. If front cover seal is damaged or worn, replace seal with a new one. Install seal using Pinion Oil Seal Installer T83T-4676-A or equivalent.
8. Lubricate hub of crankshaft pulley with Ford Polyethylene Grease D0AZ-19584-A (ESR-M1C159-A and ESB-M1C93-A) or equivalent to prevent damage to seal during installation and initial engine start. Install crankshaft pulley.
9. Install oil pan.
10. Install accessory drive pulley, if so equipped.
11. Install crankshaft pulley attaching bolt and washer. Tighten to specification.
12. Remove engine from work stand and install in vehicle.

**Camshaft****Removal**

1. With engine removed from vehicle and placed on an engine work stand, remove oil dipstick.
2. Ensure cooling system, fuel system and crankcase have been drained.
3. Remove necessary drive belts and pulleys.
4. Remove cylinder head.
5. Using a magnet, remove hydraulic tappets and keep them in order so they can be installed in their original positions. If tappets are stuck in bores by excessive varnish, use Hydraulic Tappet Puller T70L-6500-A or equivalent to remove tappets.
6. Loosen and remove drive belt, fan and pulley. Using Differential Side Gear Puller Tool T77F-4220-B1 or equivalent, remove crankshaft pulley.
7. Remove oil pan.

8. Remove cylinder front cover, oil seal and gasket as outlined.
9. Check camshaft end play. Refer to Camshaft End Play. If end play is excessive, replace thrust plate.
10. Remove timing chain, sprockets and timing chain tensioner.
11. Remove camshaft thrust plate. Carefully remove camshaft by pulling it toward front of engine. Use caution to avoid damaging bearings, journals, and lobes.

**Installation**

1. Clean and inspect all parts before installation.
2. Lubricate camshaft lobes and journals with heavy engine oil, SAE 50 weight. Carefully slide camshaft through bearings in cylinder block.
3. Install thrust plate. Tighten attaching bolts to specification.
4. Install timing chain, sprockets, and timing chain tensioner as outlined.
5. Install cylinder front cover, oil seal and crankshaft pulley as outlined.
6. Clean oil pump inlet tube screen, oil pan and cylinder block gasket surfaces. Prime oil pump by filling inlet opening with oil and rotate pump shaft until oil emerges from outlet tube. Install oil pump, oil pump inlet tube screen and oil pan.
7. Install accessory drive belts and pulleys.
8. Lubricate tappets and tappet bores with heavy engine oil, SAE 50 weight. Install tappets into their original bores.
9. Install cylinder head as outlined.
10. Install engine as outlined.
11. Position No. 1 piston at TDC after compression stroke. Position distributor in block with rotor at No. 1 firing position. Install distributor hold-down clamp.
12. Connect engine temperature sending unit wire. Connect coil primary wire. Install distributor cap. Connect spark plug wires and coil high tension lead.  
  
Coat inside of each spark plug boot with Silicone Dielectric Compound D7AZ-19A331-A (ESE-M1C171-A) or equivalent using a small screwdriver blade. Connect each spark plug wire to plug from which it was removed. Ensure each wire is fully depressed on each plug and moulded boot is firmly pressed in place.
13. Fill cooling system. Fill crankcase with correct viscosity and amount of engine oil.
14. Start engine. Check and adjust ignition timing. Connect distributor vacuum line to distributor. Check for coolant, oil, fuel and vacuum leaks. Adjust engine idle speed and idle fuel mixture.

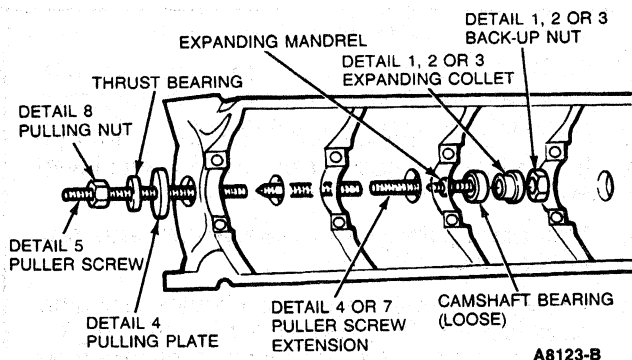
## SERVICE PROCEDURES (Continued)

### Camshaft Bearings

The camshaft bearings are available prefinished to size and require no reaming for standard and 0.38mm (0.015 inch) undersize journal diameters.

#### Removal

1. Remove engine. Place engine on a work stand and remove camshaft, crankshaft and rear bearing bore plug.
2. Remove camshaft bearing with Camshaft Bearing Set T65L-6250-A or equivalent.



3. Select proper size expanding collet and backup nut and assemble on expanding mandrel. With expanding collet collapsed, install collet assembly in camshaft bearing. Tighten backup nut on expanding mandrel until collet fits camshaft bearing.
4. Assemble puller screw and extension, if necessary, and install on expanding mandrel. Wrap a cloth around threads of puller screw to protect bearing or journal. Tighten puller nut against thrust bearing and pulling plate to remove camshaft bearing. Hold end of puller screw to prevent it from turning.
5. Repeat Step 4 for each bearing. To remove front bearing, install puller from rear of block.

#### Installation

1. Position new bearings at bearing bores and press them in place. Center pulling plate and puller screw to avoid damage to bearing.  
Failure to use correct expanding collet can cause severe bearing damage.  
NOTE: Align oil holes in bearings and install below front face of cylinder block. Check oil passage for obstructions by squirting oil into opening in cylinder block and observing flow through oil hole at rear camshaft bearing.
2. Install a new bearing bore plug.
3. Install camshaft, flywheel and related parts. Do not check connecting rod and main bearing clearances as part of camshaft bearing replacement. Install engine.

### Crankshaft

#### Removal

1. With engine removed from vehicle and placed on a work stand, remove oil level dipstick.
2. Remove accessory drive pulley, if so equipped. Remove crankshaft pulley attaching bolt and washer.
3. Remove cylinder front cover and air conditioning idler pulley assembly, if so equipped. Remove cover assembly as outlined.
4. Check timing chain deflection. Remove timing chain and sprockets.
5. Invert engine on work stand. Remove flywheel and rear seal cover. Remove oil pan and gasket. Remove oil pump inlet and oil pump assembly.
6. Ensure all bearing caps (main and connecting rod) are marked so they can be installed in their original positions. Turn crankshaft until connecting rod from which cap is being removed is up. Remove connecting rod cap. Push connecting rod and piston assembly up in cylinder. Repeat procedure for remaining connecting rod assemblies.
7. Remove main bearing caps.
8. Carefully lift crankshaft out of block so upper thrust bearing surfaces are not damaged.

**CAUTION: Handle crankshaft with care to avoid possible fracture or damage to finished surfaces.**

#### Installation

NOTE: If bearings are to be reused they should be identified to ensure that they are installed in their original position.

1. Remove main bearing inserts from block and bearing caps.
2. Remove connecting rod bearing inserts from connecting rods and caps.
3. Install a new rear oil seal in rear seal cover.
4. Apply a thin coat of Ford Polyethylene Grease D0AZ-19584-A (ESR-M1C159-A or ESB-M1C93-A) or equivalent, to rear crankshaft surface. Do not apply sealer to area forward of oil sealer groove. Inspect all machined surfaces on crankshaft for nicks, scratches or scores which could cause premature bearing wear. Lightly stone all such surfaces.
5. If crankshaft main bearing journals have been refinished to a definite undersize, install correct undersize bearings. Ensure bearing inserts and bearing bores are clean. Foreign material under inserts will distort bearing and cause a failure.
6. Place upper main bearing inserts in position in bores with tang fitted in slot provided.
7. Install lower main bearing inserts in bearing caps.

**SERVICE PROCEDURES (Continued)**

8. Carefully lower crankshaft into place.
9. Check clearance of each main bearing. Select fit bearings for proper clearance. Refer to Section 21-01.
10. After bearings have been fitted, apply a light coat of heavy engine oil, SAE 50 weight to journals and bearings. Install all bearing caps.  
NOTE: Main bearing caps must be installed in their original positions.
11. Align upper thrust bearing.
12. Check crankshaft end play.
13. If end play exceeds specification, replace upper thrust bearing. If end play is less than specification, inspect thrust bearing faces for damage, dirt or improper alignment. Install thrust bearing and align faces. Check end play.
14. Install new bearing inserts in connecting rods and caps. Check clearance of each bearing. Refer to Section 21-01.
15. If bearing clearances are to specification, apply a light coat of heavy engine oil, SAE 50 weight to journals and bearings.
16. Turn crankshaft throw to bottom of stroke. Push piston all the way down until rod bearings seat on the crankshaft journal.
17. Install connecting rod cap.
18. After piston and connecting rod assemblies have been installed, check connecting rod crankshaft journal.
19. Turn engine on work stand so front end is up. Install timing chain, sprockets, timing chain tensioner, front cover, oil seal and crankshaft pulley as outlined.  
Turn engine on work stand so rear end is up. Install rear oil seal cover.
20. Clean oil pan, oil pump and oil pump screen assembly.
21. Prime oil pump by filling inlet opening with oil and rotating pump shaft until oil emerges from outlet opening. Install oil pump.
22. Position flywheel on crankshaft. Apply Pipe Sealant with Teflon® D8AZ-19554-A (ESG-M4G194-A and ESR-M18P7-A) or equivalent oil resistant sealer to flywheel attaching bolts. Tighten to specification.

NOTE: On a flywheel (MTX only) locate clutch disc and install pressure plate.

23. Turn engine on work stand so engine is in normal upright position. Install oil level dipstick. Install accessory drive pulley, if so equipped. Install and adjust drive belt and accessory belts to specification.
24. Install either MTX transmission clutch assembly or ATX torque converter.
25. Install oil pan.
26. Remove engine from work stand. Install engine.

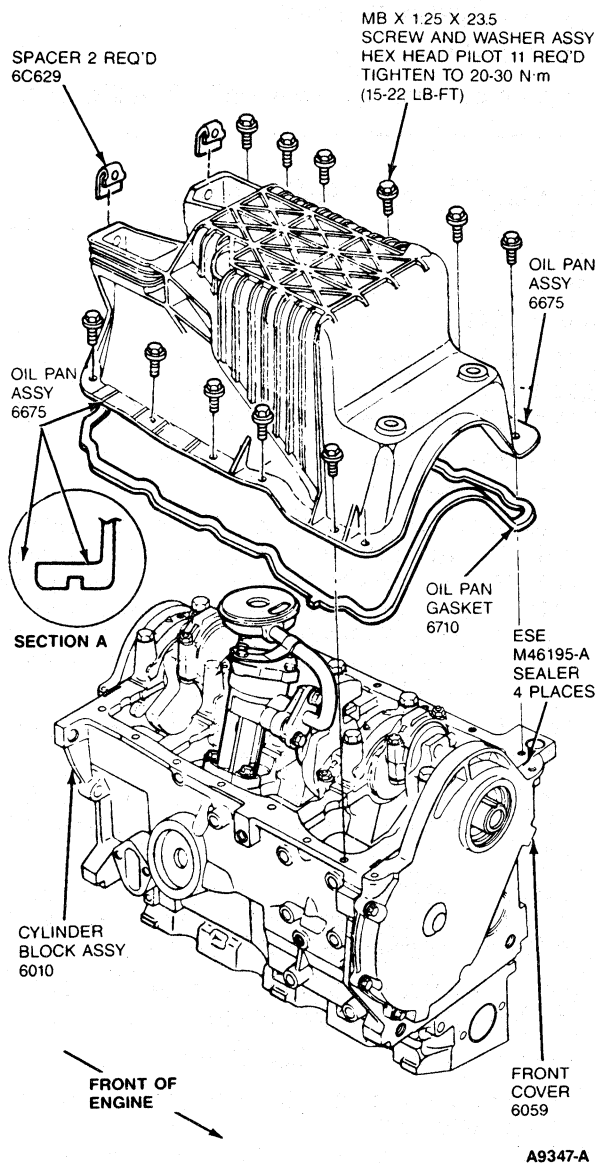
**DISASSEMBLY AND ASSEMBLY****Engine****Disassembly**

NOTE: Before starting disassembly, remove accessories and any emission control equipment which is not directly attached to the engine.

1. Remove flywheel, two rear dowels and rear cover plate.
2. Remove flexible tube-to-air cleaner assembly nipple, at RH front corner of engine compartment. Remove filter and tube assembly from rocker arm cover. Remove crankcase vent hose between vent valve and nipple at throttle body of carburetor. Pull PCV vent valve from rocker arm cover.
3. Remove carburetor attaching nuts. Remove throttle body and base gasket.
4. Remove distributor cap and spark plug wires from engine. Remove spark plugs from cylinder head.
5. Remove EGR tube between exhaust manifold and EGR valve. Remove EGR attaching bolts and remove EGR valve and gasket.
6. Remove crankshaft pulley attaching bolt. Remove flatwasher and pulley.
7. Remove accelerator shaft bracket.
8. Remove water pump attaching bolts. Remove water pump and gasket.
9. Remove oil pan attaching bolts. Insert a screwdriver or similar pry bar into any of four prying slots, and pry against cylinder block until sealant bond is broken.

## DISASSEMBLY AND ASSEMBLY (Continued)

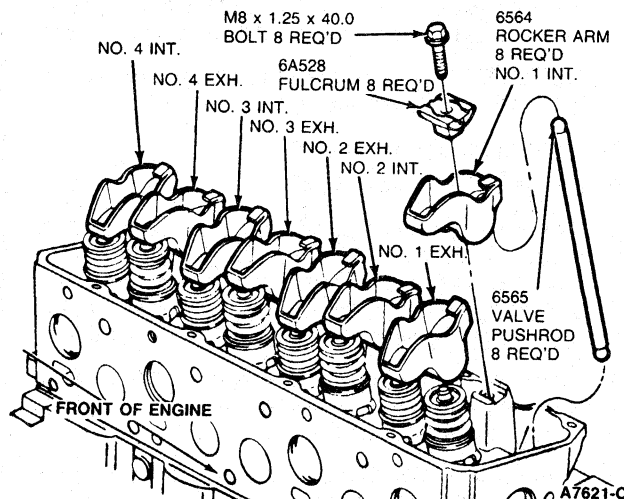
**CAUTION:** Do not hammer or pry against any other area of oil pan as this will damage oil pan.



NOTE: It may be helpful to work a narrow blade putty knife or razor through sealant to help break oil pan away from cylinder block.

10. Remove oil pump attaching bolts. Remove oil pump and intermediate driveshaft. Remove oil filter and oil sender.
11. Remove front cover assembly attaching bolts and oil seal as outlined. Remove cover, timing chain damper and gasket.

12. Remove rocker arm cover attaching bolts. Remove rocker arm cover and gasket.
13. Remove rocker arm fulcrum attaching bolts. Remove fulcrums, rocker arms and push rods.



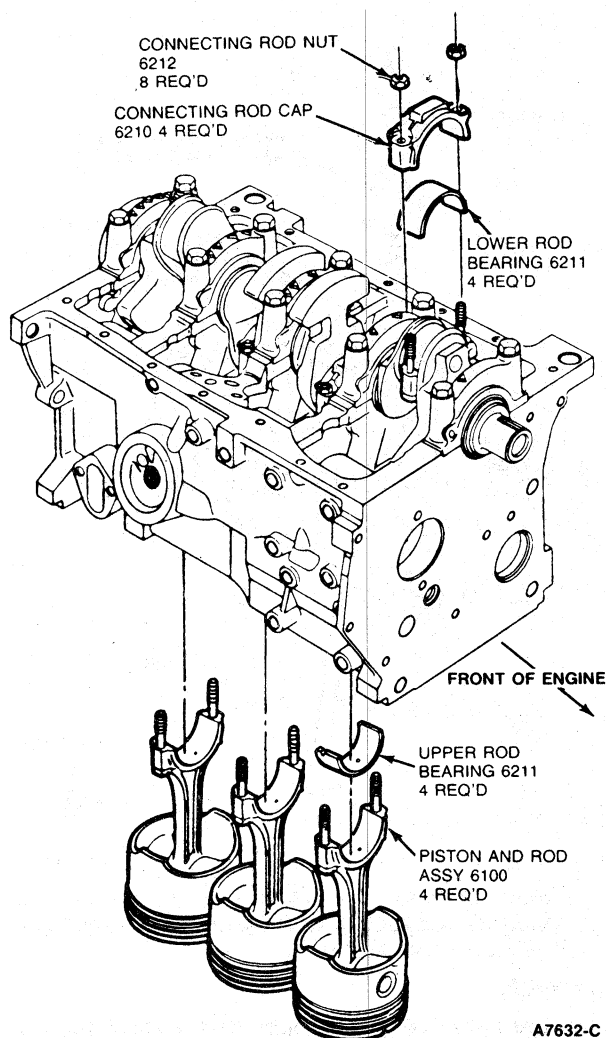
The location of each rocker arm, push rod and fulcrum should be identified. When engine is assembled each component should be installed in its original position.

14. Remove water outlet connection attaching bolts. Remove water outlet connection, thermostat and gasket. If necessary, remove fan switch.
15. Remove dipstick tube attaching bolt and remove dipstick tube and dipstick.
16. Remove distributor hold-down bolt and clamp. Remove distributor.
17. Remove intake manifold support brace attaching bolts. If necessary, remove plugs and fittings on intake manifold. Remove all intake manifold attaching bolts. Remove intake manifold and gasket.
18. Remove exhaust manifold attaching bolts. Remove exhaust manifold.
19. Remove cylinder head bolts. Remove cylinder head and gasket.
20. Using Hydraulic Tappet Puller T70L-6500-A or equivalent, remove tappets.
21. Remove timing chain tensioner attaching bolts. Remove camshaft sprocket attaching bolt and washer. Remove timing chain, camshaft sprocket, crankshaft sprocket and key.  
Remove camshaft thrust plate attaching bolts and camshaft thrust plate.
22. Remove camshaft. Use care to prevent damage to camshaft bearing surfaces, cam lobes and journals.



**DISASSEMBLY AND ASSEMBLY (Continued)**

23. Remove rear crankshaft seal retainer bolts. Remove retainer gasket.
24. Remove connecting rod caps and pistons.



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The location of each piston, bearing insert and rod cap should be identified. When engine is assembled, each component should be installed in its original position.

**NOTE:** Before removing pistons, inspect top of cylinder bores. If necessary, remove ridge and/or carbon deposits from each cylinder using a suitable ridge reamer. Before ridge or deposits are removed, turn crankshaft until piston is at bottom of its stroke. Cover piston with a clean shop towel to collect cuttings. After cutting operation, turn crankshaft until piston is at top of its stroke and remove shop towel with cuttings.

25. Remove main bearing caps, crankshaft and bearings from block.

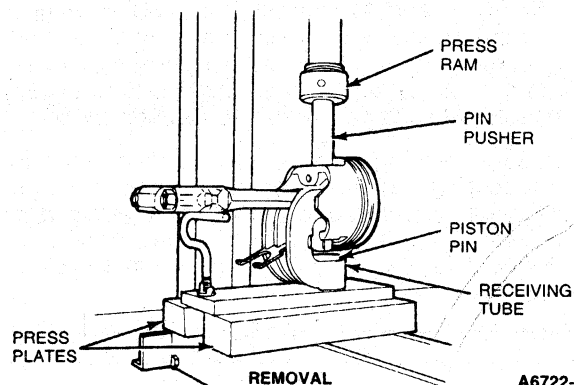
**CAUTION:** When removing crankshaft, take care not to damage any of bearing surfaces on crankshaft.

**NOTE:** The location of main bearing caps and main bearing inserts should be identified. When engine is assembled, bearings which are to be reused should be installed in their original positions.

26. For cleaning purposes, oil gallery and coolant drainplugs can be removed.

**Subassemblies****Pistons and Connecting Rods****Disassembly**

1. Remove bearing inserts from connecting rod and cap.
2. Remove piston rings using a suitable piston ring expander.
3. Mark pistons to ensure assembly with same rod and installation in same cylinder from which they were removed.
4. Using an Arbor Press and Piston Pin Removal and Installation Set T68P-6135-A or equivalent, press piston pin from piston and connecting rod.



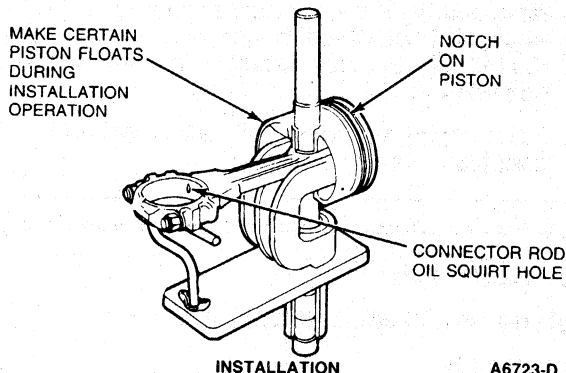
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**Assembly**

Check fit of a new piston in cylinder bore before assembling piston and piston pin to connecting rod. Refer to Section 21-01.

The piston pin bore of a connecting rod and diameter of piston pin must be within specification.

1. Apply a light coat of engine oil to all parts.
2. Assemble piston to connecting rod using notch in piston dome and connecting rod oil squirt hole for assembly reference.

**DISASSEMBLY AND ASSEMBLY (Continued)**

3. Start piston pin in piston and connecting rod (this may require a very light tap with a mallet). Using an Arbor Press and Piston Pin Removal and Installation Set T68P-6135-A or equivalent, press piston pin through piston until pin is centered in piston.
4. Check end gap of all piston rings. It must be within specification. Refer to Section 21-01. Follow instructions contained on piston ring package. Install piston rings as directed.
5. Check ring side clearance of compression rings with Feeler Gauge D81L-4201-A or equivalent, by inserting it between ring and its lower land. The gauge should slide freely around entire ring circumference without binding. Any wear that occurs will form a step at inner portion of lower land. If lower lands have high steps, piston should be replaced. Refer to Section 21-01.
6. Ensure bearing inserts and bearing bore in connecting rod and cap are clean. Foreign material under inserts will distort bearing and cause a failure. Install bearing inserts in connecting rod and cap by fitting tangs in slots provided.

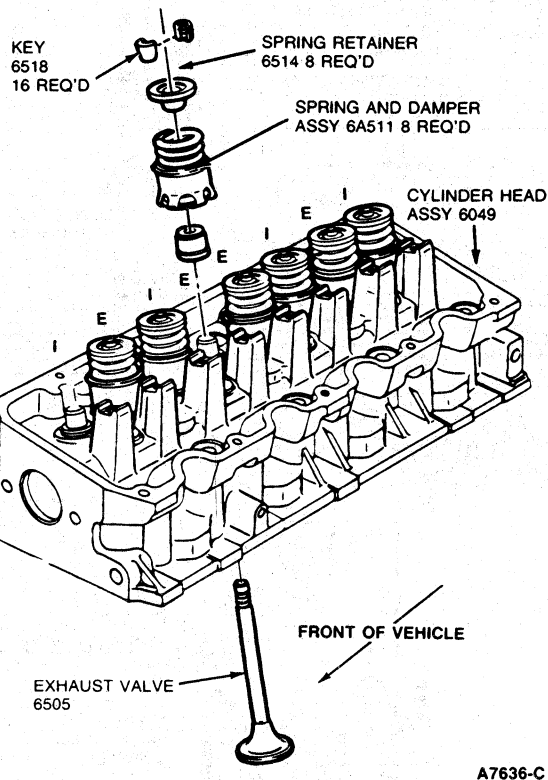
**Cylinder Head**

**NOTE:** Valve stem seals with wide band near base and ring near top are used on intake valves only. Exhaust valve stem seals have two rings.

**Disassembly**

1. Remove exhaust manifolds, if required, and spark plugs.
2. Remove rocker arm fulcrum attaching bolts, fulcrums and rocker arms.
3. Clean carbon out of cylinder head combustion chambers before removing valves.
4. Compress valve springs using Valve Spring Compressor T81P-6513-A or equivalent. Remove spring retainer key locks and release spring.

5. Remove spring retainer, valve spring, valve spring damper, stem seal and valve. Discard valve stem seals, identify all valve parts as to which cylinder they were removed from, and whether intake or exhaust.



6. Clean, inspect and service cylinder head as required, or prepare to transfer all usable parts to a new cylinder head.

**Assembly**

Lubricate all valves, valve stems and valve guides with heavy engine oil, SAE 50 weight. Apply a thin film of Ford Polyethylene Grease D0AZ-19584-A (ESR-M1C159-A and ESB-M1C93-A) or equivalent to the valve tips before installation.

1. Install each valve in valve guide hole from which it was removed or to which a new valve is to be used.
2. Install guide-mounted valve stem seal. Use a 15.87mm (5/8-inch) deep well socket and a light mallet or hammer to seat seal squarely on valve guide boss.
3. Install valve spring and damper assembly over valve, then install spring retainer. Compress spring and install retainer key locks.
4. Measure assembled height of valve spring from underside of spring damper to underside of spring retainer with dividers. Check dividers against a scale. If assembled height is not within specification, valve spring load loss may be excessive. Install a new valve spring or spring and damper assembly.

**DISASSEMBLY AND ASSEMBLY (Continued)**

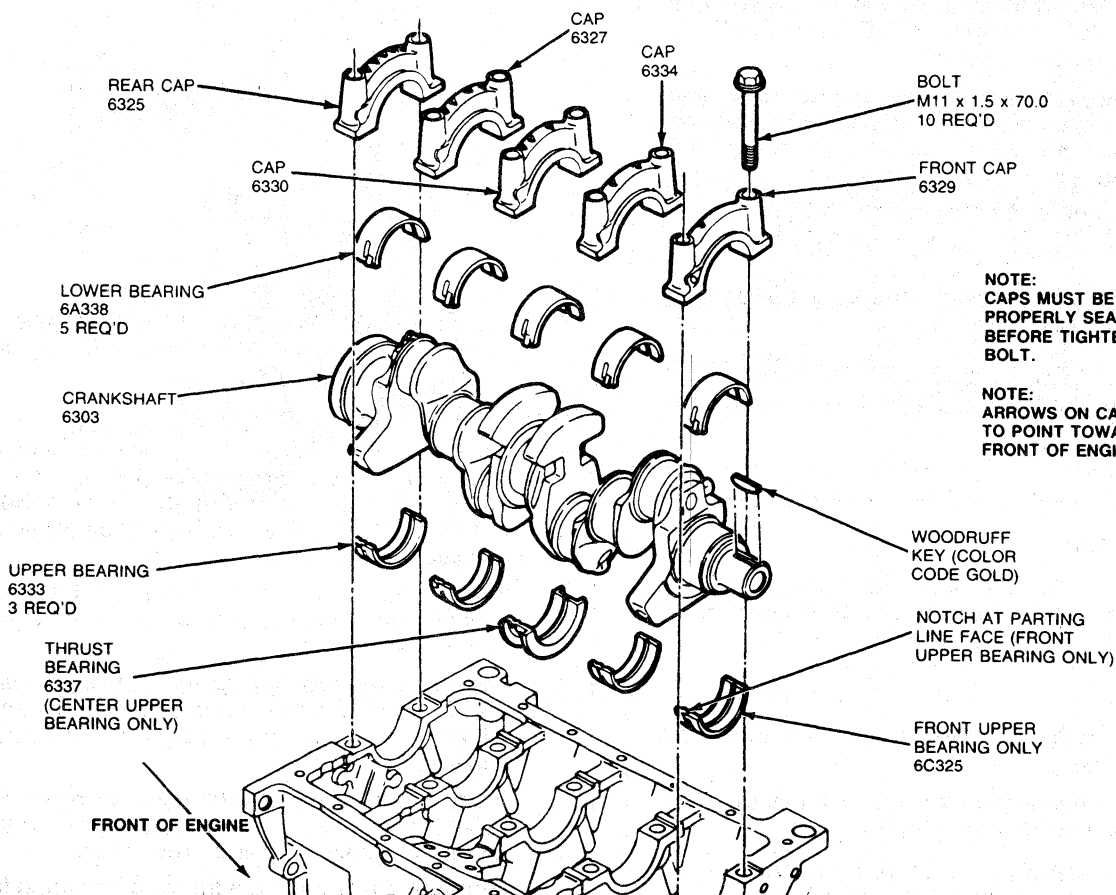
5. Position rocker arms and fulcrums on cylinder head and install fulcrum attaching bolt finger-tight. Install remaining rocker arms and fulcrums with camshaft properly positioned as outlined under Collapsed Tappet Gap. Tighten fulcrum bolts to specification.
6. Install exhaust manifolds as outlined, if removed. Install spark plugs.

**Engine****Assembly**

During the engine assembly, a sealant will be applied to some components before installation. When the sealant is applied, the component should be installed within 15 minutes. After this time the sealant begins to set up and the sealing effectiveness is reduced.

NOTE: Lightly oil all attaching bolt and stud threads before installation, except those specifying special sealant.

1. Wash cylinder block thoroughly to remove all foreign material and dry before assembling other components. All oil holes must be fully open and clean.
2. Install crankshaft as follows:
  - a. Install main bearings in cylinder block. Note that center upper bearing is a thrust bearing and front upper bearing has a small V notch on parting line face.



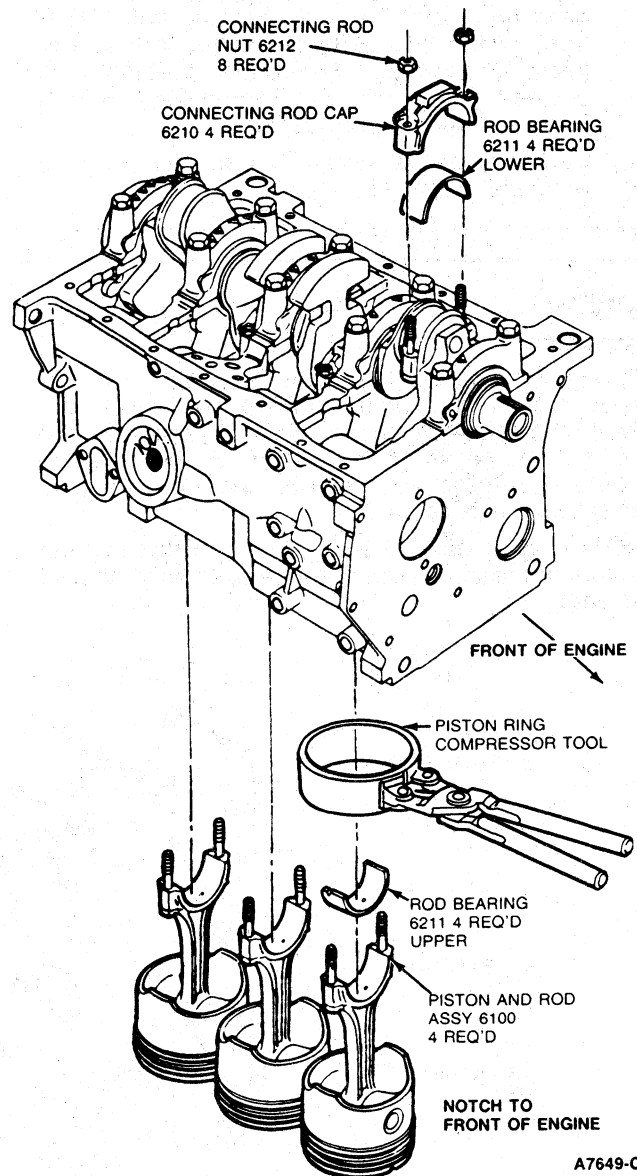
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## DISASSEMBLY AND ASSEMBLY (Continued)

- b. Lubricate bearings with SAE 50 weight, ESE-M2C39-F or equivalent oil. Carefully lower crankshaft into place. Use care to prevent damage to bearing surfaces.
  - c. Coat main bearing journals on crankshaft with SAE 50 weight, ESE-M2C39-F or equivalent engine oil.
  - d. Install main bearing caps in proper location (refer to numbers on caps) with arrows pointing toward front of engine. Oil bolts and tighten to 70-90 N·m (57.6-66.4 lb-ft).
  - e. Turn crankshaft to check for turning torque. Turning torque should be no more than 6 N·m (4.5 lb-ft).
3. Install piston rings.
 

NOTE: Oil ring segment gaps must be staggered at least 12.7mm (0.50-inch) from expander gap. Gap ink markings on rings must appear to LH of gap, or indentations or word "TOP" on side of compression rings must appear when assembled on piston (view with top of piston up).
  4. Install pistons as follows:
    - a. Coat all cylinder bores and pistons with SAE 50 weight, ESE-M2C39-F or equivalent engine oil.
    - b. Install bearings in connecting rods and caps. The oil squirt hole in bearing must be aligned with squirt hole in connecting rod.
 

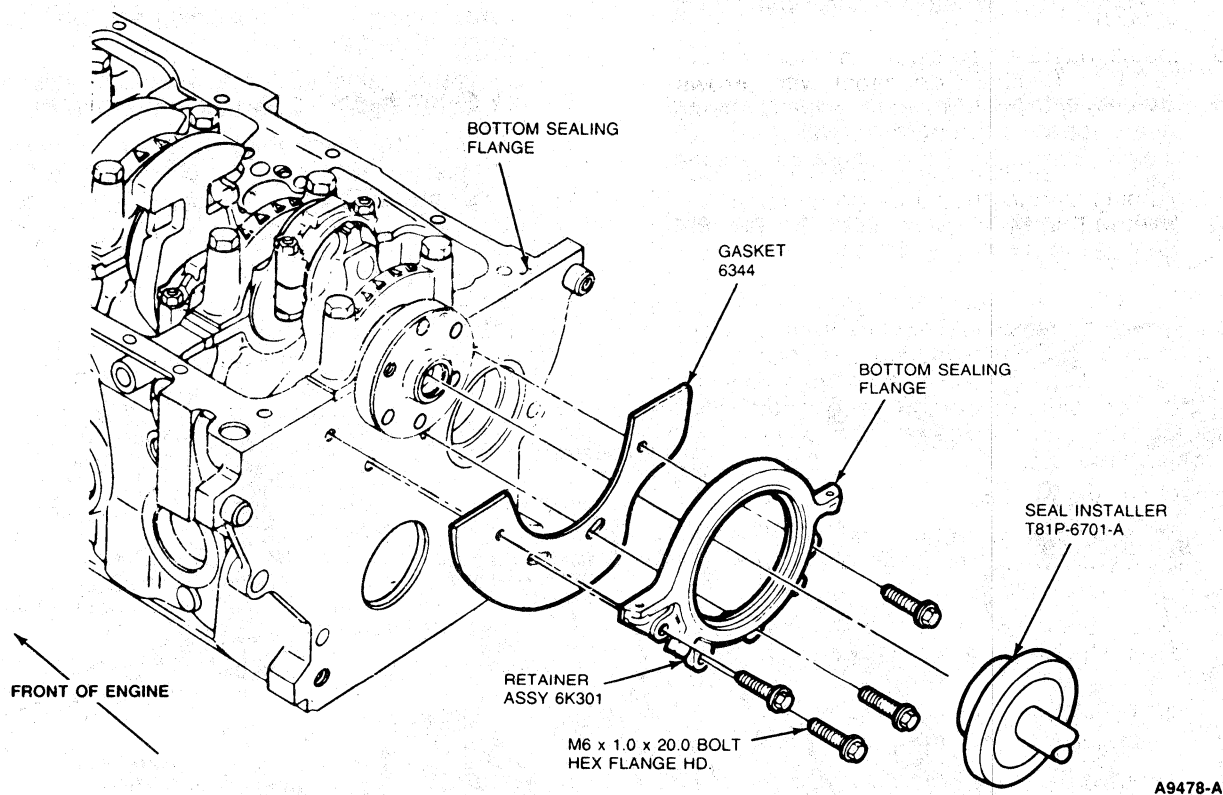
NOTE: Ensure bearing tangs are seated in appropriate slots in the rod and cap.
    - c. Install piston and rod assemblies using Ring Compressor D81L-6002-C or equivalent. The notch in piston dome must face front of engine.
    - d. Install connecting rod cap nuts. Tighten to 28-35 N·m (21-26 lb-ft).



**DISASSEMBLY AND ASSEMBLY (Continued)****5. Install rear crankshaft seal as follows:**

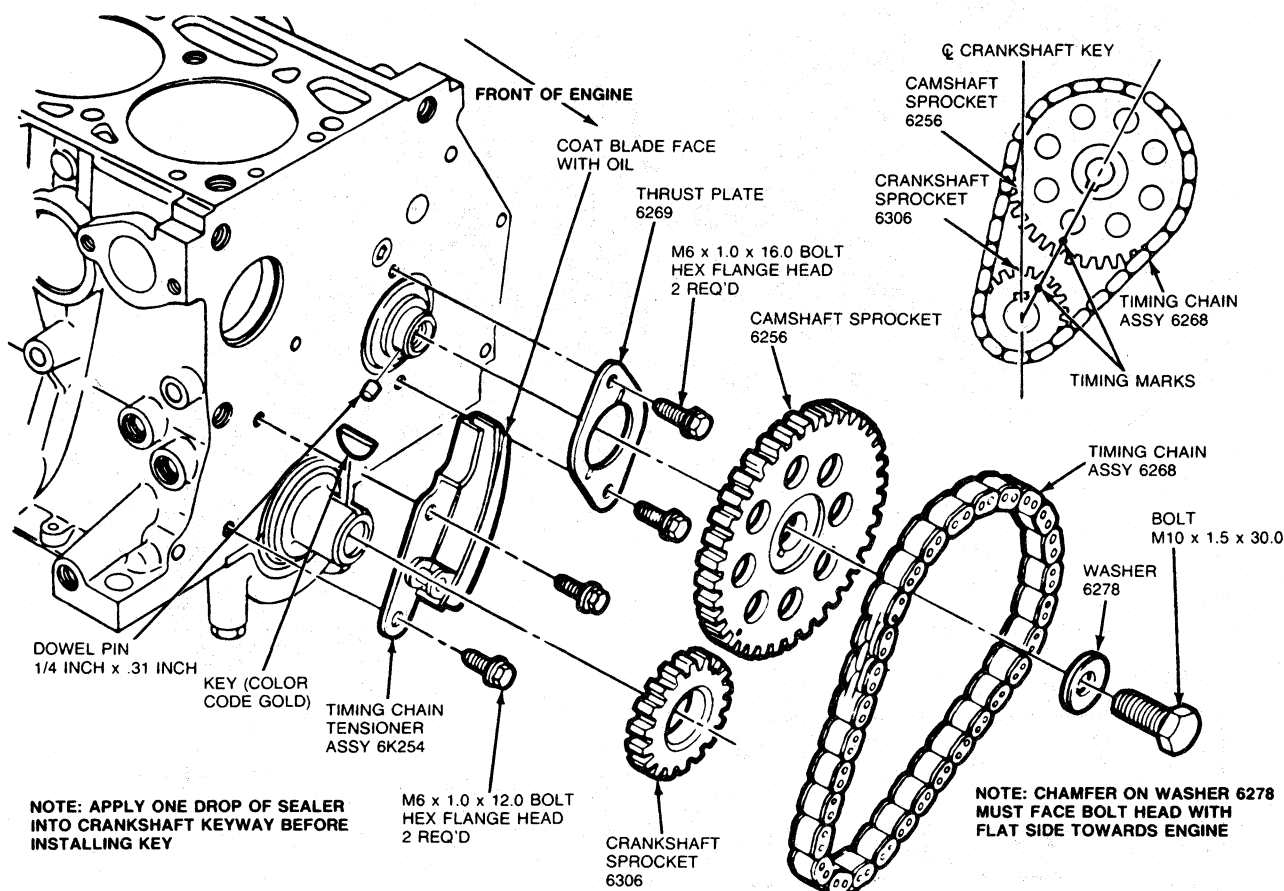
- a. Apply a thin coat of Ford Polyethylene Grease D0AZ-19584-A (ESR-M1C159-A and ESB-M1C93-A) or equivalent to

crankshaft seal journal. Fit Seal Installer T81P-6701-A or equivalent to gasket and retainer assembly, and assemble to crankshaft.



**DISASSEMBLY AND ASSEMBLY (Continued)**

- b. Align retainer assembly with holes in block and secure finger-tight with two bolts. Remove seal installer tool.
  - c. Tighten all four bolts to 8-12 N·m (6-9 lb-ft). The bottom sealing flange of retainer must not extend below sealing flange (pan rail) of block.
6. Install camshaft as follows:
- a. Before installing camshaft, coat camshaft gear, lobes and journals with SAE 50 weight, ESE-M2C39-F or equivalent engine oil.
  - b. Install camshaft. Use care to prevent damage to bearing surfaces.
- c. If removed, coat rear camshaft cover with sealant and install.
- NOTE: After installation, the camshaft must turn freely. Bearing clearance must be 0.025-0.076mm (.001-.003 inch).
7. Install timing chain tensioner, sprockets and timing chain as follows:
- a. Install camshaft thrust plate and attaching bolts. Tighten to 8-12 N·m (6-9 lb-ft).
  - b. Position crankshaft keyway in vertical position with No. 1 piston at Top Dead Center (TDC).



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## DISASSEMBLY AND ASSEMBLY (Continued)

- c. Apply a drop of sealer in crankshaft keyway or to crankshaft key and install key in crank.
- d. Assemble timing chain, camshaft and crankshaft sprockets with timing marks on sprockets aligned. Position components on crankshaft and camshaft. Install camshaft sprocket bolt and washer. Tighten to 55-75 N·m (41-56 lb-ft).

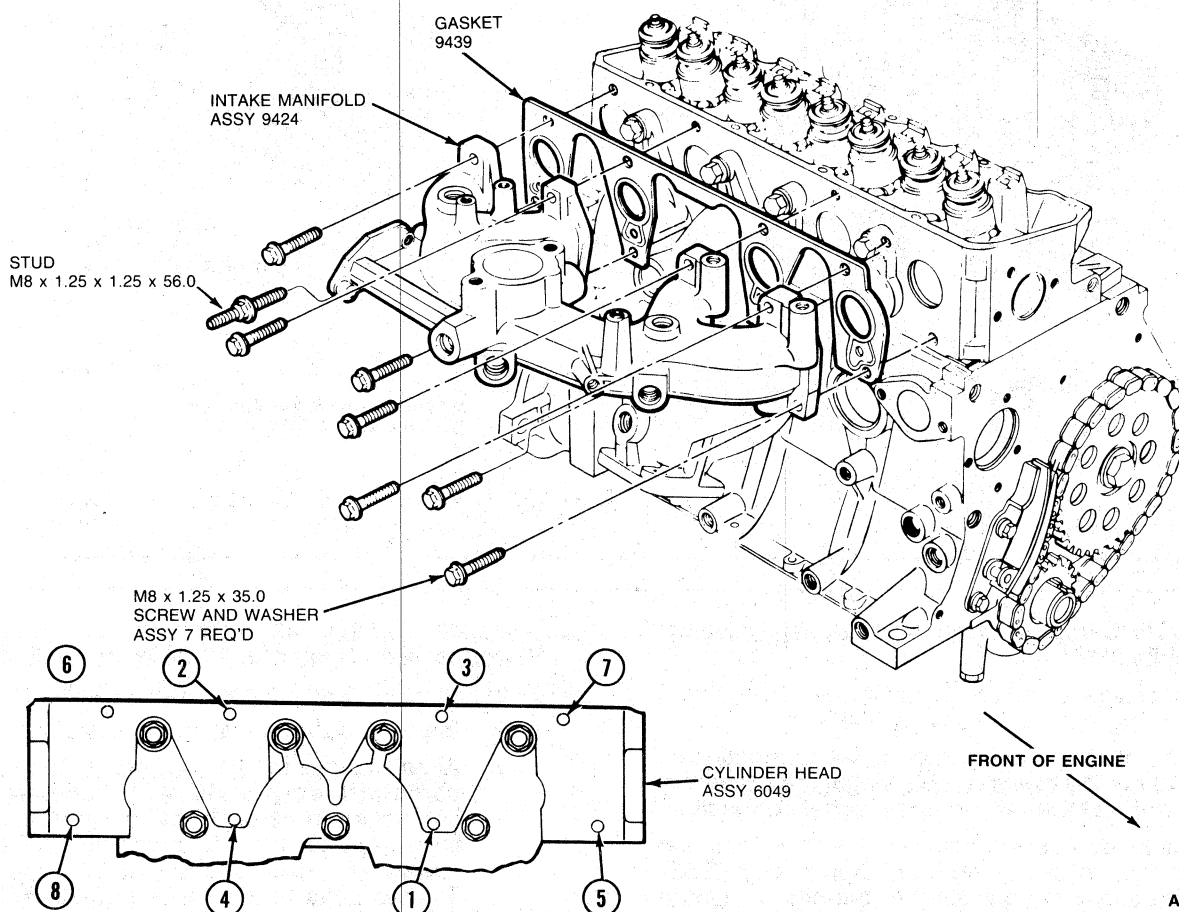
NOTE: On crankshaft sprocket with chamfers around keyway, fill keyway chamfer cavity with Threadlock and Sealer E0AZ-19554-A (ESE-M46204-A) or equivalent, flush with front face of sprocket.

- e. Coat blade face of tensioner, timing chain, and all sprocket teeth with SAE 50 weight, ESE-M2C39-F or equivalent engine oil.

Install tensioner and attaching bolts. Tighten to 8-12 N·m (6-9 lb-ft).

NOTE: Crankshaft and camshaft end play and connecting rod side clearance must be checked at this time. Refer to Adjustments.

8. Coat tappets with SAE 50 weight, ESE-M2C39-F or equivalent engine oil and install in block.
9. Install the cylinder head as outlined.
10. Install exhaust manifold as outlined.
11. Coat intake manifold gasket with sealer. Position intake manifold and gasket onto cylinder head and install attaching bolts. Tighten bolts in sequence shown to 20-30 N·m (15-23 lb-ft).



A9898-A

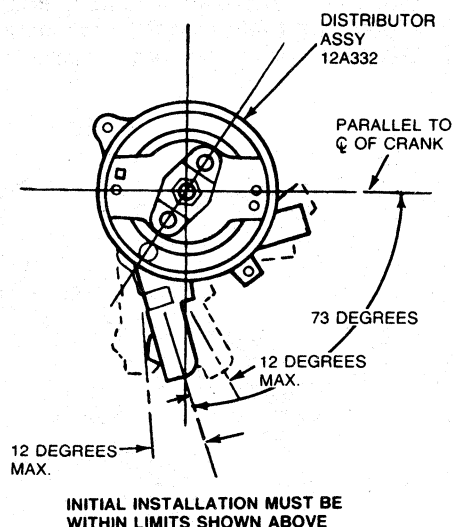
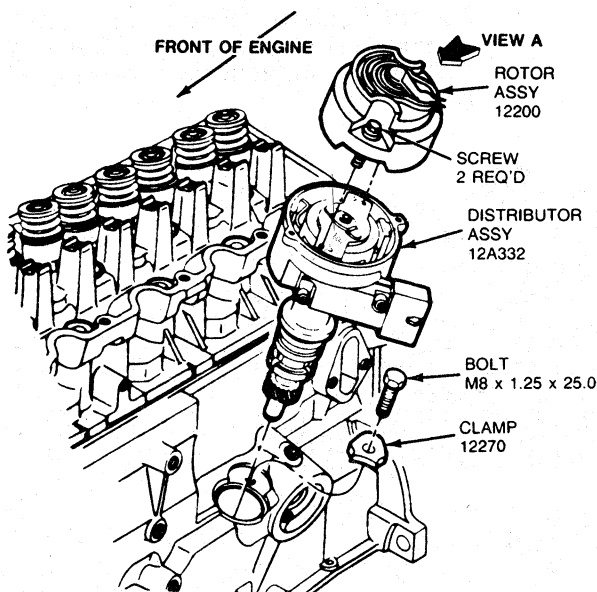
## DISASSEMBLY AND ASSEMBLY (Continued)

12. Install intake manifold plugs and fittings as follows:

- Apply sealer to all plugs and fittings in intake manifold and install.
- Tighten vacuum fittings in intake manifold to 8-14 N·m (6-10 lb-ft). Rotate to correct position.
- If removed, install engine coolant temperature sensor. Tighten to 16-24 N·m (12-18 lb-ft).

d. Install intake manifold support brace. Tighten attaching bolts to 40-50 N·m (30-40 lb-ft).

13. Install distributor. Tighten hold-down clamp bolt to 23-34 N·m (17-25 lb-ft). Camshaft and crankshaft sprocket marks must be aligned and No. 1 piston must be at TDC.



A7644-C

NOTE: Canadian engines do not use Universal distributor.

14. Install dipstick and tube assembly. Tighten tube retaining bolt to 8-12 N·m (6-9 lb-ft).
15. Install thermostat in water outlet connecting by rotating clockwise and engaging tabs on thermostat with slot in water outlet connection. Install new gasket, thermostat, and water outlet connection to cylinder head. Apply sealer ESE-M146203-4 or equivalent to the studs. Tighten to 16-24 N·m (18-29 lb-ft).

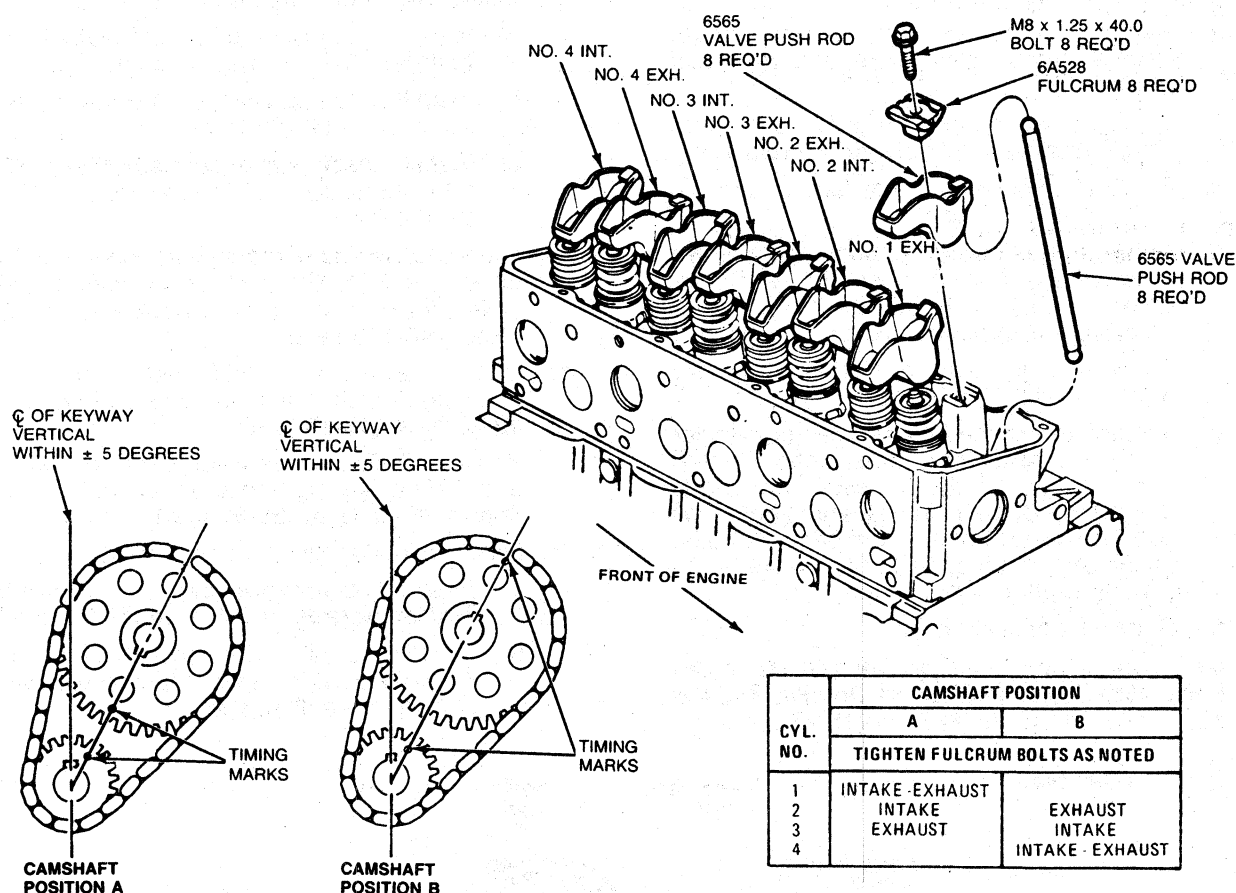
Install cooling fan switch in water outlet connection. Tighten to 11-24 N·m (8-18 lb-ft).

16. Install valve train components as follows:

- Install push rods into cylinder block.
- Align timing marks on crankshaft and camshaft sprockets with keyway on crankshaft in vertical position (position A). Install rocker arms, fulcrums and bolts on valves as shown in Camshaft Position A. Tighten bolts to 6-10 N·m (4.5-7.5 lb-ft).



## DISASSEMBLY AND ASSEMBLY (Continued)



A7643-C

- c. Rotate camshaft 180 degrees. Install remaining rocker arms, fulcrums and bolts on valves as shown in Camshaft Position B. Tighten bolts to 6-10 N·m (4.5-7.5 lb-ft).
- d. Apply SAE 50 weight, ESE-M2C39-F or equivalent engine oil to rocker arms, fulcrums and push rods. Tighten all fulcrum bolts to 26-38 N·m (19.5-26.5 lb-ft).

**NOTE:** Fulcrums must be fully seated in cylinder head slots and push rods must be seated in rocker arm and tappet sockets prior to final tightening. Return to position A before distributor installation.

## 17. Install gasket.

**NOTE:** Before proceeding, the collapsed tappet gap must be checked. Refer to Adjustments.

## 18. Install front cover assembly as outlined.

## 19. Install oil pump, filter and oil sender as follows:

- a. Prime oil pump by filling inlet port with engine oil. Rotate pump shaft until oil flows from outlet.
- b. If screen and cover assembly have been removed, replace gasket. Clean screen and

install screen and cover assembly. Tighten two attaching bolts and one nut to specification.

- c. Position intermediate driveshaft into distributor socket.
- d. Insert intermediate driveshaft into oil pump. Install pump and shaft as an assembly.

**CAUTION:** Do not attempt to force pump into position if it will not seat. The driveshaft hex may be misaligned with distributor shaft. To align, rotate oil pump or intermediate driveshaft into a new position.

- e. Tighten two attaching bolts to 20-30 N·m (15-22 lb-ft).
- f. Thoroughly coat oil filter gasket with SAE 50 weight, ESE-M2C39-F or equivalent. Install oil filter until gasket contacts block, then tighten one-half turn.
- g. Install oil sender. Tighten to 11-24 N·m (8-18 lb-ft).

**DISASSEMBLY AND ASSEMBLY (Continued)****20. Install oil pan as follows:**

- a. Remove oil sealer from oil pan flange, cylinder block, front cover and rear seal retainer.
- b. Clean sealing surfaces with Dupont Freon TF or equivalent to remove oily residue.
- c. Bolt transaxle case to rear face of cylinder block to align oil pan.
- d. Apply a continuous 4.76mm (3/16-inch) wide bead of Ford Silicone Gasket Sealer E3AZ-19562-A (ESE-M4G195-C) or equivalent to groove in oil pan flange.

Apply an extra bead of sealer to cylinder block on each side of front cover.

- e. Immediately place oil pan against cylinder block and install four corner bolts. Tighten bolts snug enough to allow horizontal movement of pan. Install and tighten oil pan-to-transaxle bolts, then back off bolts. Install oil pan attaching bolts and tighten to 8-12 N·m (6-9 lb-ft).
  - f. Remove transaxle case.
21. Install water pump and gasket with attaching bolts. Note lower front bolt is longer. Tighten attaching bolts to 20-30 N·m (15-23 lb-ft).

**22. Install following component brackets:**

- a. Install accelerator shaft bracket. Tighten bolts to 10-15 N·m (7-11 lb-ft).
- b. Install air pump bracket. Tighten bolts to 20-30 N·m (15-23 lb-ft).
- c. Install check valve connector and EGR tube connector. Tighten each to 34-47 N·m (25-35 lb-ft).

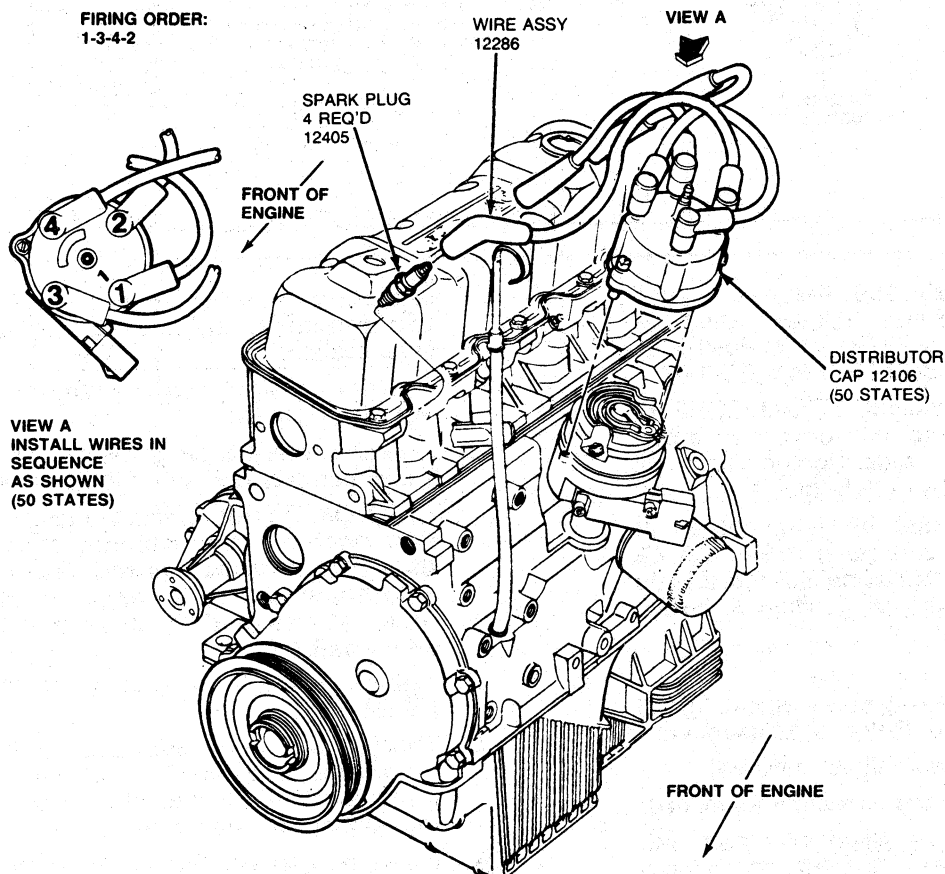
23. Lubricate outside of crankshaft pulley with SAE 50 weight, ESE-M2C39-F or equivalent. Install pulley, flatwasher and bolt. Tighten to 190-230 N·m (140-170 lb-ft).

24. Install gasket and EGR valve on intake manifold. Install attaching bolts and tighten to 18-26 N·m (13-19 lb-ft).

Position EGR tube between exhaust manifold and EGR valve. Tighten attaching nuts at each end to 34-47 N·m (25-35 lb-ft).

**25. Install following ignition components:**

- a. Position distributor cap on distributor. Tighten screws to 2-3 N·m (18-27 lb-in).
- b. Install spark plug wire terminals (1, 2, 3 and 4) in distributor cap in order and position shown in the illustration.



**DISASSEMBLY AND ASSEMBLY (Continued)**

- c. Hand start spark plugs. Tighten to 7-14 N·m (5.5-10.5 lb-ft).
  - d. Push spark plug wire terminals onto spark plugs until firmly seated.
26. Install throttle body. Refer to Section 24-03.
27. Press PCV vent valve into rocker cover. Connect crankcase vent hose between vent valve and nipple at throttle body of carburetor. Insert cap and tube assembly in rocker cover

- and twist cap until seated. Connect end of flexible tube to air cleaner assembly nipple, at RH front corner of engine compartment.
28. Apply thread sealer to flywheel attaching bolts. Position rear cover plate over dowel pins. Install flywheel and attaching bolts. Tighten to 73-87 N·m (54-64 lb-ft).

On ATX only: install reinforcement plate over flywheel before installing attaching bolts.

**SPECIFICATIONS****TORQUE SPECIFICATIONS**

Description	N·m	Lb-Ft	Description	N·m	Lb-Ft
Main Bearing Cap Bolts	70-90	51-66	EGR Tube Connector	34-47	25-35
Connecting Rod Cap Nuts	28-35	21-26	Crankshaft Pulley Bolt	111-139	140-170
Crankshaft Seal Retainer Bolts	8-12	6-9	EGR Valve Bolts	18-26	13-19
Camshaft Thrust Plate Bolts	8-12	6-9	EGR Tube Nuts	34-47	25-35
Camshaft Tensioner Bolts	8-12	6-9	Distributor Cap Screws	2.0-2.6	18-27 (lb-in)
Camshaft Sprocket Bolt	55-75	41-56	Spark Plugs	7-14	5.5-10.5
Cylinder Head Bolts	(1)	(1)	Flywheel Bolts	73-87	54-64
Exhaust Manifold	(2)	(2)	RH No. 34 Intermediate Bracket Bolt	75-100	55-75
Intake Manifold	20-30	15-23	RH No. 3A Insulator Nuts	100-135	75-100
Vacuum Fittings — Intake Manifold	8-14	6-10	LH Front No. 1 Insulator to Transaxle Bolts	35-50	25-37
Engine Coolant Temperature Sensor	11-24	8-18	LH Front No. 1 Insulator to Bracket Nut	100-135	75-100
Distributor Holddown Bolt	23-34	17-25	LH Rear No. 4 Insulator to Body Bolts	100-135	75-100
Dipstick Tube Bolt	8-12	6-9	LH Rear No. 4 Insulator to Transaxle	50-68	35-50
Water Outlet Connection Bolts	16-24	12-18	Shift Stabilizer Bar to Transaxle	31-47	25-35
Cooling Fan Switch	11-24	8-18	Shift Mechanism to Shift Shaft	9-13	7-10
Rocker Arm Bolts	(3)	(3)	Oil Pan Drain Plug	20-34	15-25
Rocker Arm Cover Bolts	8-11.5	6-8	Oil Pan to Transaxle Bolts	40-50	30-39
Front Cover Bolts	8-12	6-9	Water Pump Inlet Tube to Oil Pan	8-11	6-8
Oil Pump Bolts	20-30	15-23	Roll Restrictor Nuts	35-60	25-45
Oil Filter	(4)	(4)	Coil Nuts	15-25	11-18
Oil Sender	11-24	8-18	Low Oil Level Sensor	27-40	20-30
Oil Pan Bolts	20-30	15-23	Heat Shroud Tube Nut	8-11.5	6-8
Water Pump Bolts	20-30	15-23	Tube to Heat Shield Screw	2.2-3.1	19-27 (lb-in)
Fuel Pump Cover Bolts	20-30	15-23	CFI Throttle Body Nuts	20-34	15-25
Accelerator Shaft Bracket Bolt	10-15	7-11			

(1) Tighten in 2 Steps 70-80 N·m (51.6-59 lb-ft) 95.0-103 N·m (70-76 lb-ft)

(2) Tighten in 2 Steps 7-10 N·m (5-7 lb-ft) 27-41 N·m (20-30 lb-ft)

(3) Tighten in 2 Steps 6-10 N·m (4.5-7.5 lb-ft) 26-38 N·m (19.5-26.5 lb-ft)

(4) Advance half turn after gasket contacts surface

CA9349-B

## SPECIFICATIONS (Continued)

## GENERAL SPECIFICATION

DISPLACEMENT	2.5L (2500 cc)
NUMBER OF CYLINDERS	4
BORE AND STROKE	
Bore	93.53mm (3.68 inch)
Stroke	92mm (3.30 inch)
FIRING ORDER	1, 3, 4, 2

## CYLINDER HEAD AND VALVE TRAIN

COMBUSTION CHAMBER VOLUME (cc)	69.2-66.2
VALVE GUIDE BORE DIAMETER	
Intake and Exhaust	8.720-8.745mm (.3433 inch)
VALVE SEATS	
Width	
Intake	1.53-2.03mm (.080 inch)
Exhaust	1.78-2.28mm (.090 inch)
Angle	44°-45°
Runout (T.I.R.)	
Seat with Respect to Guide	.025mm (.001 inch)
INTAKE AND EXHAUST MANIFOLD	
Joint Face Flatness	.12mm Overall (.08mm) in Any 150mm Cylinder Head
Joint Flatness	.18mm Overall (.08mm) in Any 150mm
VALVE STEM TO GUIDE CLEARANCE	
Intake	.047mm (.0018 inch)
Exhaust	.0595mm (.0023 inch)
VALVE HEAD DIAMETER	
Intake	43.76-44.37mm (1.72-1.74 inch)
Exhaust	37.9-38.3mm (1.49-1.50 inch)
VALVE FACE ANGLE	44°-45°
VALVE STEM DIAMETER (STD.)	
Intake	8.677-8.694mm (.3415-.3422 inch)
Exhaust	8.664-8.682mm (.3411-.3418 inch)
Oversize	
Intake	9.058-9.075mm (.3566-.3572 inch)
Exhaust	9.045-9.063mm (.3561-.3568 inch)
Oversize	
Intake	9.439-9.456mm (.3716-.3722 inch)
Exhaust	9.045-9.063mm (.3561-.3568 inch)
VALVE SPRINGS	
Compression Pressure (N @ Spec. Length)	
Loaded (Without Damper)	811 ± 35.6N @ 28.13mm
Unloaded (Without Damper)	329 ± 17.8N @ 38.1mm
Free Length (approximate)	44.93mm (1.76 inch)
Assembled Height	38.1mm (1.49 inch)
Service Limit	10% Pressure Loss @ Spec. Length
ROCKER ARM	
Ratio	1.568
VALVE TAPPET, HYDRAULIC	
Diameter (Std.)	22.200-22.212mm (.874-.8744 inch)
Hydraulic Leakdown Rate	10-50 seconds
Collapsed Tappet Gap (Nominal)	
Intake	1.80-4.34mm (.070-.170 inch)
Exhaust	1.80-4.34mm (.070-.170 inch)
DISTRIBUTOR SHAFT BEARING BORE DIAMETER	
Tappet Bore Diameter	22.230-22.268mm (.875-.876 inch)
CAMSHAFT BORE INSIDE DIAMETER	
No. 1	56.013-55.987mm (2.205-2.204 inch)
No. 2	55.613-55.587mm (2.189-2.188 inch)
No. 3	55.613-55.587mm (2.189-2.188 inch)
No. 4	56.013-55.987mm (2.205-2.204 inch)

## CAMSHAFT

LOBE LIFT	Int-6.35mm (.249 inch) Exh-6.09mm (.239 inch)
Allowable Lobe Lift Loss	.127mm (.0049 inch)
THEORETICAL VALVE LIFT @ ZERO LASH	
Intake	9.957mm (.392 inch)
Exhaust	9.576mm (.377 inch)

## ENDPLAY

Service Limit	.229mm (.009 inch)
JOURNAL TO BEARING CLEARANCE	.025-.076mm (.001-.003 inch)
CAM BEARING I.D.	51.063-51.038mm (2.010-2.009 inch)
Runout Limit	.127mm (.005 inch)
Out-of-Round Limit	.127mm (.005 inch)

## CYLINDER BLOCK

HEAD GASKET SURFACE FLATNESS	.08 in Any 152.5 .15 Overall mm
HEAD GASKET SURFACE FINISH (RMS)	60-150
CYLINDER BORE	
Diameter	93.472-93.550mm (3.679-3.683 inch)
Surface Finish (RMS)	.18-.38
Out-of-Round Limit	.038mm (.0015 inch)
Out-of-Round Service Limit	.124mm (.0048 inch)
Taper Service Limit	.254mm (.010 inch)
MAIN BEARING BORE DIAMETER	61.011-60.990mm (2.402-2.401 inch)

## CRANKSHAFT AND FLYWHEEL

MAIN BEARING JOURNAL DIAMETER	57.120-57.124mm (2.2489-2.2490 inch)
Out-of-Round Limit	.0101mm (.0004 inch)
Taper Limit	.0076mm (.0003 inch)
Journal Runout Limit	.0050mm (.0002 inch)
Surface Finish (RMS)	12 micro inch
THRUST BEARING JOURNAL	
Length	32.38-32.43mm (1.275-1.277 inch)
CONNECTING ROD JOURNAL	
Diameter	53.92-53.94mm (2.1232-2.1240 inch)
Out-of-Round Limit	.0050mm (.0002 inch)
Taper Limit	.0076mm (.0003 inch)
Surface Limit (RMS)	12
MAIN BEARING THRUST FACE	
Surface Finish (RMS)	Front-35 micro Rear-25 micro
Runout Limit	.025mm (.0009 inch)
CRANKSHAFT END PLAY	.101-.203mm (.004-.008 inch)
CONNECTING ROD BEARINGS	
Clearance to Crankshaft	
Desired	.020-.038mm (.0008-.0015 inch)
Allowable	.020-.060mm (.0008-.0024 inch)
MAIN BEARINGS	
Clearance to Crankshaft	
Desired	.020-.038mm (.0008-.0015 inch)
Allowable	.020-.060mm (.0008-.0024 inch)

## CONNECTING ROD, PISTON AND RINGS

CONNECTING ROD	
Piston Pin Bore Diameter	23.104-23.144mm (.9096-.9112 inch)
Crankshaft Bearing Bore Diameter	56.866-56.886mm (2.2388-2.2396 inch)
Out-of-Round Limit — Piston Pin Bore	.0165mm (.00065 inch)
Taper Limit Piston Pin Bore	.038mm (.0015 inch)
Max. 1 inch Between Adjacent Points and Length of Bore	
Length (Center-to-Center)	138.57-138.64mm (5.4555-5.4585 inch)
ALIGNMENT (BORE-TO-BORE MAX. DIFF.)	
Twist	.076mm (.0029 inch)
Bend	.038mm (.0015 inch)
SIDE CLEARANCE (ASSEMBLED TO CRANK)	
Standard	.088-.266mm (.0035-.0105 inch)
Service Limit	.356mm (.014 inch)

## SPECIFICATIONS (Continued)

## PISTON

Diameter	
Coded Red	93.430-93.445mm (3.6783-3.6789 inch)
Coded Blue	93.460-93.475mm (3.6795-3.6801 inch)
Coded Yellow	93.490-93.502mm (3.6807-3.6811 inch)
PISTON-TO-BORE CLEARANCE	.036-.056mm (.0012-.0022 inch)
PIN BORE DIAMETER	23.175-23.183mm (.9124-.9127 inch)
RING GROOVE WIDTH	
Compression (Top)	2.03-2.06mm (.080-.081 inch)
Compression (Bottom)	2.03-2.06mm (.080-.081 inch)
Oil	4.78-4.80mm (.188-.189 inch)
PISTON PIN	
Length	70.1-69.3mm (2.75-2.73 inch)
Diameter	23.162-23.175mm (.9119-.9124 inch)
PIN TO PISTON CLEARANCE	.005-.0013mm (.0002-.0005 inch)
PIN TO ROD CLEARANCE	Interference Fit
PISTON RINGS	
Ring Width	
Compression (Top)	1.956-1.981mm (.077-.078 inch)
Compression (Bottom)	1.956-1.981mm (.077-.078 inch)
Oil Ring	Snug Fit

## PISTON — Continued

Ring Gap	
Compression (Top)	.203-.406mm (.008-.016 inch) (In 3.68 Gauge)
Compression (Bottom)	.203-.406mm (.008-.016 inch) (In 3.68 Gauge)
Oil Ring (Steel Rail)	.381-1.397mm (.015-.055 inch) (In 3.68 Gauge)
Side Clearance	
1st Ring	.051-.101mm (.002-.004 inch)
2nd Ring	.051-.101mm (.002-.004 inch)
Service Limit	.152mm (.006 inch)

## LUBRICATION SYSTEM

## OIL PUMP

Relief Valve Spring Tension	
(Force @ Length)	67.6-76.5N (15.2-17.2 Lbs.) @ 30.4mm (1.2 inch)
Relief Valve to Bore Clearance	.038-.073mm (.0015-.0029 inch)
Driveshaft to Housing Clearance	.036-.066mm (.0014-.0026 inch)
Rotor Assembly End Clearance	
(Assembled)	.101mm (.004 inch) Max.
Outer Rotor to Housing Clearance	.025-.300mm (.001-.012 inch)

OIL CAPACITY\*\*

CA9476-B

## SPECIAL SERVICE TOOLS

Tool Number	Description	Tool Number	Description
D81L-4201-A	Feeler Gauge	D81L-6135-A	Piston Pin Tool
TOOL-4201-C	Dial Indicator with Bracketry	T65L-6250-A	Camshaft Bearing Set
T77F-4220-B1	Diff. Bearing Cone Remover	T82T-6256-A2	Shaft Protector
T83T-4676-A	Pinion Oil Seal Installer	T74P-6375-A	Flywheel Holing Tool
T79P-6000-A	Engine Support Tool	T81P-6500-A	Tappet Collapser
D81L-6002-C	Piston Ring Compressor	T70L-6500-A	Hydraulic Tappet Puller
T84P-6019-C	Front Cover Aligner	T81P-6513-A	Valve Spring Compressor
T68P-6135-A	Piston Removal and Installation Set	T74P-6700-A	Front Cover Seal Remover
T84P-6065-A	Cylinder Head Alignment Studs	T81P-6701-A	Seal Installer
T84P-6065-B	Exhaust Manifold Alignment Studs	T77L-9533-B	Slide Hammer

CA9477-A

# SECTION 21-12 Engine, 3.0L

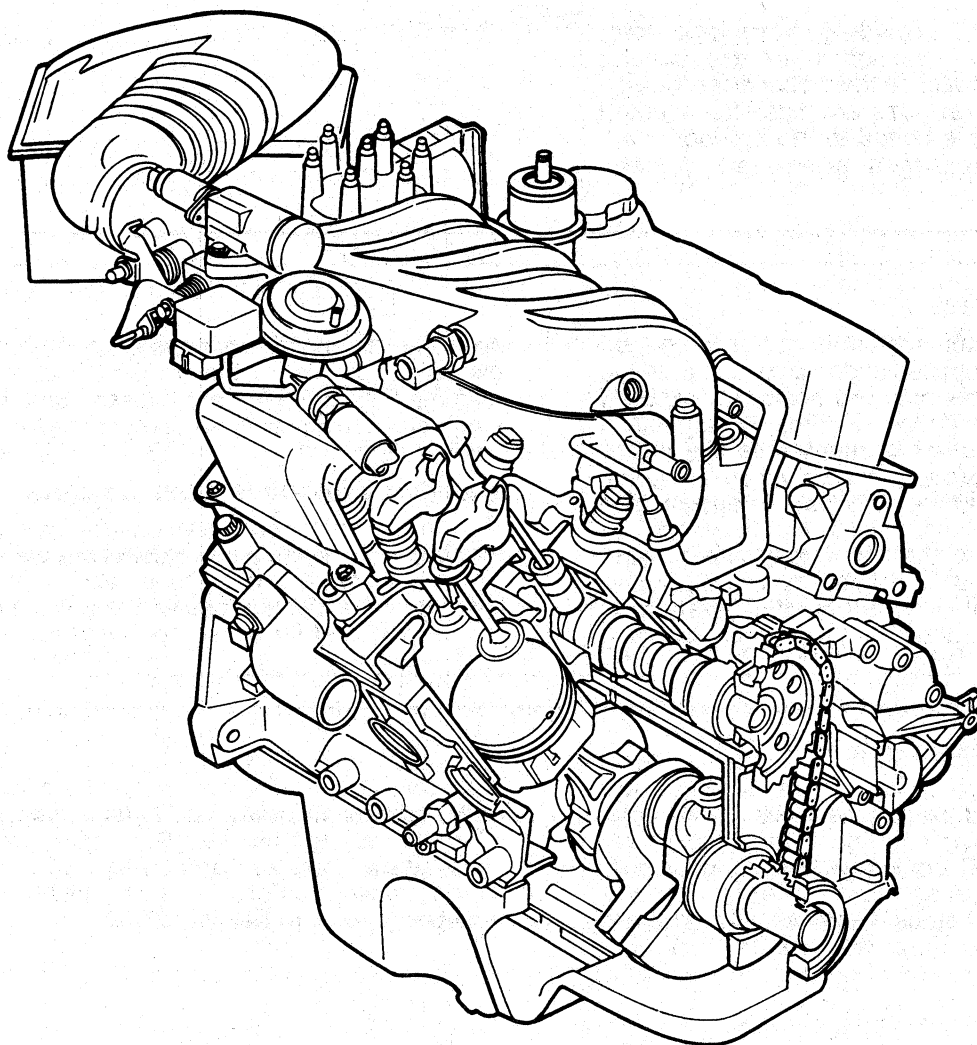
SUBJECT	PAGE	SUBJECT	PAGE
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## VEHICLE APPLICATION

Taurus/Sable.

## DESCRIPTION AND OPERATION

The 3.0L engine has a cast iron, V-block design with overhead valves. The engine is available with an automatic transaxle only and operates on unleaded fuel. The cast iron cylinder head features a central plug, dual squish combustion chamber. The V-6, 3.0L engine is compact and similar to a V-8 engine in construction and components.

**DESCRIPTION AND OPERATION (Continued)**

A9298-B

**Induction System**

The fuel/air mixture needed for burning in the cylinders is provided by Electronic Fuel Injection (EFI). Refer to Section 24-05 for EFI description and operation.

Fuel is supplied from the vehicle's fuel tank by a high pressure electric fuel pump mounted in the fuel tank. The fuel is filtered and sent to the fuel rails. A regulator on the fuel rail controls the fuel delivery pressure up to 269 kPa (39 psi). Excess fuel supplied by the pump, but not needed by the engine, is returned to the vehicle fuel tank by a fuel return line.

This fuel induction system is mounted on an aluminum intake manifold which in turn is bolted to cast iron cylinder heads. A spark plug thread service procedure is provided in the event damage should occur to these threads.

**Crankshaft and Camshaft**

The crankshaft is supported on the bottom of the cylinder block by four steel-backed, over-plated copper-lead main bearings. To provide smooth engine operation, the piston crankpins are positioned to provide a power impulse every 120 degrees of crankshaft rotation. This spacing provides smoothness of operation and quietness. Two sprockets and a timing chain connect the crankshaft with the camshaft and provide a 2:1 drive ratio.

The camshaft is installed in the block and is supported on four bearing inserts. Thrust loads and end play are limited by a thrust plate installed in the front of the camshaft. The distributor drive gear is located at the rear of the camshaft. The distributor drive gear is part of the camshaft casting.

**DESCRIPTION AND OPERATION (Continued)****Valve Train**

Hydraulic tappets, providing automatic lash adjustment, ride on camshaft lobes and transfer their up and down motion to the rocker arms through push rods. The rocker arms are pedestal-mounted and pivot on fulcrums bolted to the cylinder head. The valves are arranged alternately, intake/exhaust.

**Lubrication System**

The engine lubrication system is of the force-feed type in which oil is supplied under full pressure to the crankshaft and connecting rod bearings, hydraulic tappets and camshaft bearings. From the tappets, a controlled volume of oil is supplied to the rocker arms through the hollow push rods. All other moving parts are lubricated by gravity flow or splash. The rotary spur-type pump, which develops the oil pressure, is bolted to the No. 4 main bearing cap. The spur driven gear is rotated by the distributor shaft through an intermediate shaft. A full-flow oil filter is externally mounted on the engine block and

normally all engine oil passes through the filter element. However, if the element should become restricted, a spring-loaded bypass valve will open and allow an uninterrupted flow of oil to the engine's moving parts.

**Moulded Silicone Rubber Gaskets**

Many of the component mating surfaces which were formerly sealed with a cork gasket are being sealed with a moulded rubber silicone gasket. This gasket is used in the manufacture of the 3.0L engine and will be specified for service procedures.

**Two Belt Drive Belt System**

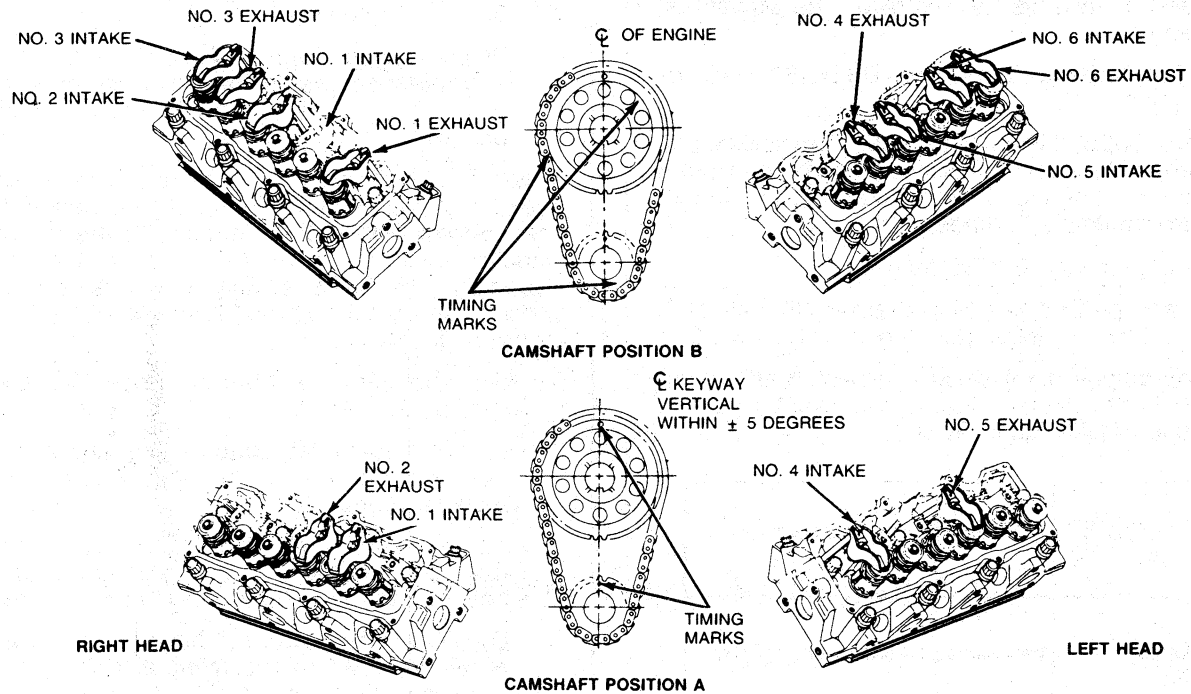
Accessories mounted on the front of the engine are belt-driven by the crankshaft. A single 6k rib Poly-Vee drive belt is routed over the water pump, power steering pump, A/C compressor, if so equipped, idler tensioning pulley, and is driven by the crankshaft pulley. Taurus/Sable vehicles use an additional V-belt to drive the alternator off the crankshaft pulley.

A second 4k Poly-Vee belt drives the alternator off of the crankshaft pulley, and is tensioned off of the alternator support bracket. Both drive belts use a "jack screw" bolt for applying tension to the belts during installation. For service procedures, including tensioning, refer to Section 27-02.



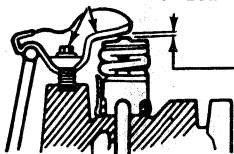
## INSPECTION

Refer to the following chart and illustrations for valve assembly inspection.



NOTE: CAMSHAFT POSITIONS "A" AND "B" ARE REQ'D TO PLACE TAPPET ASSY ON BASE CIRCLE OF CAMSHAFT LOBE TO CHECK COLLAPSED TAPPET GAP.

FULCRUM AND BOLT MUST BE FULLY SEATED AFTER FINAL TORQUE.



4.6-2.15mm (0.18-0.08 INCH)  
WITH TAPPET FULLY  
COLLAPSED ON BASE  
CIRCLE OF CAM LOBE

CYL. NO.	CAMSHAFT POSITION	
	A	B
	SET GAP OF VALVES NOTED	
1	INT.	EXH.
2	EXH.	INT.
3	NONE	INT.-EXH.
4	INT.	EXH.
5	EXH.	INT.
6	NONE	INT.-EXH.

A9316-B

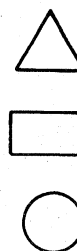
## REMOVAL AND INSTALLATION

## Engine Assembly

NOTE:

1. The engine assembly is removed out the top without the transaxle.
2. Support the front (bellhousing) end of the transaxle with a floor jack before disconnecting the transaxle from the axle.
3. Lift the engine as outlined in the lifting points procedure.

When removing and installing the engine, refer to the following illustrations. Wherever a triangle appears, it means service that particular component, a rectangle means remove or install and a circle means disconnect or connect.



REMOVAL	INSTALLATION
SERVICE	SERVICE
REMOVE	INSTALL
DISCONNECT	CONNECT

A9319-A

## REMOVAL AND INSTALLATION (Continued)

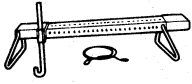

### Engine Lifting/Support Points

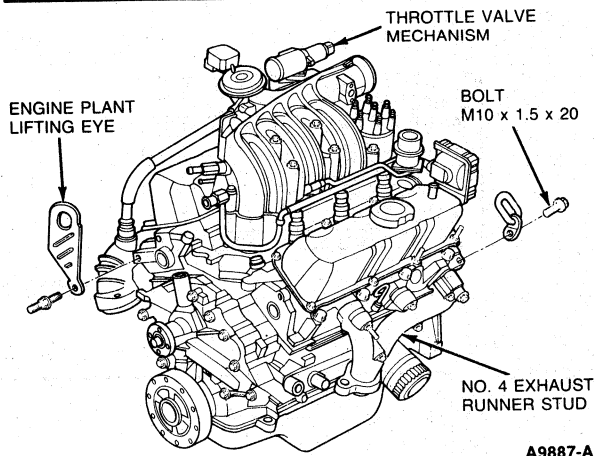
The lift points and procedures are to be used for removing the engine or supporting it during service, such as for transmission removal. The equipment required is:

- Engine Lifting Brackets D81L-6001-D or equivalent.
- Engine Support Bars D79P-6000-A or equivalent. An engine support bar may be fabricated from a length of 4x4 wood cut to appropriate length (approximately 57 inches).

Attach engine supports as follows:

1. Attach an Engine Lifting Bracket D81L-6001-D to LH rear cylinder with a bolt, M10x1.5x20.
2. The engine plant lifting eye should still be on RH front cylinder head. If not, install a second lifting bracket as in Step 1.

	D79P-6000-A	ENGINE SUPPORT BAR
	D81L-6001-D	ENGINE LIFTING BRACKET



If the engine is being removed, attach lifting chains from lifting brackets and lifting equipment. If the engine is to be supported during a service procedure, proceed with Step 3.

3. Place Engine Support Bars D79P-6000-A or equivalent across engine over each rocker arm cover and attach chains to bars and lifting brackets.

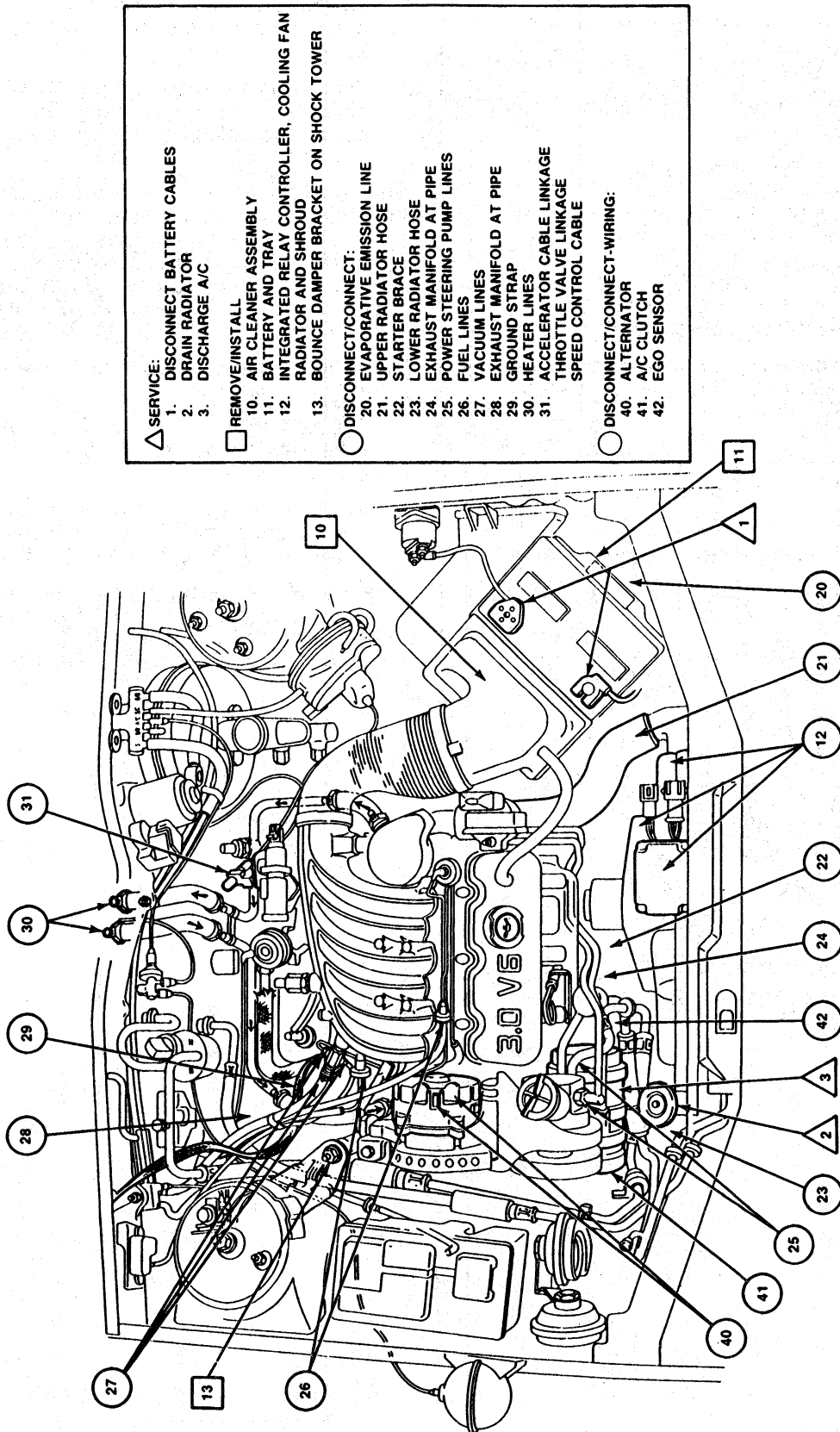
When only the two support points above are used, the engine assembly will hang slightly down at the rear (approximately 5 degrees) with the transaxle attached. With the transaxle removed, the engine assembly will hang slightly down at the front (approximately 15 degrees) because of the weight of the accessories.

To eliminate either or both of these tilts, attach supports as follows:

1. For the forward tilt, attach a chain from the LH front support bar to the stud on the No. 4 exhaust runner.
2. For the rearward tilt, attach a chain from the RH rear support bar to the exhaust manifold between the No. 2 and No. 3 exhaust runner.

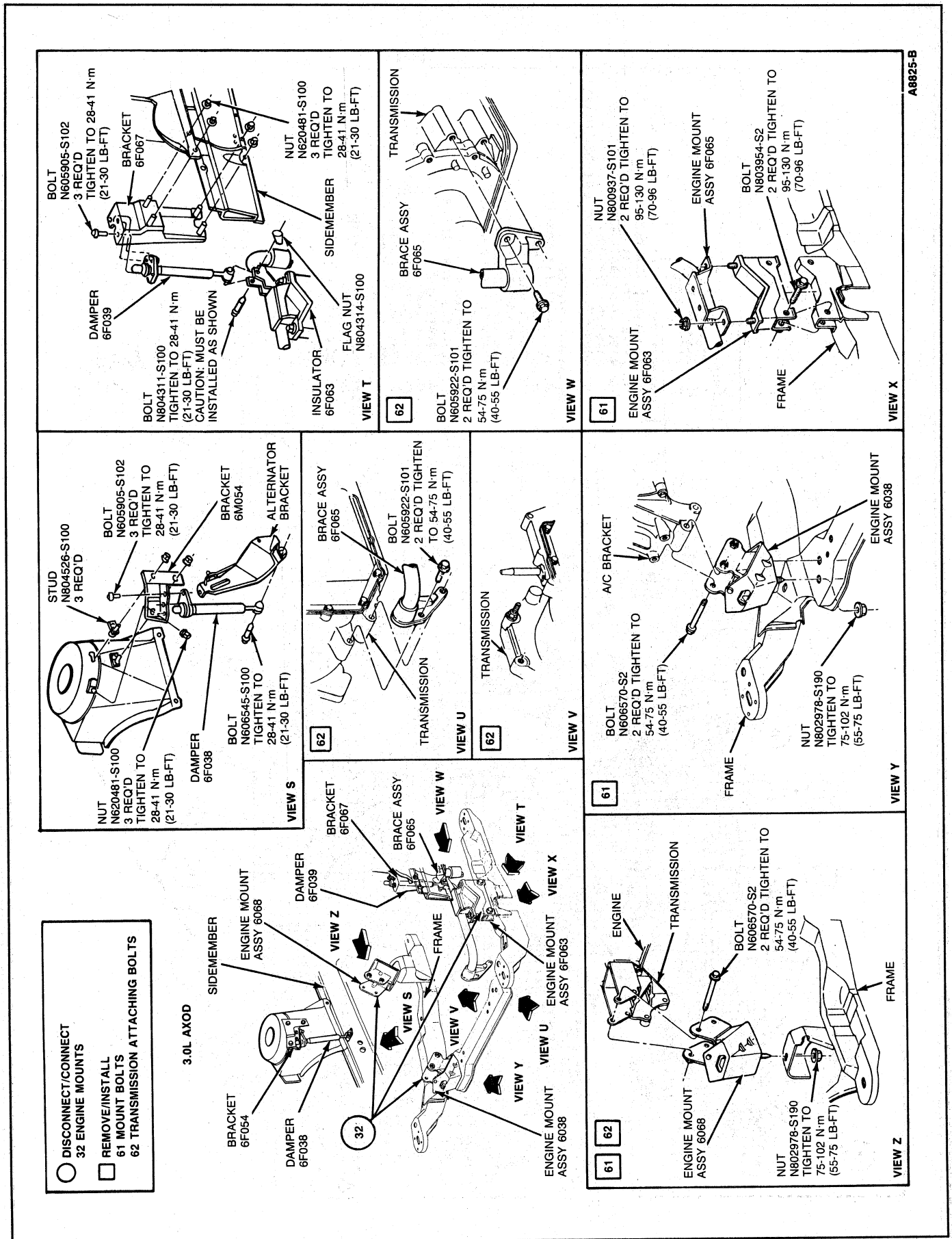
**CAUTION: The support hook or chain must angle forward to the front attaching point. Damage WILL result if it runs across the throttle cable or throttle valve mechanism.**

## REMOVAL AND INSTALLATION (Continued)

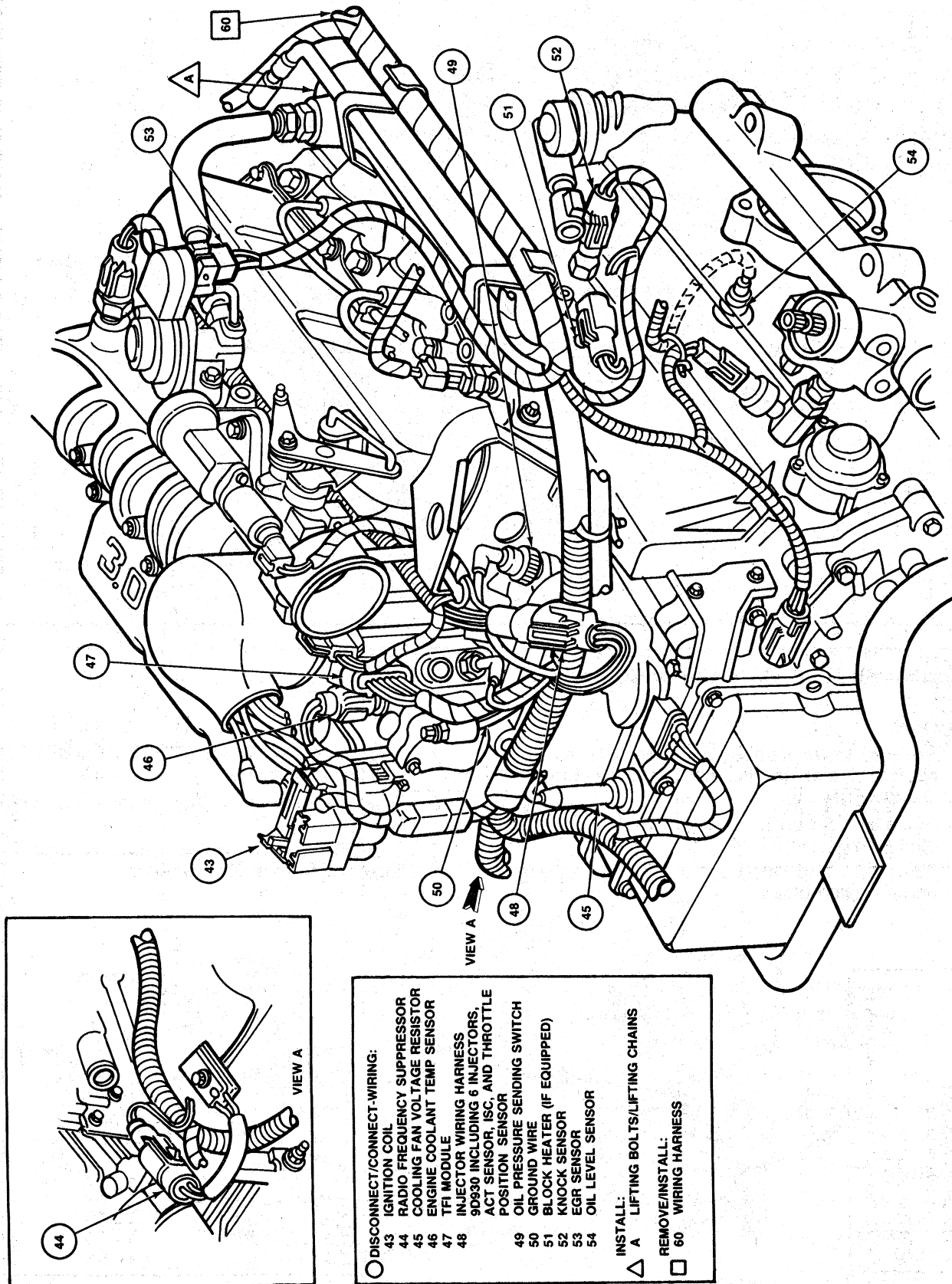


A9320-A

# REMOVAL AND INSTALLATION (Continued)

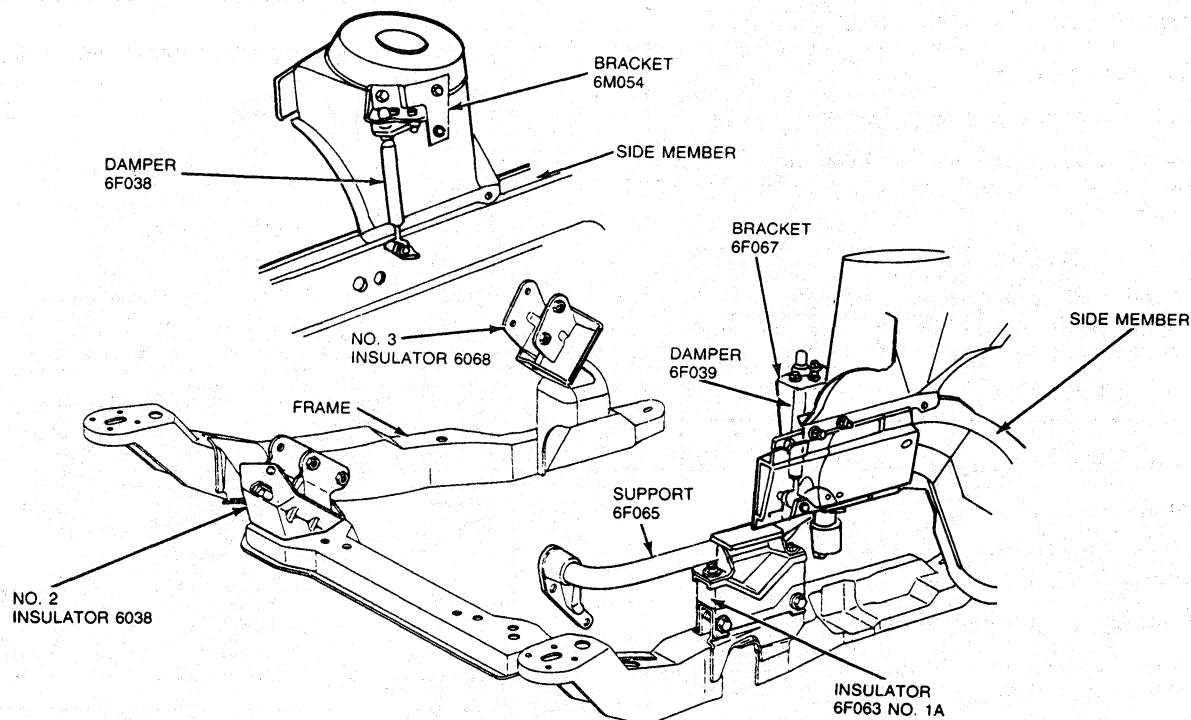


## REMOVAL AND INSTALLATION (Continued)



## REMOVAL AND INSTALLATION (Continued)

## Engine Mounts

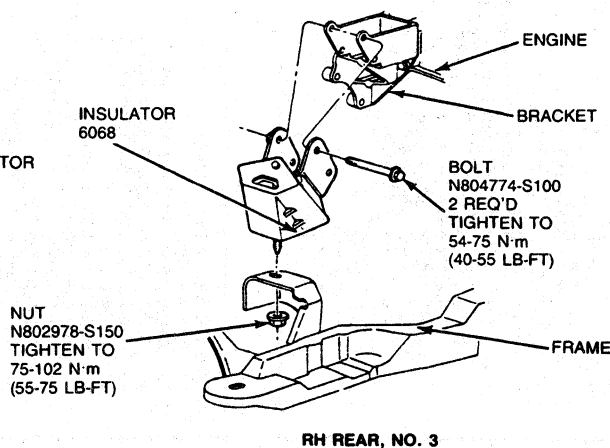
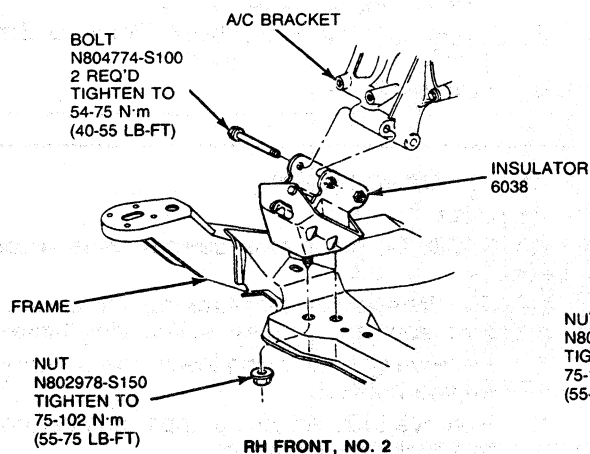


A9703-A

## Insulator, RH Front, No. 2 and/or RH Rear, No. 3

## Removal

1. Remove lower damper bolt from RH side of engine. Refer to illustration under Engine Damper, RH.
2. Raise vehicle on hoist. Refer to Pre-Delivery manual, Section 50-04.
3. Place jack and wood block in suitable place under engine block.
4. Remove nuts attaching RH front and RH rear insulators to frame.
5. Raise engine with jack (enough to unload insulator).
6. Remove two through bolts and remove insulator from engine bracket.



A9704-B

## REMOVAL AND INSTALLATION (Continued)

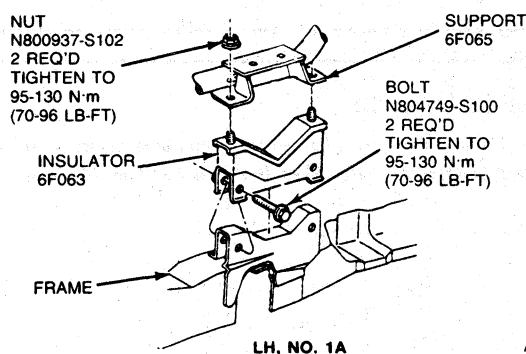
### Installation

1. Attach insulator to engine bracket with two through bolts. Tighten through bolts to 54-75 N·m (40-55 lb-ft). Refer to illustration under Removal, Step 6.
2. Lower engine down onto frame.
3. Install nuts attaching RH front and RH rear insulators to frame. Tighten nuts to 75-102 N·m (55-75 lb-ft).
4. Remove jack and lower vehicle.
5. Install bolt attaching RH engine damper to engine. Tighten bolt to 28-41 N·m (21-30 lb-ft). Refer to illustration under Engine Damper, RH.

### Insulator, LH and Support Assembly No. 1A

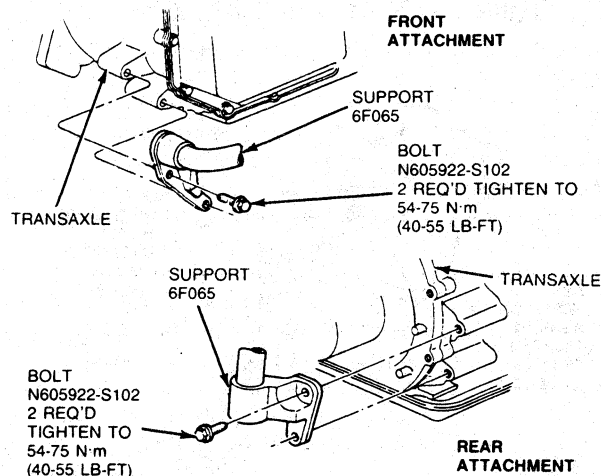
#### Removal

1. Raise vehicle on hoist. Refer to Pre-Delivery manual, Section 50-04.
2. Remove LH tire and wheel.
3. Place jack and wood block in suitable place under transmission and support transmission.
4. Remove bolt and flag nut attaching hydraulic engine damper to transmission support assembly. Push damper shaft up out of the way. Refer to illustration under Engine Damper, LH.
5. Remove two nuts attaching insulator to support assembly.
6. Remove two through bolts attaching insulator to frame.



A9706-B

7. Raise transmission with jack (enough to unload insulator).
8. Remove bolts attaching support assembly to transmission.
9. Remove insulator and/or transmission support assembly.



A9707-A

### Installation

1. Loosely install insulator to support assembly and frame.
2. Attach support assembly to transmission. Tighten bolts to 54-75 N·m (40-55 lb-ft). Refer to illustration under Removal, Step 9.
3. Attach insulator to frame with two through bolts. Tighten bolts to 95-130 N·m (70-96 lb-ft).
4. Lower transmission (enough to load insulator).
5. Attach insulator to support assembly with two nuts. Tighten nuts to 95-130 N·m (70-96 lb-ft). Refer to illustration under Removal, Step 6.
6. Attach damper shaft to support assembly using a new flag nut. Tighten bolt to 28-41 N·m (21-30 lb-ft). Refer to illustration under Engine Damper, LH.
7. Remove jack.
8. Install LH tire and wheel. Refer to Section 11-01.
9. Lower vehicle.

### Engine Damper, RH

#### Removal

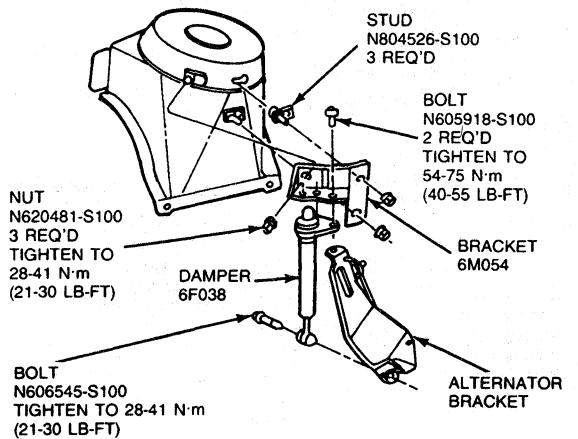
**CAUTION:** Do not clamp damper tube or piston rod.

**NOTE:** Whenever self-locking fasteners are removed, replace with new self-locking fasteners.

1. Remove bolt attaching lower end of damper to engine bracket.
2. Remove bolts attaching upper damper bracket to shock tower bracket.
3. Remove engine damper.

**REMOVAL AND INSTALLATION (Continued)****Installation**

1. Position engine damper lower sleeve to line up with engine bracket notch. Secure with a new bolt. Tighten to 28-41 N·m (21-30 lb-ft).
2. Position engine damper with upper bracket to shock tower bracket. Secure with new bolts. Tighten to 28-41 N·m (21-30 lb-ft).



A9708-B

**Engine Damper, LH****Removal**

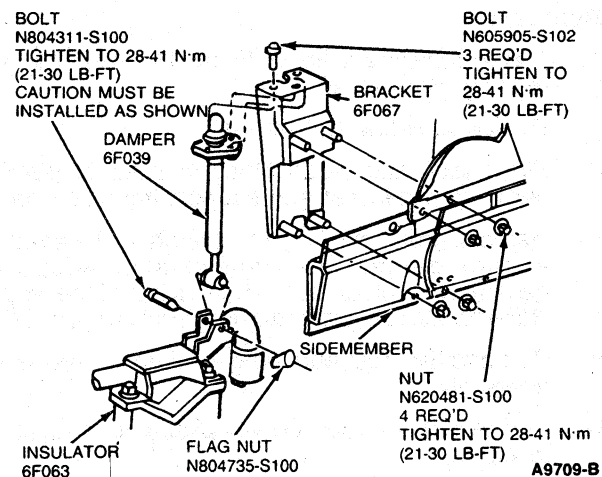
**CAUTION:** Do not clamp damper tube or piston rod.

**NOTE:** Whenever self-locking fasteners are removed, replace with new self-locking fasteners.

1. Remove speed control servo and bracket assembly. Refer to Section 37-05.
2. Remove bolt and flag nut attaching lower end of damper to No. 1A engine mount attaching bracket.
3. Remove bolts attaching upper damper bracket to side rail bracket.
4. Remove engine damper.

**Installation**

1. Insert lower end of damper into engine mount attaching bracket being careful to align groove in damper sleeve with notch in bracket.
  2. Insert bolt through bracket and damper and hand start new flag nut. Tighten bolt to 28-41 N·m (21-30 lb-ft).
- NOTE:** Bolt must be inserted with head toward engine.
3. Pull damper into position against side rail mounting bracket. Secure with three new bolts. Tighten to 28-41 N·m (21-30 lb-ft).
  4. Install speed control servo and bracket assembly. Refer to Section 37-05.



A9709-B

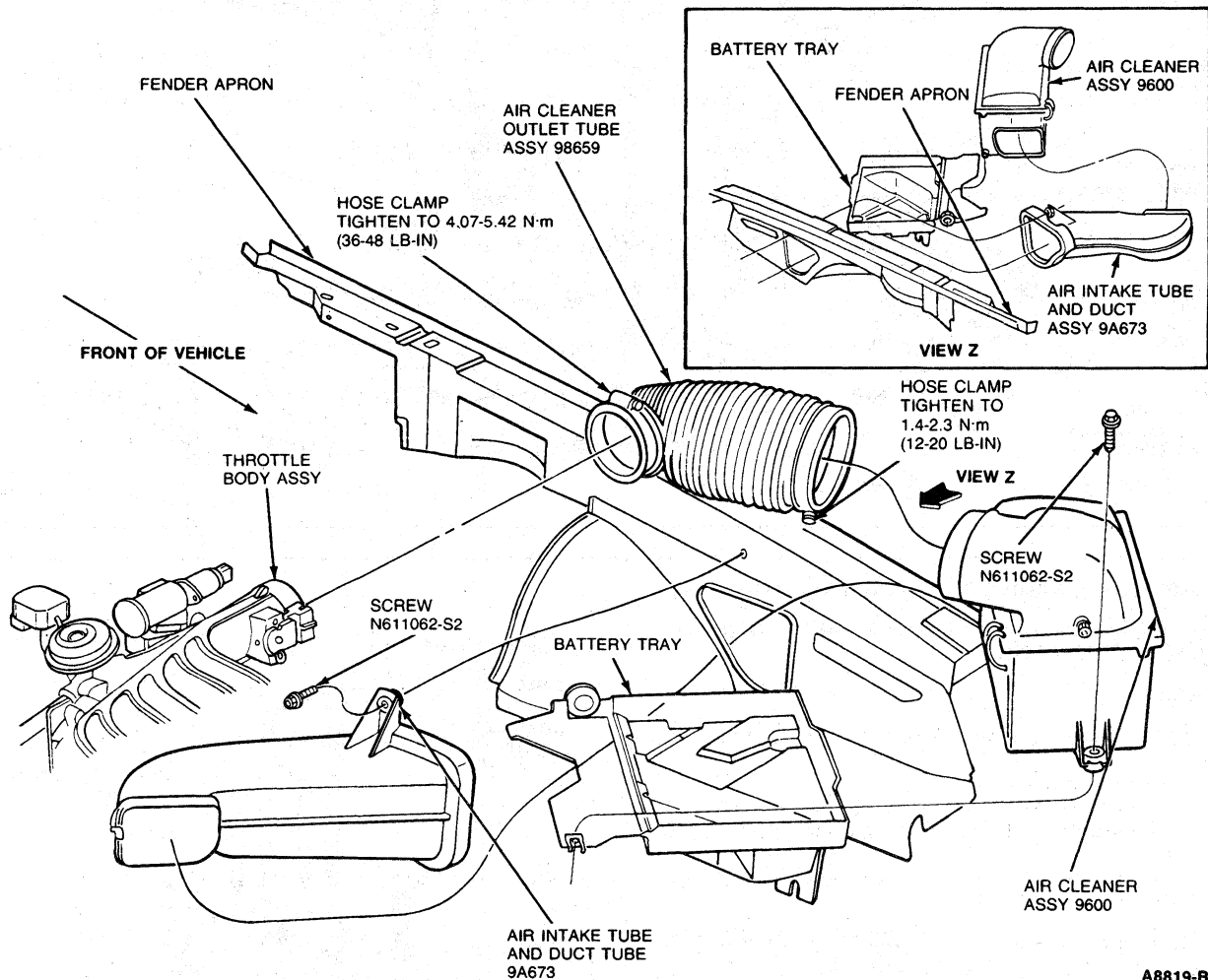
**Engine In-Vehicle**

**NOTE:** These Removal and Installation procedures can be performed with the engine in the vehicle.



**REMOVAL AND INSTALLATION (Continued)****Throttle Body****Removal and Installation**

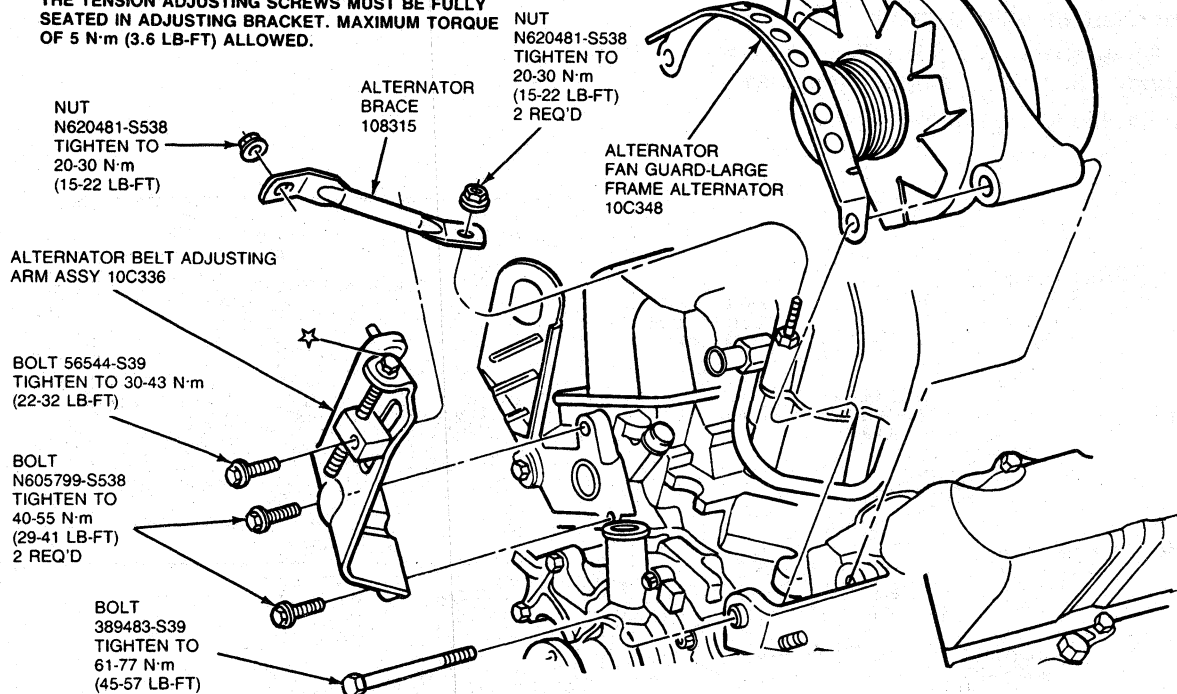
1. Disconnect battery ground cable.
2. Loosen hose clamp attaching flex hose to throttle body. Remove air cleaner flex hose.
3. Remove throttle linkage snowshield.



4. Loosen and disconnect all vacuum connections to throttle body.
5. Disconnect EGR valve assembly as outlined.
6. Disconnect throttle linkage. Refer to Section 24-60.
7. Disconnect Throttle Position (TP) sensor, air charge temperature (ACT) sensor and idle speed control (ISC).
8. Disconnect PCV hose.
9. Disconnect alternator support brace.

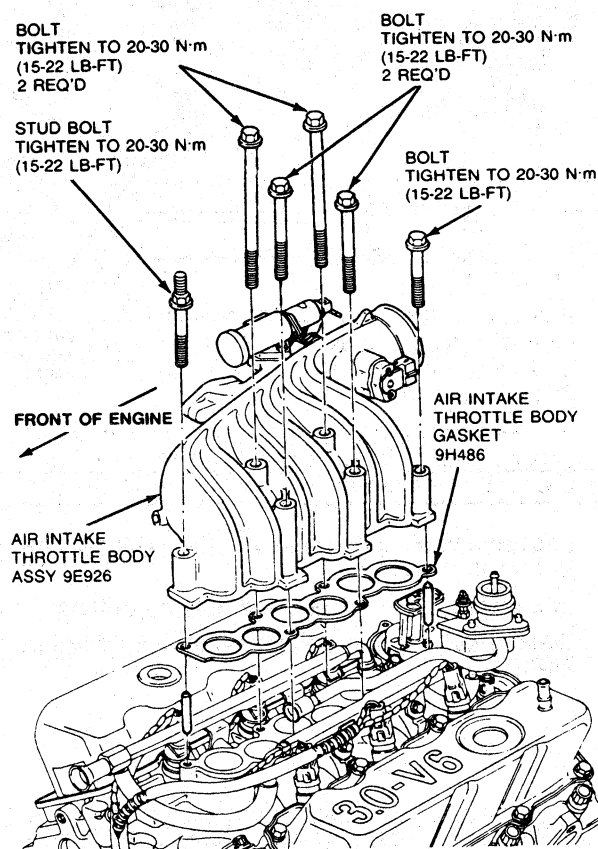
## REMOVAL AND INSTALLATION (Continued)

★ NOTE: IF BELTS ARE TENSIONED WITHOUT USING THE TENSION ADJUSTING SCREWS, THE TENSION ADJUSTING SCREWS MUST BE FULLY SEATED IN ADJUSTING BRACKET. MAXIMUM TORQUE OF 5 N·m (3.6 LB-FT) ALLOWED.



A8820-B

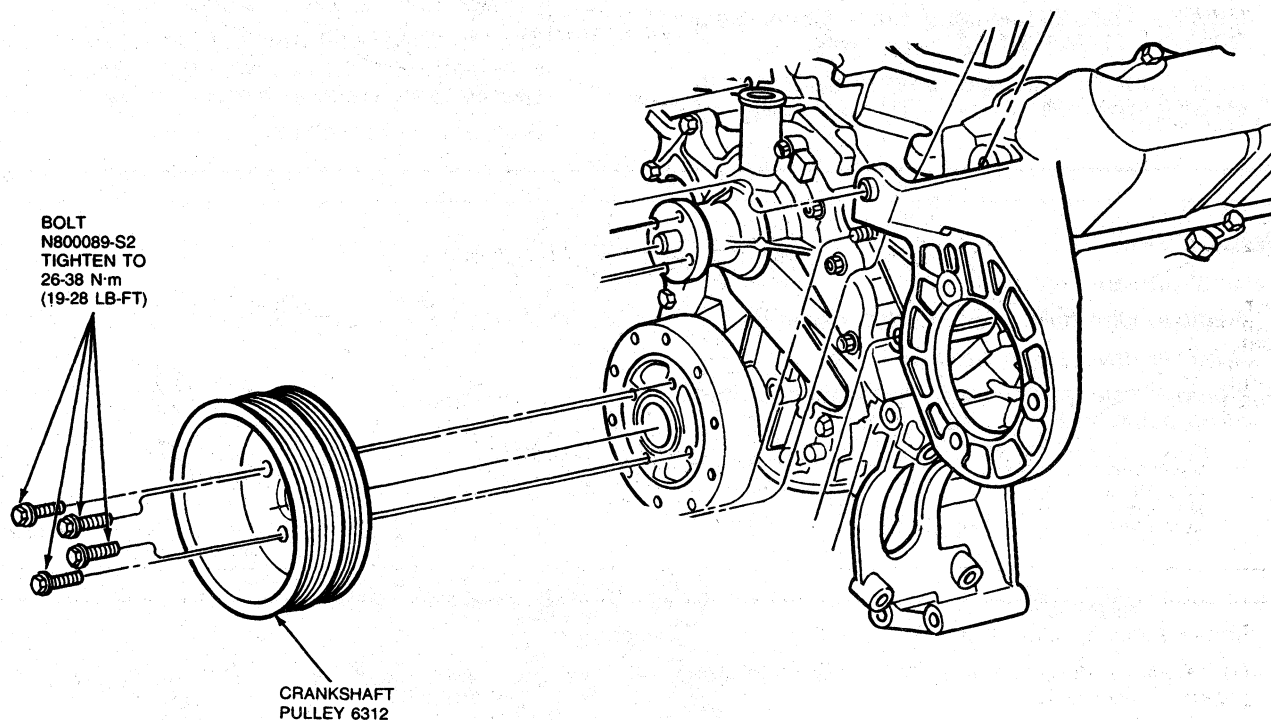
10. Remove six throttle body attaching bolts.
11. To install, reverse Steps 1 through 9. Replace gasket if necessary.



A8581-A

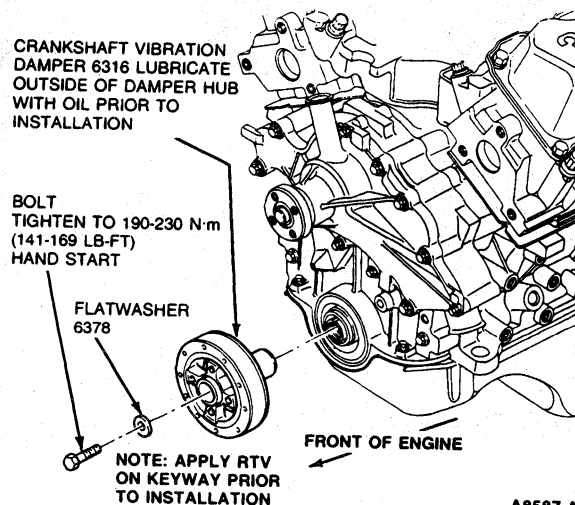
**REMOVAL AND INSTALLATION (Continued)****Crankshaft Pulley/Damper/Front Oil Seal****Removal**

1. Loosen accessory drive belts.
2. Remove RH front wheel.
3. Remove four pulley-to-damper attaching bolts.



A8588-B

4. Disengage accessory drive belt and remove crankshaft pulley.
5. Remove damper from crankshaft using Crankshaft Damper Remover T58P-6316-D and Vibration Damper Remover Adapter T82L-6316-B or equivalent.
6. Pry seal from timing cover with a flat blade screwdriver or other similar tool. Use care to prevent damage to front cover and crankshaft.



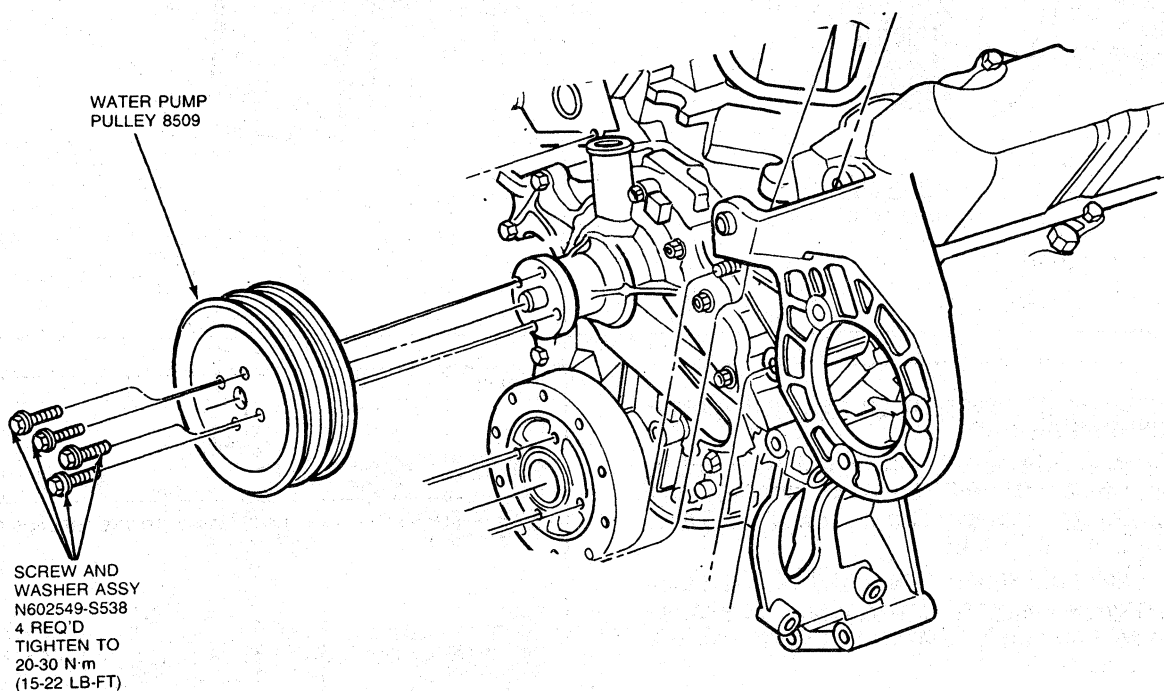
A8587-A

**REMOVAL AND INSTALLATION (Continued)****Installation**

1. Inspect front cover and shaft seal surface of the crankshaft damper for damage, nicks, burrs or other roughness which may cause the new seal to fail. Service or replace components as necessary.
2. Lubricate seal lip with clean engine oil and install seal using Vibration Damper Seal Installer T82L-6316-A and Front Cover Seal Replacer T70P-6B070-A or equivalent.
3. Coat crankshaft damper sealing surface with clean engine oil. Apply RTV to keyway of damper prior to installation. Install damper using Vibration Damper Seal Installer T82L-6316-A.
4. Position crankshaft pulley and install attaching bolts. Tighten attaching bolts to 26-38 N·m (19-28 lb-ft).
5. Position drive belt over crankshaft pulley.
6. Check drive belt for proper routing and engagement in the pulleys. Adjust drive belt to specification. Refer to Section 27-02.
7. Start engine and check for oil leaks.

**Timing Cover****Removal and Installation**

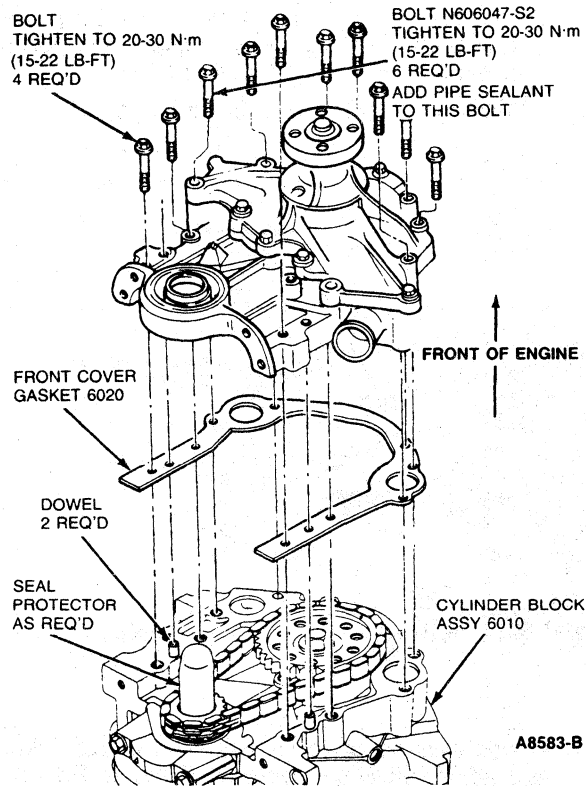
1. Remove idler pulley and bracket assembly.
2. Remove drive and accessory belts.
3. Remove four pulley to pump hub bolts, and allow pulley to hang loose on hub.



A8817-B

## REMOVAL AND INSTALLATION (Continued)

4. Remove crankshaft pulley and damper.
5. Remove lower radiator hose.
6. Remove oil pan.
7. Unbolt front cover and water pump by removing ten bolts.

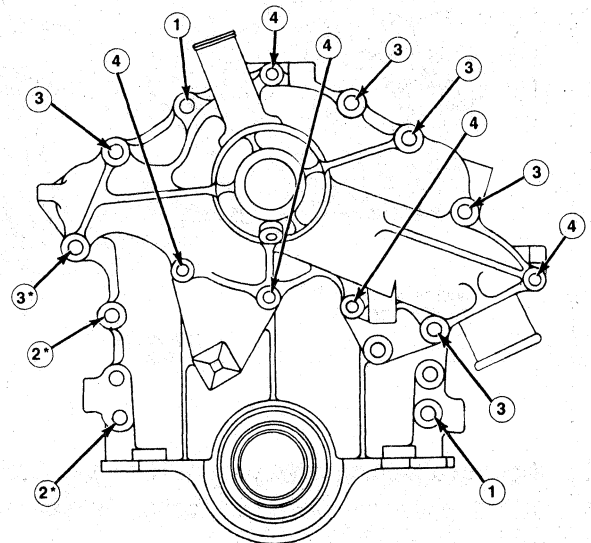


8. Remove loose pulley from water pump hub.  
NOTE: DO NOT cut and seal oil pan gasket. Either reuse or replace entire gasket.
9. Install new crankshaft seal in front cover.
10. To Install, reverse Steps 1 through 9.  
NOTE: Use sealant for front cover bolts which go into water jacket of block.

## Water Pump

### Removal

1. Drain cooling system.
2. Loosen accessory drive belt idler. Remove drive belts.
3. Remove two nuts and one bolt attaching idler bracket to engine.
4. Disconnect heater hose at water pump.
5. Remove the four pulley-to-pump hub bolts. The pulley will remain loose on the hub due to insufficient clearance between body and pump restricting removal from vehicle.
6. Remove 11 water pump-to-engine attaching bolts.



NUMBER	PART NUMBER	SIZE	QTY	N·m	LB-FT
1	N605909-SB	M8 x 1.25 x 42.0	2	20-30	15-22
2	N804113-S8	M8 x 1.25 x 43.5 (LARGE HEX)	2	20-30	15-22
3	N606547-S8	M8 x 1.25 x 70.0	6	20-30	15-22
4	N804168-S8	M6 x 1.0 x 25.0	5	8-12	6-8

NOTE: APPLY PIPE SEALANT D6AZ-19558-A TO THE THREADS OF THESE BOLTS

A8818-B

7. Lift water pump and pulley up and out of vehicle.

## REMOVAL AND INSTALLATION (Continued)

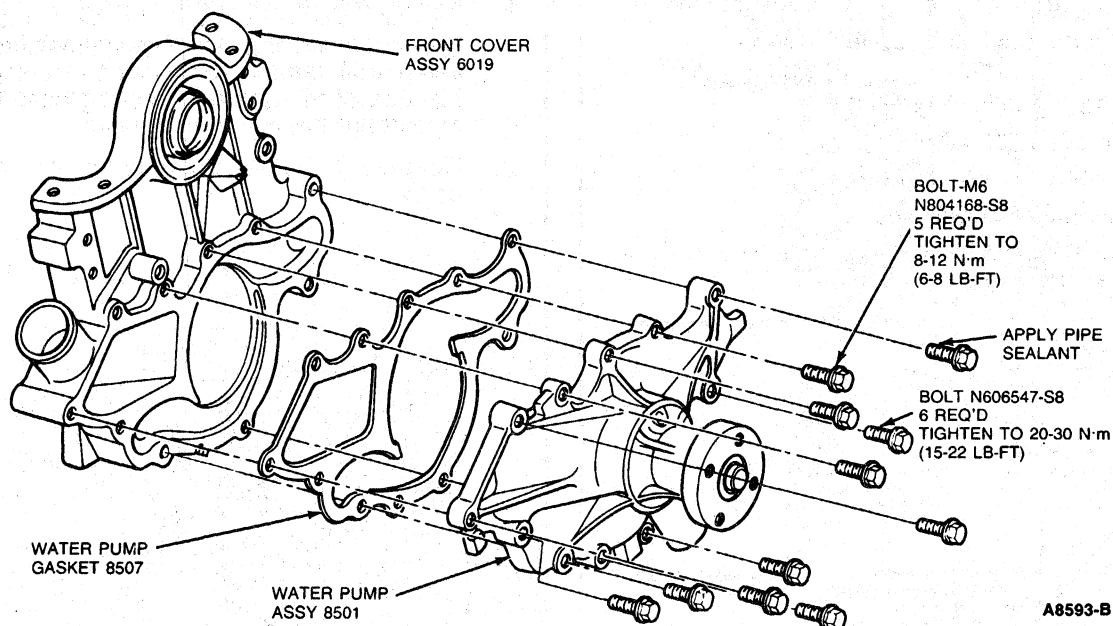
## Installation

NOTE: Lightly oil all bolt and stud threads before installation except those specifying special sealant.

1. Clean gasket surfaces on water pump and front cover.
2. Position a new gasket on water pump sealing surface using Contact Adhesive D7AZ-19B508-A or equivalent to hold the gasket in position.

3. With pulley positioned on water pump hub, position water pump on the front cover and install attaching bolts. **CAUTION: Two lengths of bolts are used to attach water pump. Install bolts as shown.**

NOTE: Use sealant for front cover bolt which goes into water jacket of block.



4. Tighten attaching bolts to 8-12 N·m (6-8 lb-ft).
5. Install pulley-to-pump hub bolts. Tighten to 20-30 N·m (15-22 lb-ft).
6. Connect coolant bypass/heater hose to water pump.
7. Install idler bracket to front cover.
8. Position accessory drive belt over pump pulley and adjust drive belt tension. Refer to Section 27-02.
9. Fill and bleed cooling system.
10. Start engine and check for coolant leaks.

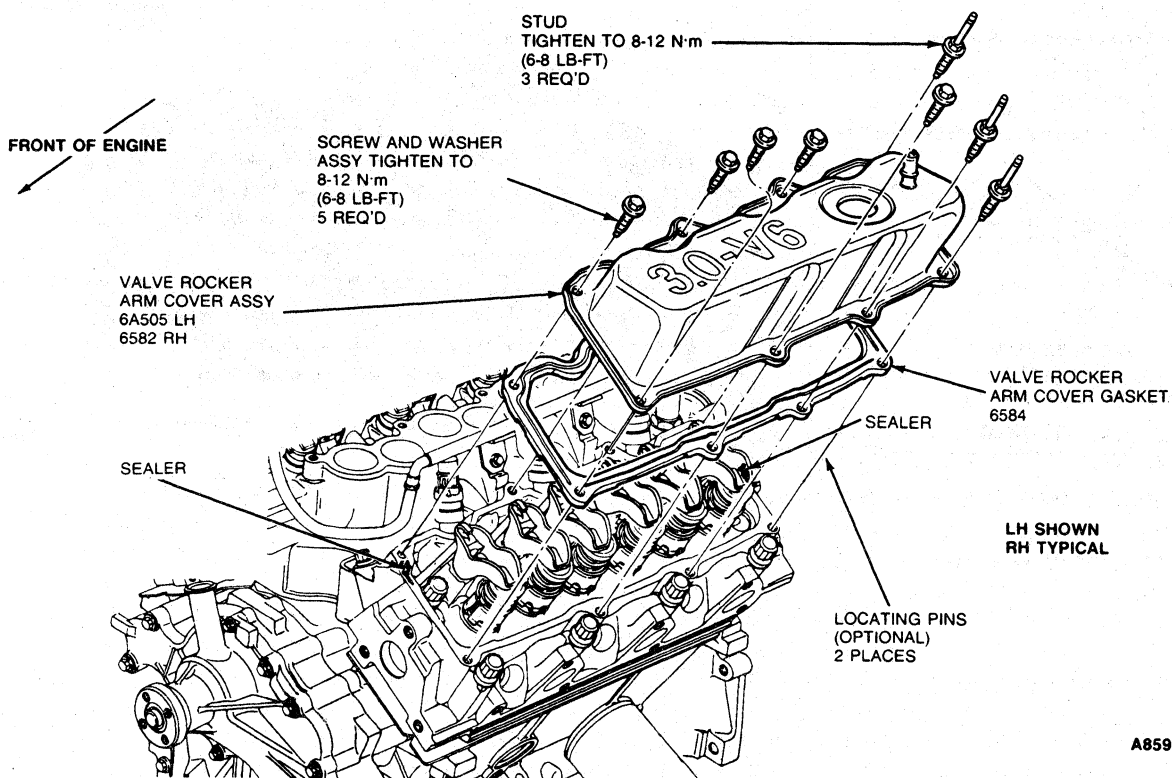
**REMOVAL AND INSTALLATION (Continued)****Rocker Arm Cover****Removal**

1. Disconnect ignition wires from spark plugs.
2. Remove ignition wire separators from the rocker arm cover attaching bolt studs (three places per cover).
3. If LH rocker arm cover is being removed perform the following:
  - Remove oil fill cap.
  - Disconnect closure system hose.
4. If RH rocker arm cover is being removed, perform the following:
  - Remove PCV valve.
  - Disconnect EGR tube.
  - Disconnect heater hoses.
5. Remove rocker arm cover attaching screws and remove cover.

**Installation**

NOTE: Lightly oil all bolt and stud threads before installation. Using solvent, clean cylinder head and rocker arm cover sealing surfaces to remove all gasket material and dirt.

1. Apply bead of RTV silicone sealant at cylinder head to intake manifold rail step (two places per rail). Position a new gasket into place.
2. Position cover on the cylinder head and install five attaching bolts and three attaching studs. Note the location of the ignition wire separator clip stud bolts. Tighten attaching bolts to 9-12 N·m (80-106 lb-in).



A8592-A

3. If LH rocker arm cover is being installed, perform the following:
  - Install oil fill cap.
  - Connect PCV closure hose.
4. If the RH rocker arm cover is being installed perform the following:
  - Install PCV valve.
  - Connect EGR tube. Tighten to 35-50 N·m (25-36 lb-ft).
5. Install ignition wire separators.
6. Connect ignition wires to the spark plugs.
7. Start engine and check for fuel, coolant and oil leaks.

**REMOVAL AND INSTALLATION (Continued)****Intake Manifold****Removal**

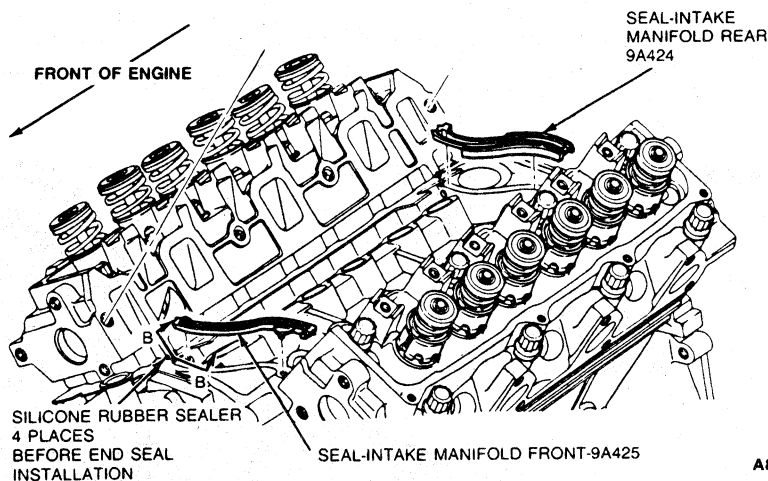
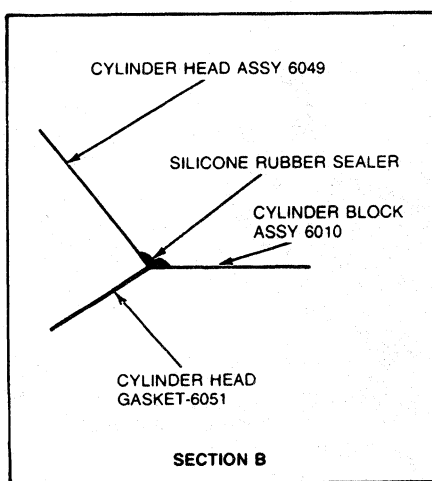
1. Drain engine cooling system.
  2. Disconnect battery ground cable.
  3. Remove throttle body as outlined.
  4. Disconnect fuel lines as outlined.
  5. Remove fuel injector wiring harness from engine.
  6. Disconnect upper radiator hose.
  7. Disconnect water outlet heater hose.
  8. Mark and remove distributor assembly.
  9. Remove intake manifold attaching bolts/studs.
- Remove manifold side gaskets and end seals, and discard. Manifold assembly can be removed with fuel rails and injectors in place.

**Installation**

NOTE: Lightly oil all attaching bolts and stud threads before installation.

NOTE: When using silicone rubber sealer, assembly must occur within 15 minutes after sealer application. After this time, the sealer may start to set-up, and its sealing effectiveness may be reduced. In high temperature/humidity conditions RTV will start to "skin over" in about 5 minutes.

1. The intake manifold, cylinder head and cylinder block mating surfaces should be clean and free of old silicone rubber sealer. Use a suitable solvent to clean these surfaces.
2. Apply Silicone Rubber Sealer D6AZ-19562-A or equivalent, to intersection of cylinder block assembly and head assembly at four corners as shown.

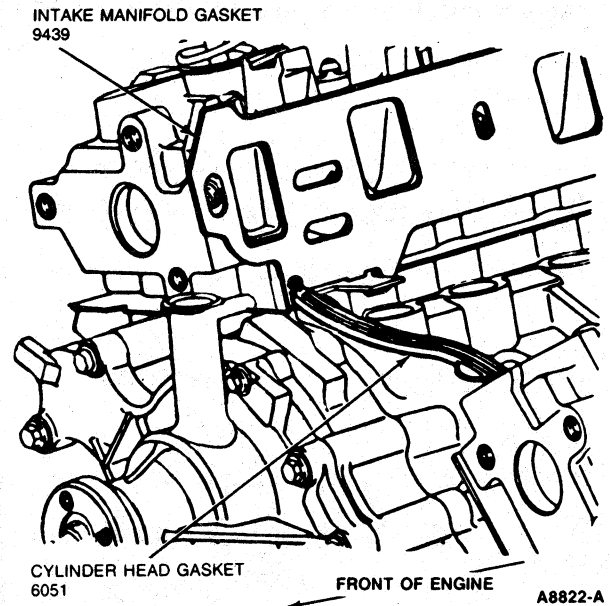
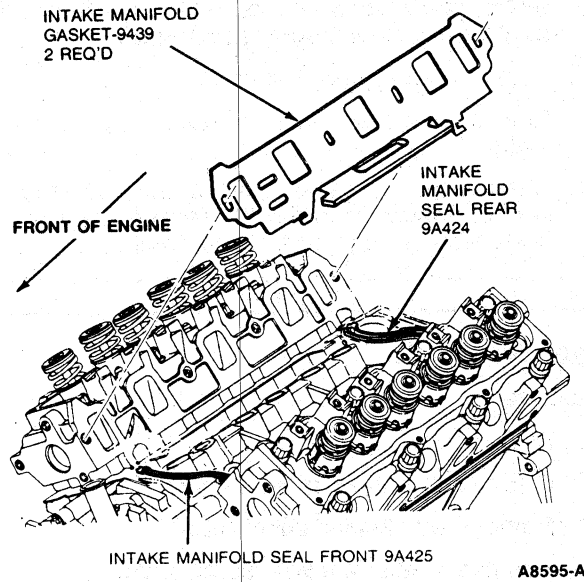


A8821-A

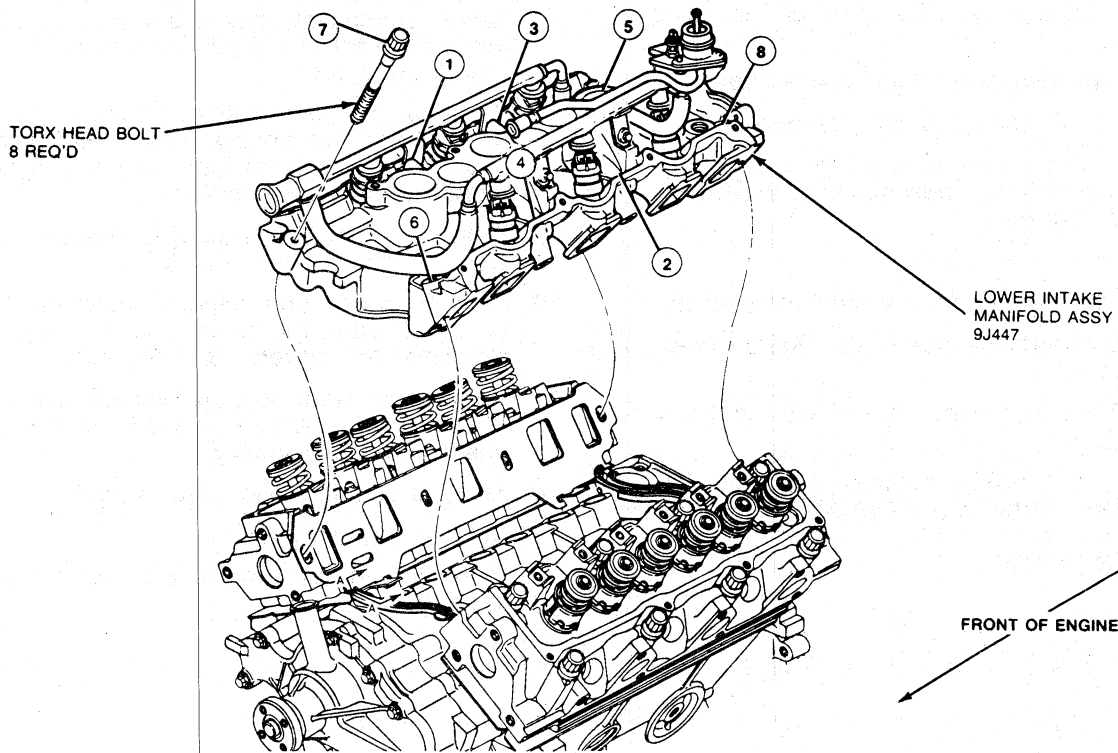


## REMOVAL AND INSTALLATION (Continued)

3. Install front intake manifold seal and rear intake manifold seal. Secure with retaining features.
4. Position intake manifold gaskets in place and insert locking tabs over tabs on cylinder head gaskets as shown.

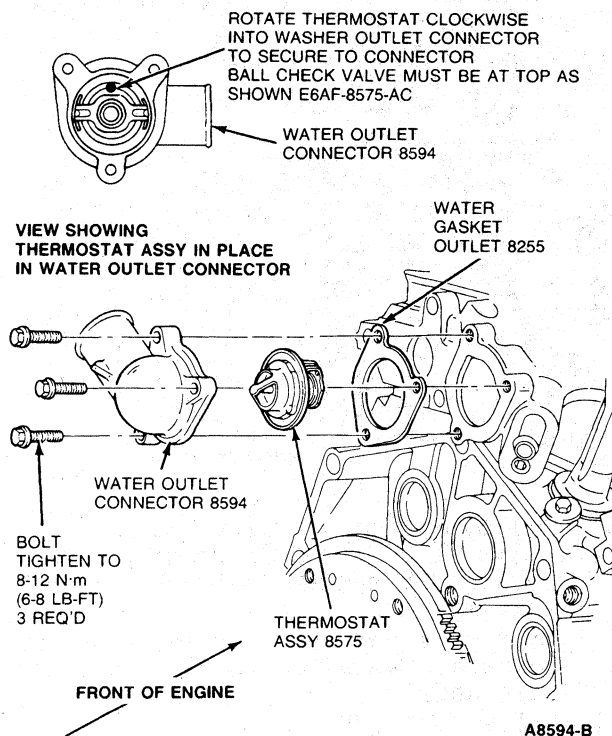


5. Carefully lower intake manifold into position on cylinder block and cylinder heads to prevent smearing the silicone sealer and causing gasketing voids.
6. Install bolts and tighten in the numerical sequence shown to the following specifications in two steps:
  - 15 N·m (11 lb-ft).
  - 24 N·m (18 lb-ft).



## REMOVAL AND INSTALLATION (Continued)

7. Install thermostat housing and new gasket. Tighten attaching bolts to 8-12 N·m (6-8 lb-ft).



8. Connect PCV line at PCV valve and exhaust manifold.
9. Connect necessary electrical connectors.
10. Connect EGR valve assembly as outlined.
11. Connect necessary vacuum hoses. Apply silicone sealer to split between head and intake manifold (four places).
12. Install rocker arm cover.
13. Connect heater tube hose to the heater elbow.
14. Connect coolant bypass hose. Tighten hose clamp securely.
15. Connect radiator upper hose. Tighten hose clamp securely.
16. Connect fuel line(s) at fuel charging assembly using Tube Spring Lock Coupler T83P-19623-C, or equivalent. Replace fuel line(s) and connector O-rings.

17. Install air cleaner outlet tube.
18. Fill and bleed cooling system with specified coolant.

**CAUTION: This engine has aluminum components and requires a special unique corrosion inhibited coolant formulation to avoid radiator damage. Refer to Section 27-01 for coolant specifications.**

19. Connect battery ground cable.
20. Start engine and check for coolant, oil or fuel leaks.
21. Check and, if necessary, adjust the engine idle speed, transmission throttle linkage (overdrive transmission only) and speed control.

## Cylinder Heads

### Removal

1. Drain cooling system.
2. Disconnect battery ground cable.
3. Remove air cleaner outlet tube.
4. Remove intake manifold as outlined.
5. Loosen accessory drive belt idler. Remove drive belt.
6. If LH cylinder head is being removed, remove alternator adjusting arm. If RH cylinder head is being removed, remove accessory belt idler.
7. If equipped with power steering, remove pump mounting brackets attaching bolts. Leaving the hoses connected, place the pump/bracket assembly aside in a position to prevent the fluid from leaking out.
8. If LH cylinder head is being removed, remove coil bracket and dipstick tube. If RH cylinder head is being removed, remove grounding strap throttle cable support bracket.
9. Remove exhaust manifold(s). Remove PCV valve and rocker arm covers.
10. Loosen rocker arm fulcrum attaching bolts enough to allow the rocker arm to be lifted off the push rod and rotated to one side.
11. Remove push rods. Identify the position of each rod. The rods should be installed in their original position during assembly.
12. Remove cylinder head attaching bolts.
13. Remove cylinder head(s).
14. Remove and discard the old cylinder head gasket(s).

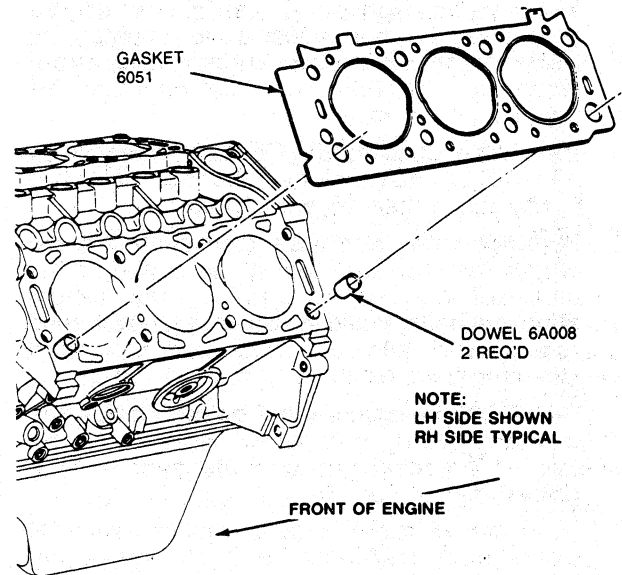
## REMOVAL AND INSTALLATION (Continued)

### Installation

**NOTE:** Lightly oil all bolt and stud bolt threads before installation except those specifying special sealant.

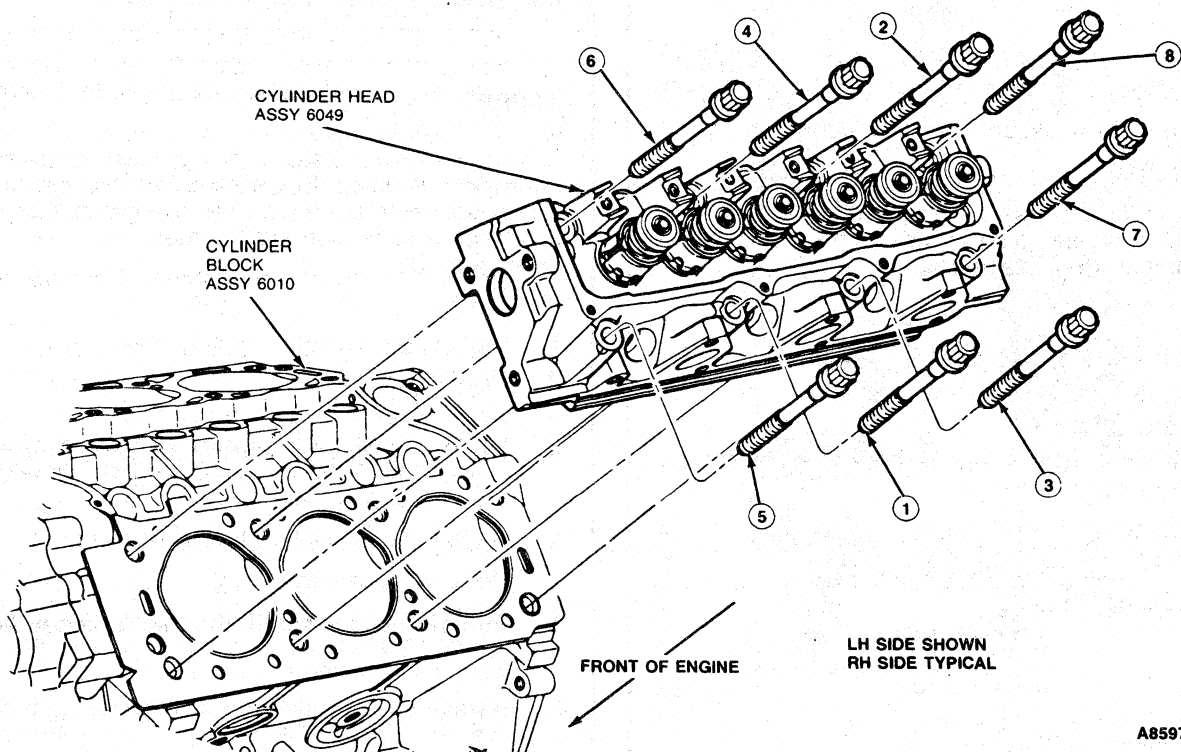
1. Clean cylinder head, intake manifold, rocker arm cover and cylinder head gasket surfaces. If the cylinder head was removed for a cylinder head gasket replacement, check the flatness of the cylinder head and block gasket surfaces. Refer to Section 21-01.
2. Position new head gasket(s), noting UP designation on gasket face, on cylinder block using the dowels for alignment.

**NOTE:** Replace dowels if damaged.



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3. Position cylinder head(s) on block.
4. Tighten the cylinder head attaching bolts in two tightening steps in the following sequence:
  - 65-75 N·m (48-54 lb-ft).
  - 85-110 N·m (63-80 lb-ft).



A8597-B

## REMOVAL AND INSTALLATION (Continued)

NOTE: When cylinder head attaching bolts have been tightened using the above procedure, it is not necessary to retighten the bolts after extended engine operation. However, the bolts can be checked for tightness if desired.

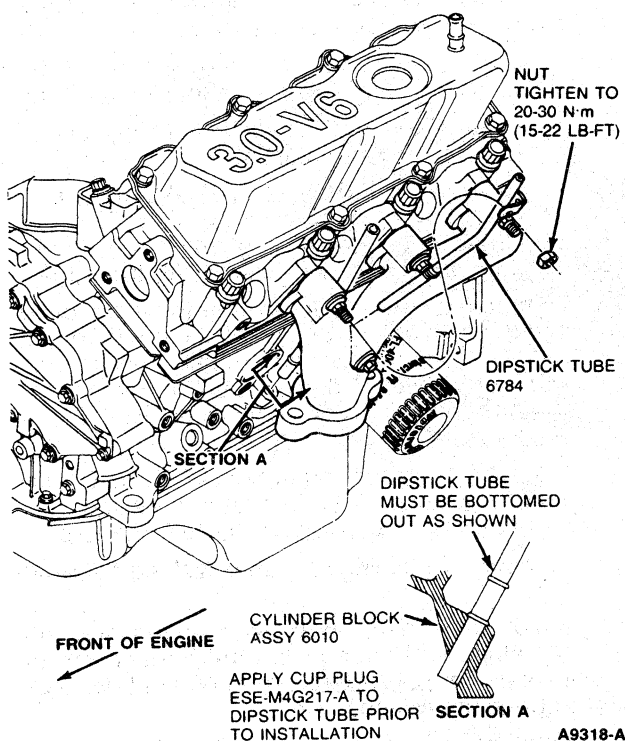
5. Dip each push rod end in Oil Conditioner D9AZ-19579-C or equivalent heavy engine oil. Install push rods in their original position.
6. For each valve, rotate the crankshaft until the tappet rests on the heel (base circle) of the camshaft lobe, before tightening the fulcrum attaching bolts. Position rocker arms over push rods, install fulcrums, and tighten fulcrum attaching bolts to 26-38 N·m (19-29 lb-ft).

**CAUTION: Fulcrums must be fully seated in cylinder head, and push rods must be seated in rocker arm sockets prior to final tightening.**

7. Lubricate all rocker arm assemblies with Oil Conditioner D9AZ-19579-C or equivalent, heavy engine oil.

NOTE: If the original valve train components are being installed, a valve clearance check is not required. If a component has been replaced, perform a valve clearance check. Refer to Section 21-01.

8. Install exhaust manifold(s).
9. Install dipstick tube.



10. Install intake manifold.
11. Position rocker arm cover and new gasket on the cylinder head and install attaching bolts. Note the location of spark plug wire routing clip stud bolts. Tighten attaching bolts to 9-12 N·m (80-106 lb-in).
12. Install spark plugs, if removed.
13. Connect secondary wires to the spark plugs.
14. If LH cylinder head is being installed, install oil fill cap.
15. If equipped with power steering, install pump mounting and support brackets. Refer to Section 13-51.
16. Install PCV valve.
17. Install throttle body.
18. Install alternator bracket. Tighten attaching nuts to 40-55 N·m (30-40 lb-ft).
19. Install the accessory drive belt and tighten to specification. Refer to Section 27-02.
20. Connect battery ground cable.
21. Fill and bleed cooling system.

**CAUTION: This engine has aluminum components and requires a special unique corrosion inhibited coolant formulation to avoid radiator damage. Refer to Section 27-01 for coolant specifications.**

22. Start engine and check for coolant, fuel, oil and exhaust leaks.
23. Check, and if necessary, adjust the transmission throttle linkage and speed control.
24. Install air cleaner outlet tube duct.

### Tappet

NOTE: Before replacing a tappet for noisy operation, ensure the noise is not caused by improper valve-to-rocker arm clearance, worn rocker arms or push rods or by improper rocker arm-to-rocker arm cover baffle clearance. Refer to Section 21-01.

### Removal

1. Disconnect battery ground cable.
2. Drain coolant.
3. Remove throttle body as outlined.
4. Remove plug wire routing clips from studs on rocker arm cover attaching bolts. Lay plug wires with the routing clips toward rear of engine.
5. Remove rocker arm covers.
6. Remove intake manifold.
7. Sufficiently loosen each rocker arm fulcrum attaching bolt to allow rocker arm to be lifted off the push rod and rotated to one side.
8. Remove push rods. The location of each push rod should be identified. When engine is assembled each rod should be installed in its original position.

## REMOVAL AND INSTALLATION (Continued)

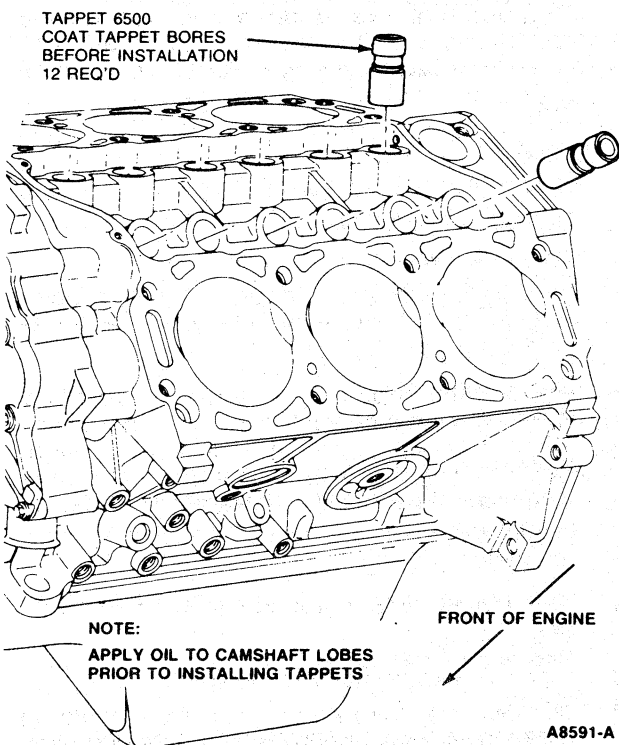
9. Remove tappets using a magnet. The location of each tappet should be identified. When engine is assembled each tappet should be installed in its original position.

NOTE: If the tappets are stuck in the bores due to excessive varnish or gum deposits, it may be necessary to use Hydraulic Tappet Puller T70L-6500-A or equivalent, or a claw-type tool to aid removal. Rotate the tappet back and forth to loosen it from the gum or varnish that may have formed on the tappet.

### Installation

NOTE: Lightly oil all bolt and stud threads before installation except those specifying special sealant. Using solvent, clean the intake manifold, cylinder head and valve rocker arm cover sealing surfaces.

1. Lubricate each tappet and bore with Oil Conditioner D9AZ-19579-C or equivalent.
2. Install each tappet in the bore from which it was removed. If new tappet(s) is being installed, check the new tappet for free fit in bore into which it is to be installed.



3. Dip each push rod end in Oil Conditioner D9AZ-19579-C or equivalent, heavy engine oil. Install push rods in their original position.
4. For each valve, rotate the crankshaft until tappet rests on the heel (base circle) of the camshaft lobe. Position rocker arms over the push rods. Position fulcrums and tighten fulcrum attaching bolts to 26-38 N·m (19-28 lb-ft).

5. Lubricate all rocker arm assemblies with Oil Conditioner D9AZ-19579-C or equivalent.

**CAUTION: Fulcrums must be fully seated in cylinder head and push rods must be seated in rocker arm sockets prior to final tightening.**

6. Install intake manifold as outlined.
7. Install valve rocker arm covers as outlined.
8. Install throttle body as outlined.
9. Install plug wire routing clips. Connect wires to the spark plugs.
10. Fill and bleed cooling system.
11. Start engine and check for oil or coolant leaks.

## Pistons and Connecting Rods

### Removal

1. Drain engine cooling system.
2. Remove throttle body as outlined.
3. Remove intake manifold.
4. Remove cylinder heads as outlined.
5. Remove oil pan and oil baffle.
6. Remove oil pump assembly and intermediate shaft.
7. Before removing the piston, inspect the top of each cylinder bore. If a ridge has formed at the top of the cylinder it must be removed before piston removal. Remove ridge as follows:
  - a. Turn crankshaft until the piston to be removed is at the bottom of cylinder bore.
  - b. Place a clean shop cloth over the piston head to collect cuttings.
  - c. Remove ridge using a suitable ridge reamer following the instructions of manufacturer. Never cut into the ring travel area more than 1/32-inch when removing the ridge.
8. Turn crankshaft until the piston to be removed is at the high point of its travel. If more than one piston is being removed, identify the pistons and connecting rod caps. Each component should be installed in its original position during assembly.

NOTE: The cylinder number is stamped on the top of the piston. Matched letters are stamped on the sides of corresponding rod and cap.

9. Remove connecting rod cap attaching nuts and cap.
10. Install spark plug boots over connecting rod cap studs and push piston out through top of the cylinder bore. Use care to prevent damage to bearing surfaces.
11. Install connecting rod cap and hold in position with cap attaching nuts.
12. If piston is to be disassembled, refer to Piston Disassembly.

**REMOVAL AND INSTALLATION (Continued)**

13. Inspect cylinder bore. If new piston rings are to be installed on the piston, a visible cross-hatch pattern should be obvious on cylinder bore wall. If honing is required, remove glaze from cylinder wall using spring-loaded hone. Follow manufacturer's instructions when using this type of equipment.

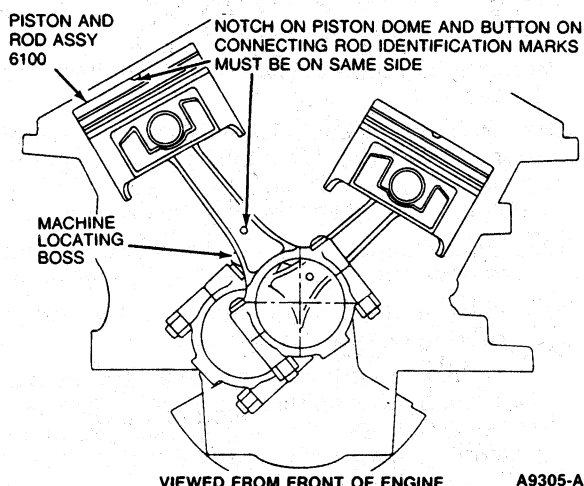
After honing, thoroughly clean cylinder bore using a detergent and water solution.

**Installation**

Lightly oil all attaching bolt and stud threads before installation except those specifying special sealant.

1. Lubricate cylinder wall and piston with Oil Conditioner D9AZ-19579-C or equivalent heavy engine oil.
2. Install spark plug boots on the connecting rod studs.
3. Install piston using a suitable piston ring compressor.

Ensure notch in piston dome faces the front of engine and machine locating boss is facing RH side of engine.



As piston is tapped into bore with a hammer handle, guide connecting rod onto crankshaft journal to avoid damage to bearing surfaces.

**NOTE:** Install the pistons in the same cylinders from which they were removed or to which they were fitted. The connecting rod and bearing caps are identified with matching correlation letters. Letters on the connecting rod and bearing cap must be on the same side when installed in the cylinder bore. If a connecting rod is transposed from one block or cylinder to another, new bearings should be fitted.

**NOTE:** Connecting rod and cap are not identified to cylinder position.

4. Check connecting rod bearing clearance. Refer to Section 21-01.

5. Lubricate bearing surfaces with Oil Conditioner D9AZ-19579-C or equivalent, heavy engine oil.
6. Ensure connecting rod is seated on crankshaft journal. Install connecting rod cap. Tighten the attaching nuts to 38 N·m (28 lb-ft).
7. If necessary, check connecting rod side clearance as outlined. Refer to Section 21-01.
8. Install oil pump and intermediate shaft assembly. Tighten attaching bolts to 40-55 N·m (30-40 lb-ft).
9. Install oil baffle. Tighten nuts to 40-53 N·m (30-40 lb-ft).
10. Install oil pan.
11. Install cylinder heads as outlined.
12. Install intake manifold.
13. Install rocker arm cover and throttle body.
14. Fill crankcase with specified oil.
15. Fill cooling system with specified coolant.
16. Start engine and check for oil, exhaust and coolant leaks.
17. Check, and if necessary, adjust transmission throttle linkage and speed control.

**Oil Pan****Removal**

1. Disconnect battery ground cable.
2. Remove oil level dipstick.
3. Raise vehicle.
4. If equipped with a low oil level sensor, remove retainer clip at sensor. Remove electrical connector from sensor.
5. Drain crankcase.
6. Remove starter motor.
7. Disconnect EGO sensor.
8. Remove catalyst and pipe assembly.
9. Remove lower engine/flywheel dust cover from converter housing.
10. Remove oil pan attaching bolts. Remove oil pan.
11. Remove oil pan gasket.

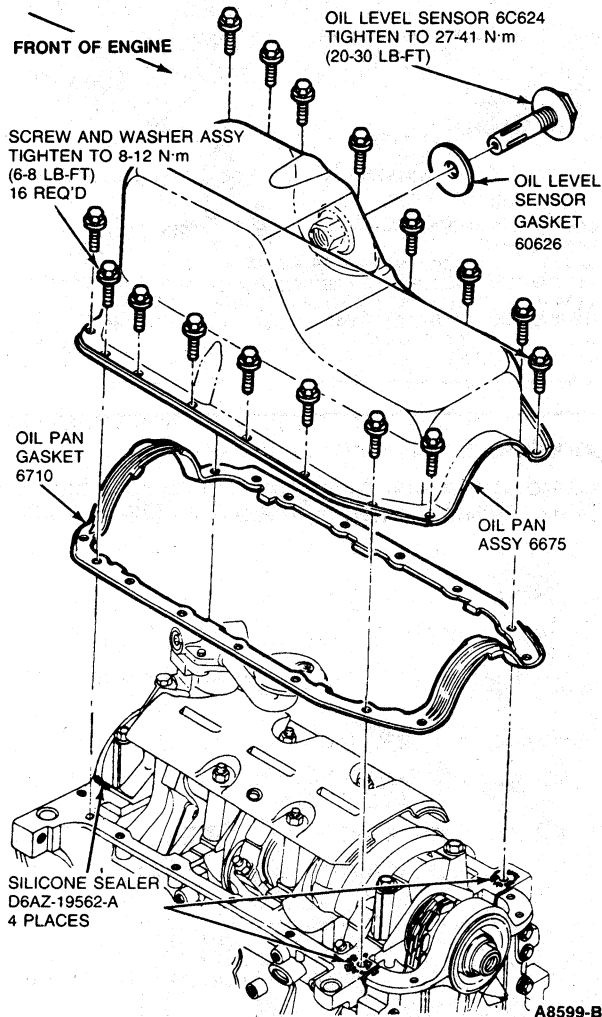
**Installation**

1. Clean the gasket surfaces on the cylinder block and oil pan.
2. Apply a 4.0-5.0mm (1/5-inch) bead of Silicone Sealer D6AZ-19562-A or equivalent, to the junction of the rear main bearing cap and cylinder block and junction of the front cover assembly and cylinder block.

**NOTE:** When using silicone rubber sealer, assembly should occur within 15 minutes after sealer application. After this time, the sealer may start to set-up, and its sealing effectiveness may be reduced.

**REMOVAL AND INSTALLATION (Continued)**

3. Locate oil pan gasket to oil pan with bend against pan surface and secure with Gasket and Seal Contact Adhesive D7AZ-19B508-A (ESR-M11P17-A and ESE-M2G52-A).
4. Position oil pan.
5. Install oil pan attaching bolts. Tighten to 8-12 N·m (71-106 lb-in).



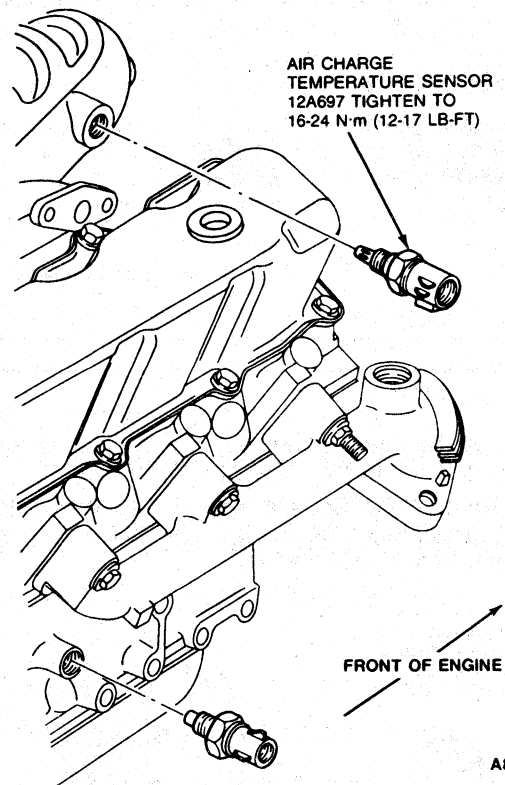
6. Install lower engine/flywheel dust cover to the converter housing.
7. Install catalyst and pipe assembly. Connect EGO sensor.
8. Install starter motor.
9. Install low oil level sensor connector to the sensor and install retainer clip.
10. Lower vehicle.
11. Replace oil level dipstick.
12. Connect battery ground cable.
13. Fill crankcase with the correct viscosity and amount of engine oil.
14. Start engine and check for engine oil and exhaust leaks.

**Sensors****Removal**

Unless otherwise noted, all sensors are removed by disconnecting wiring connector and unscrewing sensor. Refer to Section 34-01 for electrical connector disengagement.

**ACT**

Located in the throttle body. When installing, tighten to 16-24 N·m (12-17 lb-ft).

**EGO**

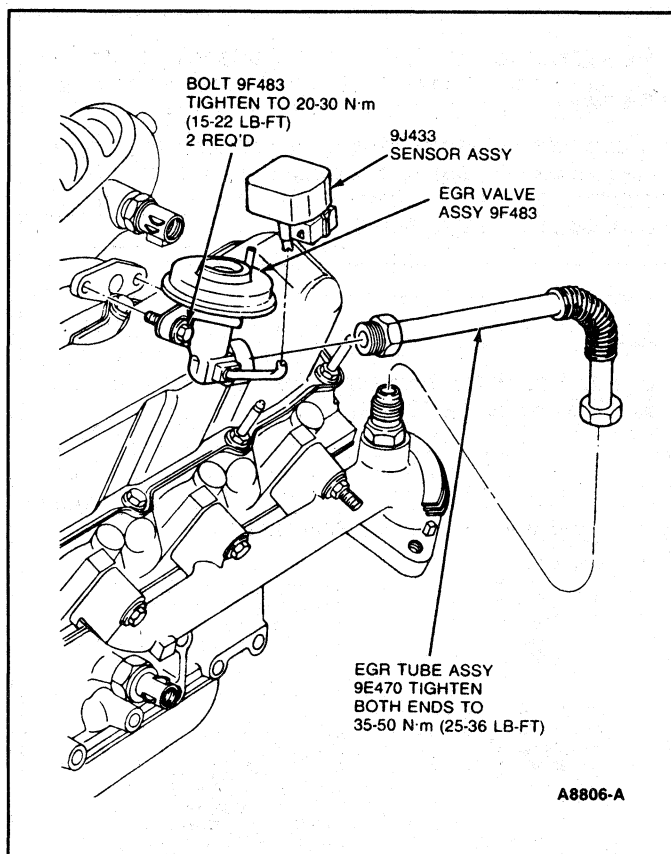
Located in the catalytic converter shell. When installing, tighten to 37-45 N·m (27-33 lb-ft).

**EGR PFE (Pressure Feedback EGR)**

Located in the pressure tube connected with EGR valve. Sensor is retained by a clip.



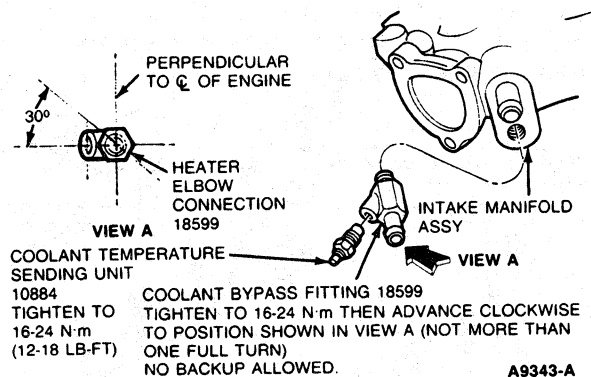
## REMOVAL AND INSTALLATION (Continued)



## Coolant Bypass Fitting

Coolant bypass fitting is located at the rear of the intake manifold. When installing, tighten to 16-24 N·m (12-17 lb-ft).

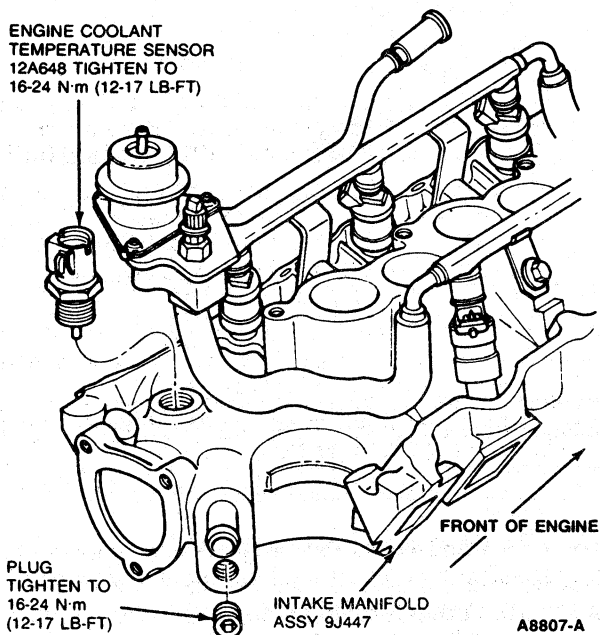
NOTE: Apply pipe sealant with Teflon® D8AZ-19554-A (ESE-M4G194-A or ESR-M18P7-A) or equivalent.



## ECT

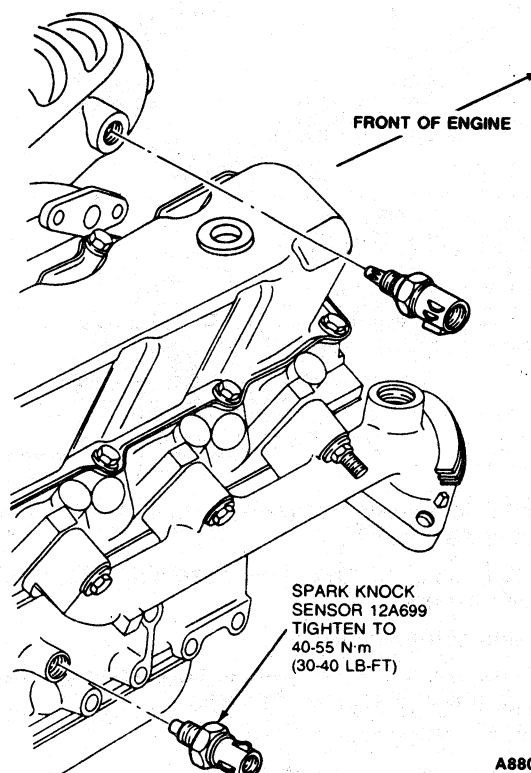
Located at the rear of the intake manifold. When installing, tighten to 16-24 N·m (12-17 lb-ft).

NOTE: Apply Pipe Sealant with Teflon® D8AZ-19554-A (ESG-M4G194-A and ESR-M18P7-A) or equivalent, before installation.



## Spark Knock

Located in the rear facing bank of engine block. When installing, tighten to 40-55 N·m (30-40 lb-ft).



## Oil Level Sensor

Located in the oil pan. When installing, tighten to 34.0-47.5 N·m (25-35 lb-ft).



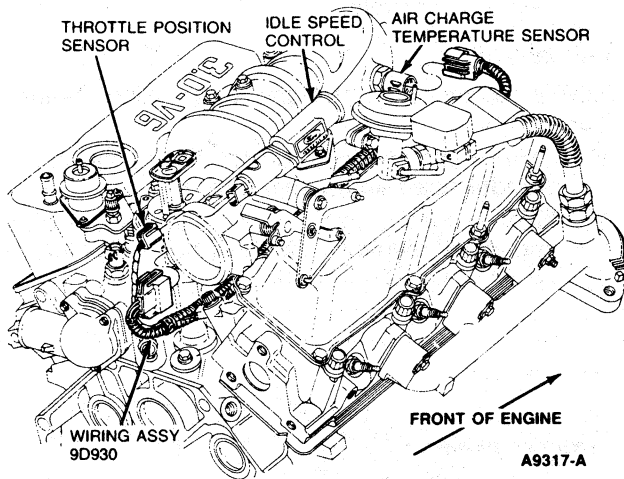
## REMOVAL AND INSTALLATION (Continued)

### Oil Pressure Sending Switch

Located in the right rear face of cylinder block. When installing, tighten to 16-24 N·m (12-17 lb-ft).

### Throttle Position Sensor

Located in the throttle body. When installing, tighten to 2-3 N·m (18-26 lb-in).

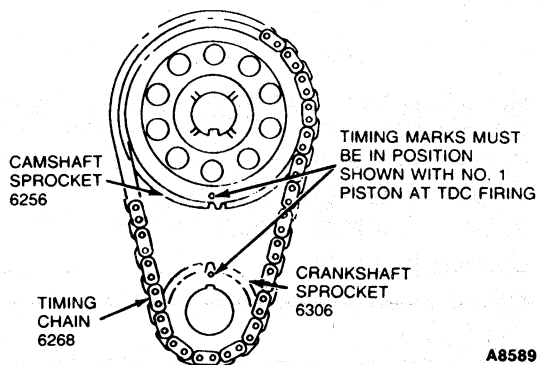


Throttle position sensor must engage on throttle shaft and then must be clocked into position for attachment.

### Timing Chain and Sprockets

#### Removal

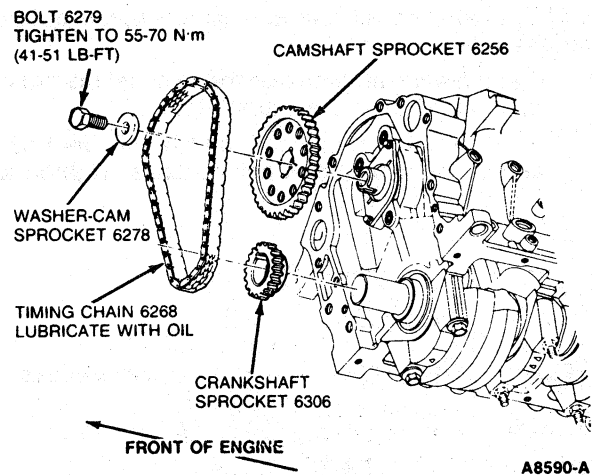
1. Remove crankshaft pulley/damper/front cover assemblies as outlined.
2. Cover oil pan opening to prevent dirt from entering.
3. Rotate crankshaft until No. 1 piston is at TDC on compression stroke and the timing marks are aligned.



4. Remove camshaft sprocket attaching bolts and washer. Slide both sprockets and timing chain forward and remove as an assembly.
5. Check timing chain and sprockets for excessive wear. Replace if necessary.

### Installation

1. Clean and inspect all parts before installation. Clean gasket material and dirt from oil pan, cylinder block and front cover.
2. Slide both sprockets and timing chain onto the camshaft and crankshaft with timing marks aligned. Install camshaft bolt and washer and tighten to specification. Apply oil to timing chain and sprockets after installation.



**NOTE:** The camshaft bolt has a drilled oil passage in it for timing chain lubrication. **If damaged do not replace with standard bolt.**

3. Position oil pan gasket and install oil pan using Gasket and Seal Contact Adhesive D7AZ-19B508-A (ESR-M11P17-A and ESE-M2G52-A) or equivalent, to hold in place. Apply a bead of RTV on the gap at the cylinder block.
4. Apply Oil Resistant Sealer B5A-19554-A or equivalent, to a new front cover gasket and position gasket into front cover.
5. Position the front cover on the engine taking care not to damage front seal.
6. Ensure cover is installed over alignment dowels.
7. Bolt front cover to engine and tighten to specification. Ensure oil pan seal is dislodged.
8. If front cover seal is damaged or worn, replace seal with a new one. Install seal using Seal Installer T70P-6B070-A or equivalent.

**REMOVAL AND INSTALLATION (Continued)**

9. Install water pump.
10. Install crankshaft pulley/damper/front seal as outlined.
11. Fill crankcase with the correct viscosity and amount of engine oil.
12. Fill and bleed cooling system.

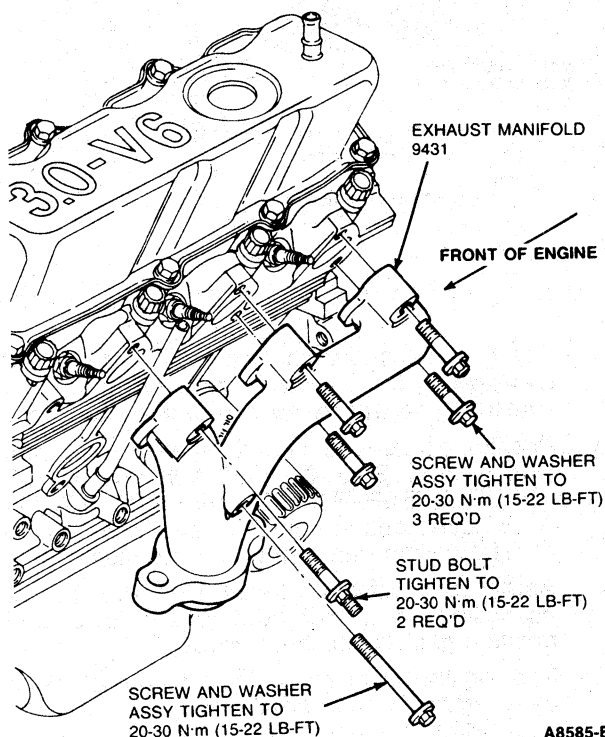
**Exhaust Manifold, LH****Removal**

1. Remove oil level indicator tube support bracket.
2. Remove power steering pump pressure and return hoses.
3. Remove manifold to exhaust pipe attaching nuts.
4. Remove exhaust manifold attaching bolts and manifold.

**Installation**

NOTE: Lightly oil all bolt and stud threads before installation.

1. Clean mating surfaces on the exhaust manifold, cylinder head and exhaust pipe.
2. Position exhaust manifold on the cylinder head and install manifold attaching bolts. Tighten to 20-30 N·m (15-22 lb-ft).



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3. Connect exhaust pipe to the manifold. Tighten the attaching nuts to 21-32 N·m (16-24 lb-ft).
4. Connect power steering pump pressure and return hoses.
5. Install oil level indicator tube support bracket.

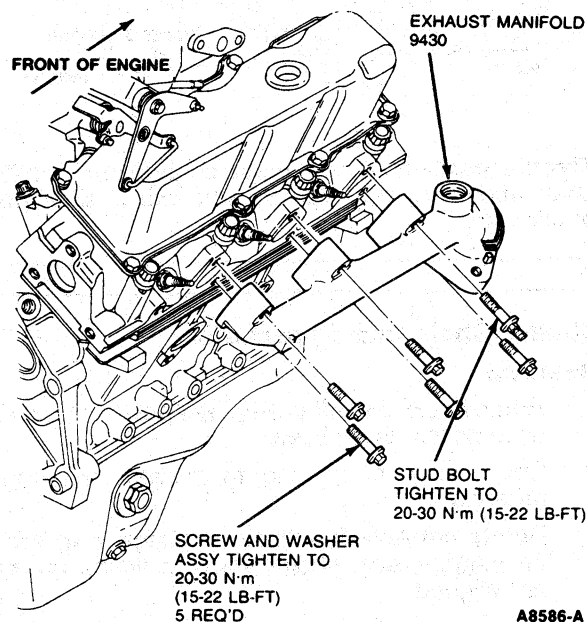
**Exhaust Manifold, RH****Removal**

1. Remove heater hose support bracket.
2. Disconnect heater hoses.
3. Remove EGR tube from exhaust manifold. Use a backup wrench on the lower adapter.
4. Remove manifold-to-exhaust pipe attaching nuts.
5. Remove exhaust manifold attaching bolts. Remove manifold.

**Installation**

NOTE: Lightly oil all bolt and stud threads before installation.

1. Clean mating surfaces on the exhaust manifold, cylinder head and exhaust pipe.
2. Position exhaust manifold on the cylinder head and install manifold attaching bolts. Tighten to 20-30 N·m (15-22 lb-ft).



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3. Connect exhaust pipe to the manifold. Tighten the attaching nuts to 21-32 N·m (16-24 lb-ft).
4. Connect EGR tube to exhaust manifold. Tighten to 35-50 N·m (25-36 lb-ft).
5. Install heater hose support bracket.
6. Connect heater hoses.
7. Fill and bleed cooling system. Refer to Section 27-01.
8. Start engine and check for exhaust and coolant leaks.

## REMOVAL AND INSTALLATION (Continued)

**Main Bearing Inserts**

The main bearing inserts are precision selective fit. To check the bearing clearances or to select fit a new bearing, refer to Section 21-01.

**Removal**

1. Remove oil pan.
2. Remove oil pump.
3. Remove oil pump baffle.
4. Replace one bearing at a time, leaving the other bearings securely fastened. Remove main bearing cap to which new bearings are to be installed.
5. Insert Upper Main Bearing Insert Remover and Replacer TOOL-6331-E or equivalent in the oil hole in the crankshaft.

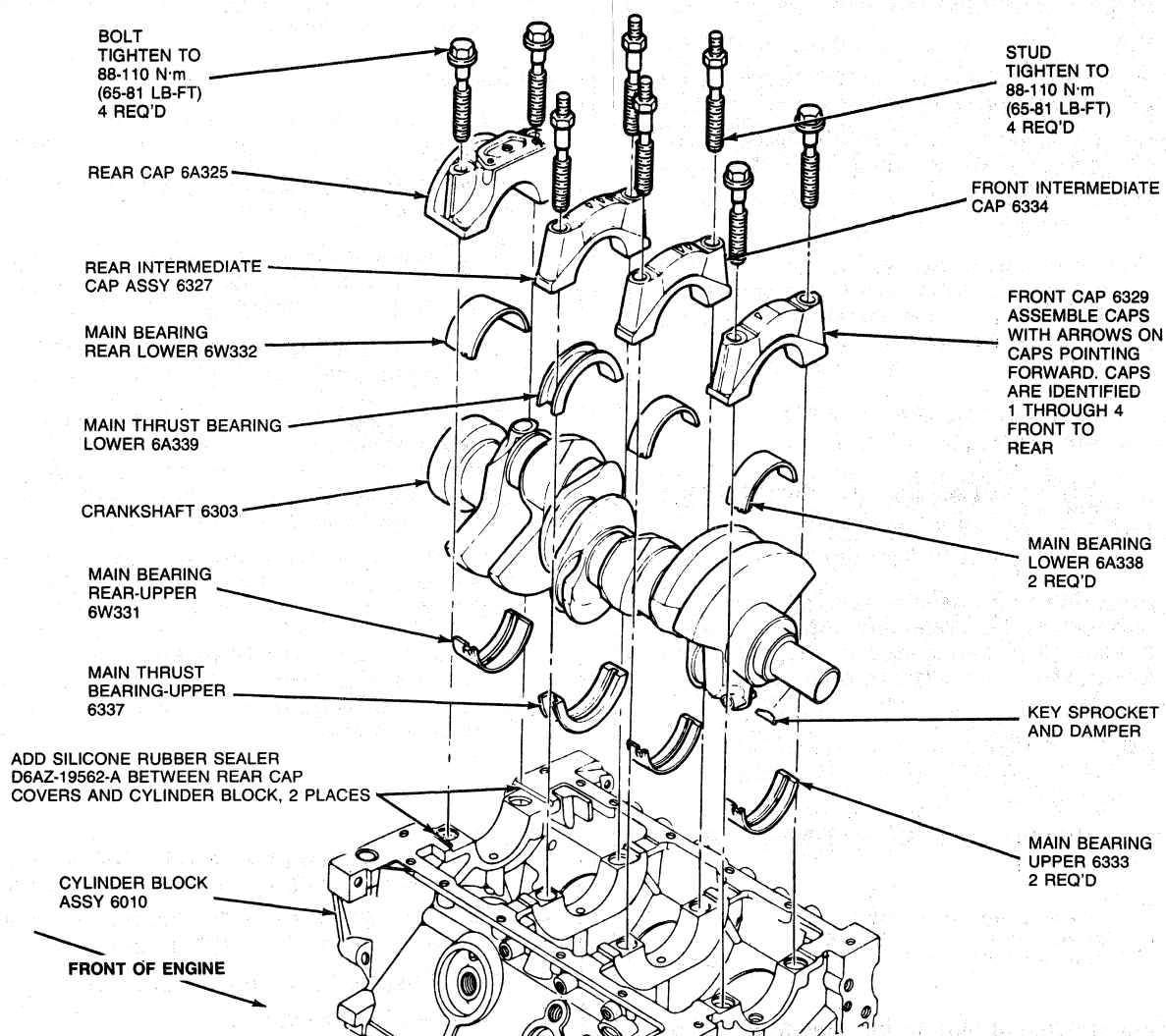
NOTE: Rotate remover against end of bearing opposite locating tang.

6. Rotate crankshaft in the direction of the engine rotation to force the bearing out of the block.
7. Clean crankshaft journals. Inspect journals and thrust faces (thrust bearings) for nicks, burrs or bearing pickup that would cause premature bearing wear.
8. If the crankshaft rear oil seal is to be replaced, refer to Crankshaft Rear Oil Seal.

**Installation**

Lightly oil all bolt and stud threads before installation.

1. Lubricate and position the upper bearing insert on the crankshaft journal with the plain end started into the side of the cylinder block with the locking tang slot. Line up the bearing tang with the slot in the block.



A8600-B

**REMOVAL AND INSTALLATION (Continued)**

2. Install Upper Main Bearing Insert Remover and Replacer TOOL-6331-E or equivalent, in the crankshaft journal oil hole.
3. With the bearing and tool in position, rotate the crankshaft so that the tool catches the edge of the bearing and pushes into position, and seats in the cylinder block. Remove tool.
4. Install bearing insert in the main cap.
5. If bearing insert clearance is to be checked, refer to Section 21-01.
6. If No. 1 or No. 2 bearing insert was removed, lubricate the bearing surface with Oil Conditioner D9AZ-19579-C or equivalent, and install main cap. Tighten attaching bolts to 88-110 N·m (65-81 lb-ft).
7. If the rear main bearing insert was removed, perform the following:
  - a. Remove all traces of sealant from the main bearing cap to cylinder block parting line.
  - b. Apply a 3.0mm (1/8-inch) bead of Silicone Sealer D6AZ-19562-B or equivalent to the main bearing cap to cylinder block parting line. **NOTE:** The bearing cap must be installed within 15 minutes after the silicone sealer application. After this time, the sealer may start to set-up and its sealing effectiveness may be reduced.
  - c. Lubricate bearing surfaces with Oil Conditioner D9AZ-19579-C or equivalent heavy engine oil, and install main bearing cap. Tighten attaching bolts to 88-110 N·m (65-81 lb-ft).
8. If the thrust bearing inserts were removed, perform the following:
  - a. Lubricate bearing surface with Oil Conditioner D9AZ-19579-C or equivalent heavy engine oil. Install the main bearing cap with the bolts finger-tight.
  - b. Pry crankshaft forward against the thrust surface on the upper bearing insert while holding the bearing cap to the rear. This aligns thrust rear surfaces on both halves of the bearing.
  - c. While holding the crankshaft forward, tighten cap attaching bolts to 88-110 N·m (65-81 lb-ft).
9. Install crankcase oil baffle and oil pump assembly.
10. Install oil pan.

**Connecting Rod Bearings**

The connecting rod bearings are a selective fit to provide the necessary clearance. Refer to Section 21-01 to measure clearance and select the proper bearing insert.

**Removal**

1. Remove spark plugs.
2. Remove oil pan.
3. Mark bearing caps to ensure installation in same positions.
4. Turn crankshaft until connecting rod from which the bearings are to be removed is at lowest point of travel.
5. Remove connecting rod cap and bearing lower insert.
6. Remove upper bearing insert. Push piston up into the cylinder bore slightly to provide clearance for removal.

**Installation**

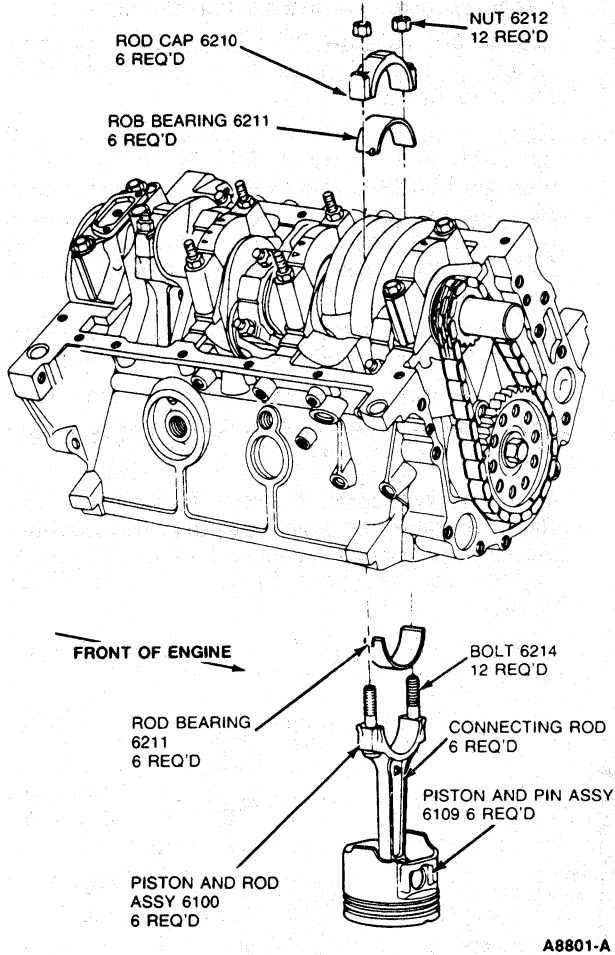
Lightly oil all bolt and stud threads before installation.

1. Thoroughly clean bearing inserts, connecting rod cap and connecting rod.

**CAUTION: Contaminants allowed to remain on the cap or bearing can distort the bearing or damage the crankshaft journals.**

2. Clean crankshaft journal and lubricate with Oil Conditioner D9AZ-19579-C or equivalent.
3. Install bearing insert in the connecting rod and pull the rod down until it seats on the crankshaft. When installing bearing insert ensure tab on bearing engages slot in rod and that bearing is fully seated in rod.
4. Install bearing insert in connecting rod cap and lubricate bearing surface with Oil Conditioner D9AZ-19579-C or equivalent.
5. Install connecting rod cap and the attaching nuts. Install caps with code letters on same side as code letters on rods. Tighten nuts to 28-38 N·m (21-28 lb-ft).

## REMOVAL AND INSTALLATION (Continued)



6. Install oil pan.
7. Install spark plugs.

### Engine Out of Vehicle

NOTE: These Removal and Installation procedures must be performed with engine out of the vehicle.

### Flywheel/Flex Plate

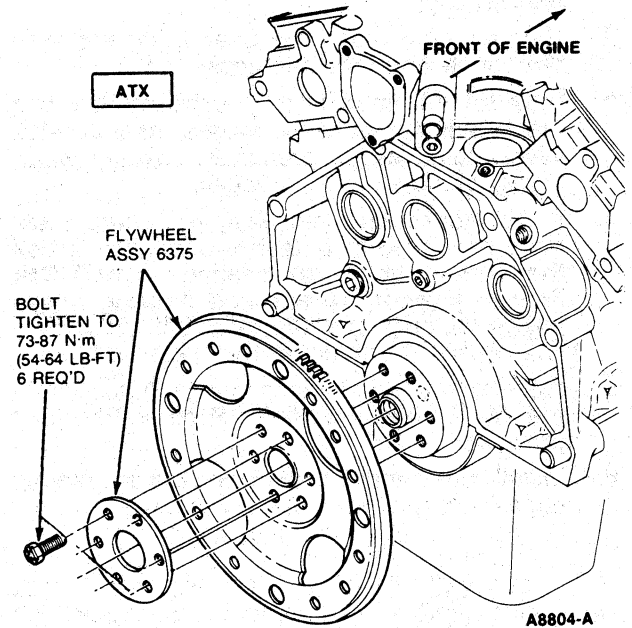
#### Removal

1. Remove transmission.
2. Remove flywheel/flex plate attaching bolts and flywheel.
3. The rear cover plate can be removed (manual transmission only).

#### Installation

All major rotating components including flex plate/flywheel are individually balanced to zero. Engine assembly balancing is not required. Balance weights should **NOT** be installed on new flywheels.

1. Install rear cover plate, if removed.
2. Position flywheel on the crankshaft and install attaching bolts. Tighten attaching bolts to 73-87 N·m (54-64 lb-ft) using the standard cross-tightening sequence.



3. Install transmission.

### Crankshaft

#### Removal

1. With engine removed from vehicle and placed on a workstand, loosen idler pulley and alternator belt adjusting bolt.
2. Remove oil pan and gasket as outlined.
3. Remove front cover assembly as outlined.
4. Check timing chain deflection. Remove timing chain and sprockets.
5. Invert engine on the workstand. Remove flywheel. Remove oil pump inlet and oil pump assembly.
6. Ensure all bearing caps (main and connecting rod) are marked so that they can be installed in their original positions. Turn crankshaft until connecting rod from which the cap is being removed is up. Remove connecting rod cap. Push connecting rod and piston assembly up in the cylinder. Repeat procedure for the remaining connecting rod assemblies.
7. Remove main bearing caps.
8. Carefully lift the crankshaft out of the block so that the upper thrust bearing surfaces are not damaged.

**CAUTION:** Handle the crankshaft with care to avoid possible fracture or damage to the finished surfaces.

## REMOVAL AND INSTALLATION (Continued)

## Installation

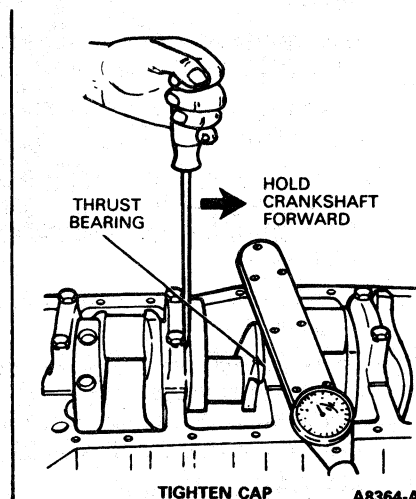
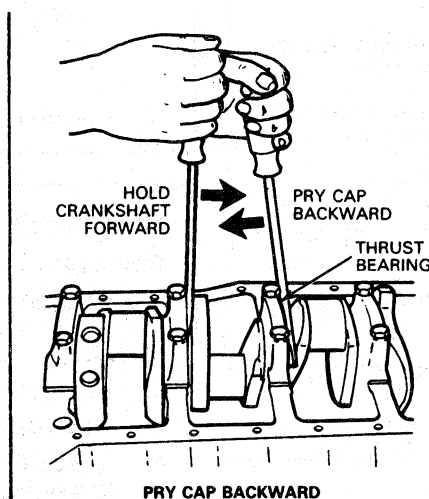
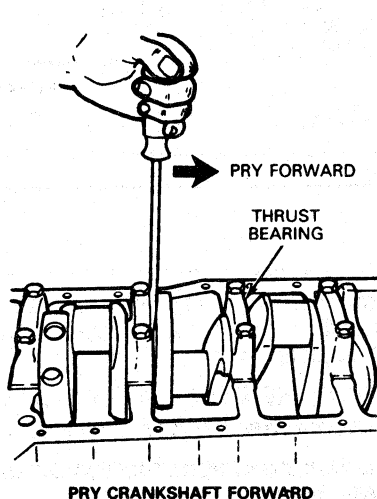
NOTE: If bearings are to be reused they should be identified to ensure that they are installed in their original positions.

1. Remove main bearing inserts from block and bearing caps.
2. Remove connecting rod bearing inserts from the connecting rods and caps.
3. Inspect all machined surfaces on the crankshaft for nicks, scratches, scores, etc., which could cause premature bearing wear. Lightly stone all such surfaces.
4. If the crankshaft main bearing journals have been refinished to a definite undersize, install the correct undersize bearings. **CAUTION: Ensure bearing inserts and bearing bores are clean. Foreign material under the inserts will distort the bearing and cause a failure.**
5. Place upper main bearing inserts in position in the bores with the tang fitted in the slot provided.
6. Install lower main bearing inserts in bearing caps.

7. Carefully lower crankshaft into place.
8. Check the clearance of each main bearing. Select fit the bearings for proper clearance. Refer to Section 21-01.
9. After bearings have been fitted, apply a light coat of heavy engine oil, SAE 50 weight, to the journals bearings and rear seal surface. Install all bearing caps. Apply RTV to gap between rear main bearing and block. Take care to keep RTV from parting surfaces between block and cap.

NOTE: Ensure main bearing caps are installed in their original positions and orientation.

10. Lubricate the journal with engine oil. Install the thrust bearing cap with the bolts finger-tight. Pry the crankshaft forward against the thrust surface of the upper half of the bearing. Hold the crankshaft cap to the rear. This will align the thrust surfaces of both halves of the bearing. Retain the forward pressure on the crankshaft. Tighten the cap bolts to 88-110 N·m (65-81 lb-ft).



**REMOVAL AND INSTALLATION (Continued)**

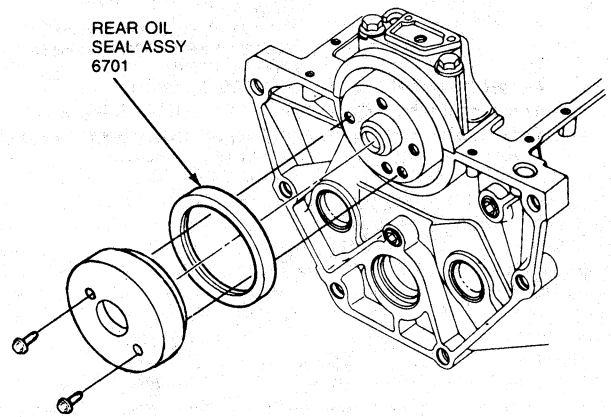
11. Check crankshaft end play.
12. If end play exceeds specification, replace upper and lower thrust bearings. If the end play is less than specification, inspect thrust bearing faces for damage, dirt or improper alignment. Install thrust bearing and align the faces. Recheck end play.
13. Install new bearing inserts in the connecting rods and caps. Check the clearance of each bearing. Refer to Section 21-01.
14. If bearing clearances are to specification, apply a light coat of heavy engine oil, SAE 50 weight, to the journals and bearings.
15. Turn the crankshaft throw to the bottom of the stroke. Push the piston all the way down until the rod bearings seat on the crankshaft journal.
16. Install connecting rod cap.
17. After piston and connecting rod assemblies have been installed, check connecting rod crankshaft journal.
18. Turn engine on the work stand so that the front end is up. Install timing chain, sprockets, front cover, new oil seal and crankshaft pulley as outlined.  
  
Turn engine on the work stand so that the rear end is up. Install rear oil seal.
19. Clean oil pan, oil pump and oil pump screen assembly.
20. Prime oil pump by filling the inlet opening with oil and rotating the pump shaft until oil emerges from the outlet opening. Install oil pump, baffle and oil pan.
21. Position flywheel on the crankshaft. Tighten to specification.
22. Turn engine on the work stand so that the engine is in the normal upright position. Install accessory drive pulley. Install and adjust accessory drive belts to specification. Refer to Section 27-02.
23. Install ATX torque converter.
24. Remove engine from the work stand. Install engine.

**Crankshaft Rear Main Oil Seal****Removal**

Using a sharp awl, punch one hole into the seal metal surface between the lip and block. Screw in the threaded end of Slide Hammer Tool T77L-9533-B or equivalent. Use the slide hammer to remove seal. Use caution to avoid scratching or damaging oil seal surface.

**Installation**

1. Apply engine oil to outer lips and inner seal edge.
2. Position seal on Rear Main Seal Installer T82L-6701-A or equivalent. Position tool and seal to rear of engine. Alternate bolt tightening to seat the seal properly. (Two bolts are supplied with Rear Main Seal Installer T82L-6701-A. Engine flywheel bolts may be used if necessary).



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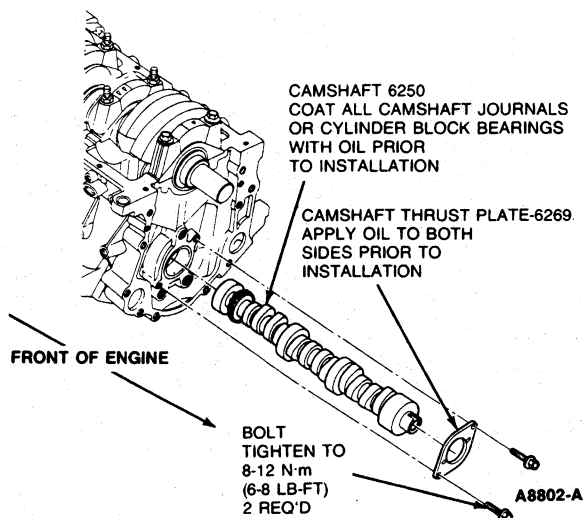
**Camshaft****Removal**

1. Ensure engine is removed from the vehicle and placed on an engine work stand.
2. Ensure that the cooling system, fuel system and crankcase have been drained.
3. Remove timing cover as outlined.
4. Remove intake manifold.
5. Using a magnet, remove the hydraulic tappets and keep them in order so that they can be installed in their original positions. If the tappets are stuck in the bores by excessive varnish, etc., use Hydraulic Tappet Puller T70L-6500-A or equivalent, to remove tappets.
6. Check camshaft end play. Refer to Camshaft End Play. If the end play is excessive, replace the thrust plate.
7. Remove timing chain and sprockets.
8. Remove camshaft thrust plate. Carefully remove the camshaft by pulling it toward the front of the engine. Use caution to avoid damaging bearings, journals and lobes.



**REMOVAL AND INSTALLATION (Continued)****Installation**

1. Clean and inspect all parts before installation.
2. Lubricate camshaft lobes and journals with heavy engine oil, SAE 50 weight. Carefully slide the camshaft through the bearings in the cylinder block.
3. Install thrust plate. Tighten attaching bolts to 8-12 N·m (6-8 lb-ft).



4. Install timing chain and sprockets. Check the camshaft sprocket bolt for blockage of drilled oil passages.
5. Install front cover, damper, crankshaft pulley and water pump as outlined.
6. Lubricate tappets and tappet bores with heavy engine oil, SAE 50 weight. Install tappets into their original bores.

7. Install cylinder head throttle body, intake manifold, valve rocker arm covers and push rods as outlined.
8. Install accessory drive belts and pulleys.
9. Install engine as outlined.
10. Coat the inside of each spark plug boot with Silicone Dielectric Compound D7AZ-19A331-A or equivalent using a small screwdriver blade. Connect each spark plug wire to the plug from which it was removed. Ensure each wire is fully depressed on each plug and the moulded boot is firmly pressed in place.
11. Fill and bleed the cooling system. Fill crankcase with the correct viscosity and amount of engine oil.
12. Start engine. Check and adjust ignition timing. Refer to the Engine/Emissions Diagnosis\* manual. Check for coolant, oil, fuel and vacuum leaks.

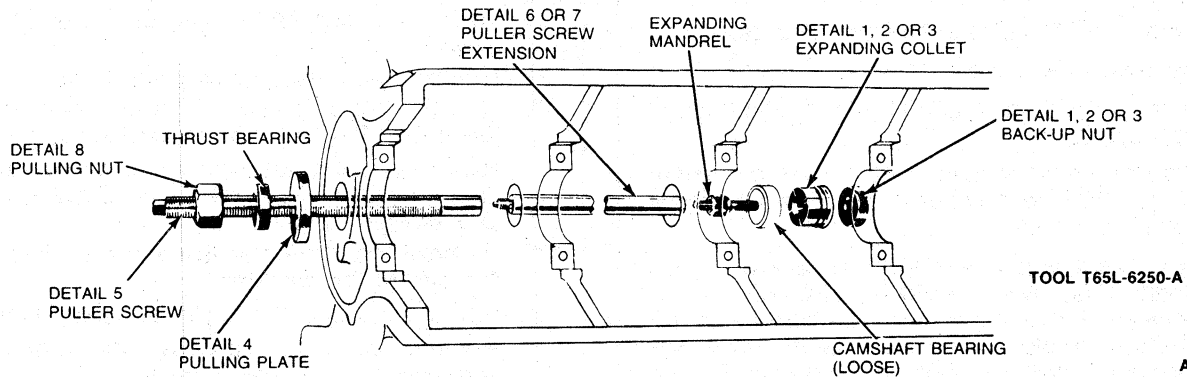
**Camshaft Bearings****Removal**

1. Remove engine. Place engine on work stand and remove camshaft, crankshaft and rear bearing bore plug.
2. Remove camshaft bearing with Camshaft Bearing Set T65L-6250-A or equivalent.
3. Select proper size expanding collet and backup nut, and assemble on the expanding mandrel. With the expanding collet collapsed, install collet assembly in the camshaft bearing, and tighten backup nut on the expanding mandrel until the collet fits the camshaft bearing.

\*Can be purchased as a separate item.



## REMOVAL AND INSTALLATION (Continued)



4. Assemble puller screw and extension if necessary, and install on the expanding mandrel. Wrap a cloth around the threads of the puller screw to protect the bearing or journal. Tighten the puller nut against the thrust bearing and pulling plate to remove camshaft bearing. Hold the end of the puller screw to prevent it from turning.
5. Repeat Step 4 for each bearing. To remove the front bearing, install the puller from the rear of the block.

### Installation

The camshaft bearings are available prefinished to size and require no reaming for standard and 0.081mm (0.015-inch) undersize journal diameters.

1. Position new bearings at the bearing bores and press them in place with Camshaft Bearing Set T65L-6250-A or equivalent. Center the pulling

plate and puller screw to avoid damage to the bearing.

Failure to use the correct expanding collet can cause severe bearing damage.

**NOTE:** Align the oil holes in the bearings with the oil holes in the cylinder block before pressing bearings into place.

Ensure the front bearing is installed 0.51-0.89mm (0.020-0.035 inches) below the front face of the cylinder block.

2. Install camshaft rear bearing bore plug as outlined.
3. Install camshaft, crankshaft, flywheel and related parts. Do not check connecting rod and main bearing clearances as part of camshaft bearing replacement.
4. Install engine in vehicle as outlined.

## Camshaft Rear Bearing Bore Plug

### Removal

1. Remove transmission. Refer to the applicable Section in Group 17.
2. Remove flywheel.
3. Using a sharp chisel or punch and hammer, cut a hole in the center of the plug.
4. Remove the plug using Impact Slide Hammer T59L-100-B or T50T-100-A or equivalent. The plug can also be pried from the bore using a large punch. Use care to prevent damage to the plug bore.

### Installation

Prior to installing a core plug the plug bore should be inspected for any damage that would interfere with

the proper sealing of the plug. If the bore is damaged it will be necessary to true the surface by boring for the next specified oversize plug. Oversize (OS) plugs are identified by the OS stamped in the flat located on the cup side of the plug.

1. Install bore plug using a suitable driver.  
Apply a light coating of Perfect-Seal Sealing Compound D5AZ-19554-A or equivalent, to the sealing edge of the plug before installation.
2. Install flywheel.
3. Install transmission. Refer to the applicable Section in Group 17.

## DISASSEMBLY AND ASSEMBLY

### Engine

#### Disassembly

Before starting disassembly, remove accessories and any emission control equipment which are not directly attached to the engine.

1. Remove flywheel and rear cover plate.

2. Remove exhaust manifolds.

When LH exhaust manifold is removed, note the location of the dipstick tube support bracket.

## DISASSEMBLY AND ASSEMBLY (Continued)

3. Remove the oil filler cap and closure tube.
4. Remove PCV valve to fuel charging assembly.
5. Remove PCV valve.
6. Remove PCV valve grommet and tube hose, if necessary.
7. Disconnect secondary wires from the spark plugs. Remove distributor cap (with secondary wires) and rotor.

When removing a wire from a spark plug, use Spark Plug Wire Remover T74P-6666-A or equivalent. Grasp and twist the boot back and forth on the plug insulator to free the boot. Use the tool to pull the boot from the plug. Do not pull on the wire directly or it may become separated from the connector inside the boot.

8. Remove EGR valve and EGR gasket as an assembly. If necessary EGR valve can be removed from the spacer.
9. Remove the throttle body and disconnect the fuel charging wiring harness (9D930).
10. Remove crankshaft pulley and the vibration damper. Use Crankshaft Damper Remover T58P-6316-D and Damper Remover Adapter T82L-6316-B or equivalent, to remove vibration damper.
11. Remove distributor hold-down clamp and the distributor.
12. Remove rocker arm covers.
13. Remove intake manifold and manifold side gaskets. Discard intake manifold side gaskets.  
Before attempting to remove the intake manifold, break the seal between the manifold and the cylinder block. Wedge a large screwdriver between the manifold and the block. Pry downward on the screwdriver using the lug on the water pump as a leverage point. Use care to prevent damage to machined surfaces.
14. Remove spark plugs.
15. Remove rocker arms and push rods.

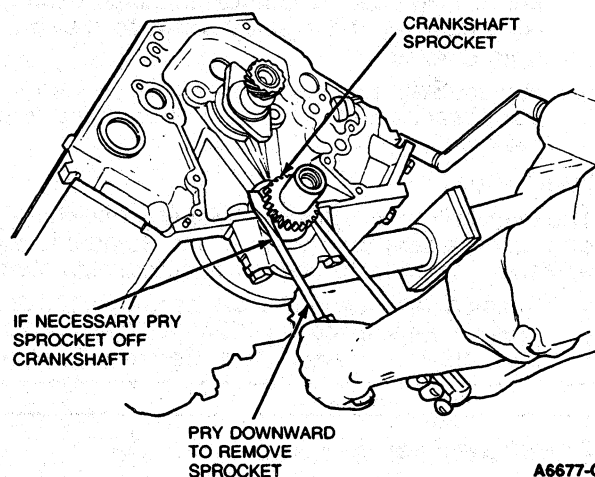
The location of each rocker arm, push rod and fulcrum should be noted. When engine is assembled each component should be installed in its original position.

16. Remove cylinder heads. Discard cylinder head attaching bolts.
17. Remove and discard cylinder head gaskets.
18. Remove valve tappets.

The location of each tappet should be identified. When the engine is assembled each tappet should be installed in its original position.

If the tappets are stuck in the bores due to excessive varnish or gum deposits, it may be necessary to use Hydraulic Tappet Puller T70L-6500-A or equivalent, or a claw-type tool to aid removal. When using a remover tool rotate the tappet back and forth to loosen it from the gum or varnish that may have formed on the tappet.

19. Remove oil filter.
20. Remove oil pan and oil pan end seal. Discard seal.
21. Remove oil pump and oil pump baffle.
22. Remove water pump and front cover as an assembly. Remove and discard cover gasket.  
NOTE: If necessary, the water pump can be removed from the front cover. Discard pump gasket after removal.
23. Remove thrust plate bolts and thrust plate from the end of the camshaft.
24. Remove camshaft sprocket attaching bolt.  
Remove camshaft sprocket, the crankshaft sprocket and the timing chain.  
NOTE: If the crankshaft sprocket is difficult to remove, it can be pried off using two large screwdrivers. Use care to prevent damage to finished areas on the crankshaft.



25. Remove camshaft. Use care to prevent damage to camshaft bearing surfaces.
26. If necessary, remove camshaft plug from the back of the engine.
27. Remove connecting rod caps and pistons.

The location of each piston, crank bearing and rod cap should be noted. When the engine is assembled each component should be installed in its original position.

NOTE: The cylinder number is stamped on the top of the piston. Matched letters are stamped on the sides of corresponding rod and cap.

NOTE: Before removing the pistons, inspect the top of the cylinder bores. If necessary, remove the ridge and/or carbon deposits from each cylinder using a suitable ridge reamer. Before the ridge or deposits are removed, turn the crankshaft until the piston is at the bottom of its stroke. Cover the piston with a clean shop towel to collect the cuttings. After the cutting operation, turn the crankshaft until the piston is at the top of its stroke and remove the shop towel with the cuttings. **Never cut into the ring travel area in excess of .794mm (.03125 inch).**

**DISASSEMBLY AND ASSEMBLY (Continued)****28. Remove main bearing caps and crankshaft.**

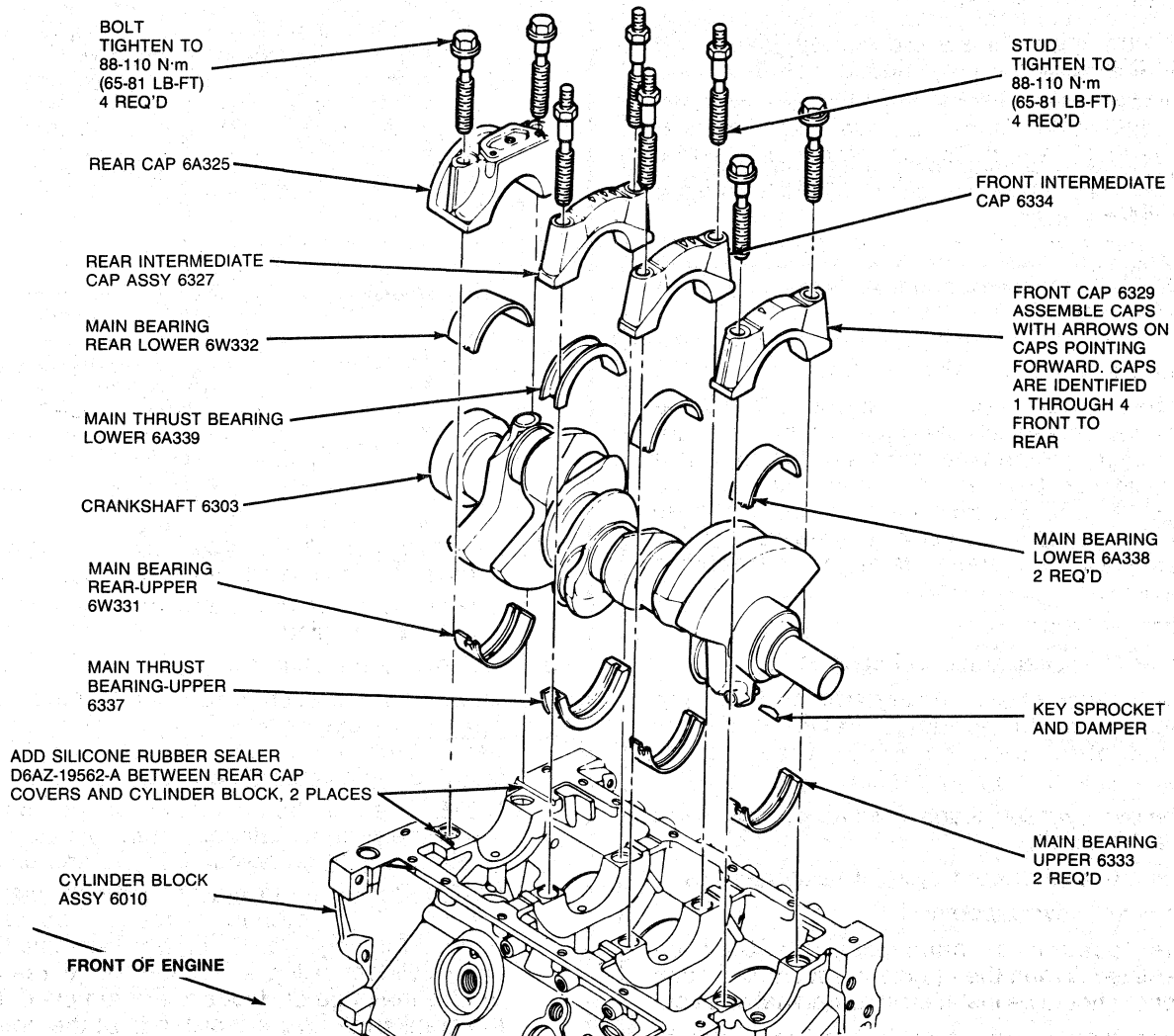
The location of the main bearings should be identified. When the engine is assembled each bearing should be installed in its original position.

**29. For cleaning purposes, oil gallery and cooling jacket plugs can be removed.****Assembly**

**NOTE:** During the engine assembly, a RTV-type sealer will be applied to many areas before installation. When the sealant is applied, the component should be installed within 15 minutes. After this time the sealant begins to set-up and its sealing effectiveness can be reduced.

Lightly oil all attaching bolt and stud threads before installation expect those specifying special sealant.

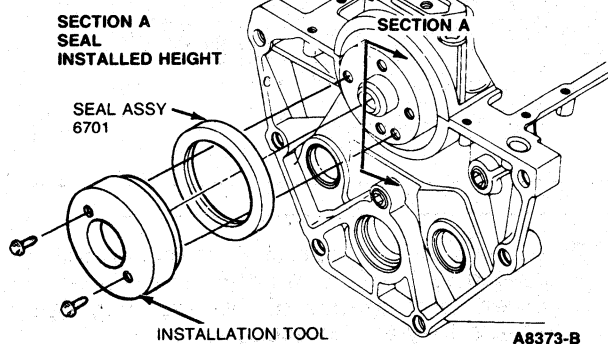
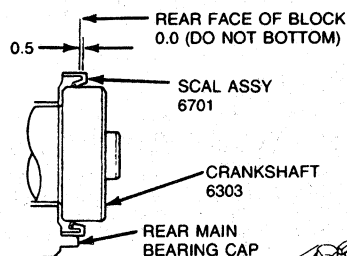
1. If removed, install oil gallery and cooling jacket plugs. Tighten plugs to 16-24 N·m (12-17 lb-ft). Before installation, coat plug threads with Pipe Sealant D8AZ-19558-A or equivalent.
2. Install crankshaft as follows:
  - a. Install main bearing inserts in the cylinder block. Note that third bearing from front is the thrust bearing.



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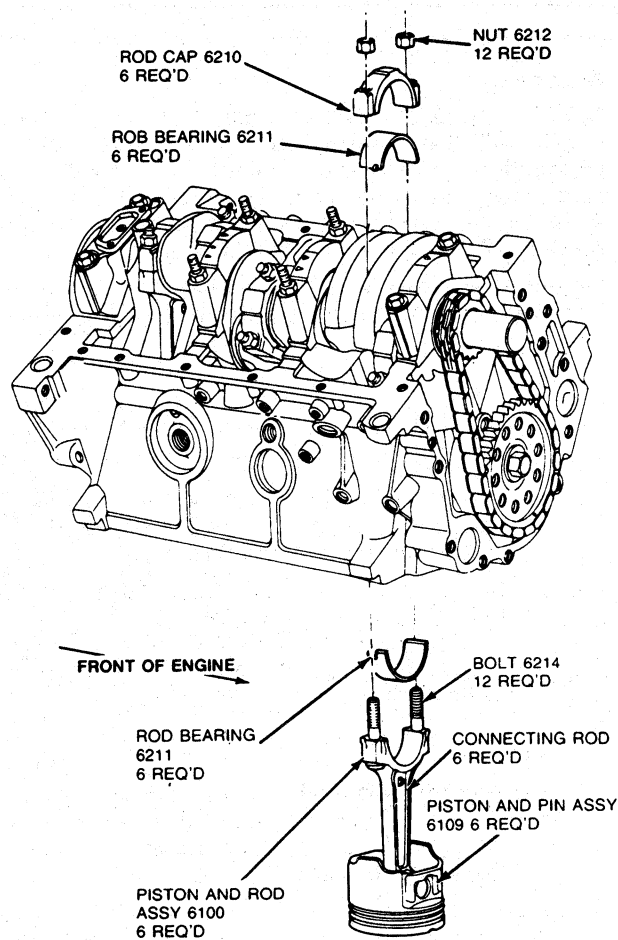
## DISASSEMBLY AND ASSEMBLY (Continued)

- b. Lubricate bearing inserts with Oil Conditioner D9AZ-19579-C or equivalent heavy engine oil, and carefully lower the crankshaft into place. Use care to prevent damage to bearing surfaces.
  - c. Apply a 3.0mm (1/8-inch) bead of Silicone Sealer D6AZ-19562-B or equivalent, to the cylinder block rear main bearing cap parting line.
  - d. Install bearing inserts in the main caps and install caps. Note that caps are numbered with arrow heads. No. 1 is located at front of engine with arrow heads facing front of engine.
  - e. Install main bearing cap attaching bolts.
  - f. Before tightening bearing cap attaching bolts, wedge a large screwdriver between cylinder block web and crankshaft cheek located in front of the No. 3 main bearing. Do not jam the screwdriver into place. Tap into position only enough to hold the crankshaft forward while the cap bolts are tightened.
  - g. Tighten bearing cap attaching bolts to 88-110 N·m (65-81 lb-ft) and remove screwdriver.
3. Install rear main crank seal as outlined and check for crankshaft end play. Refer to Section 21-01.



4. Install the piston as follows:

- a. Install bearing inserts in the connecting rods and the connecting rod caps.

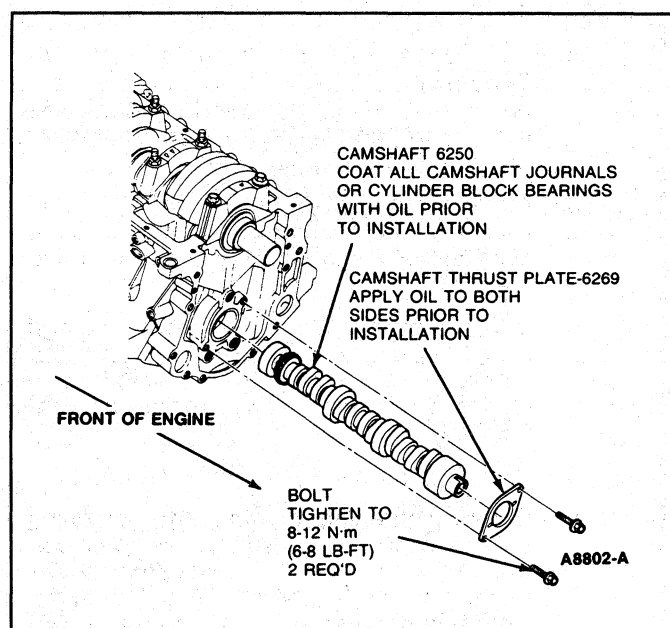
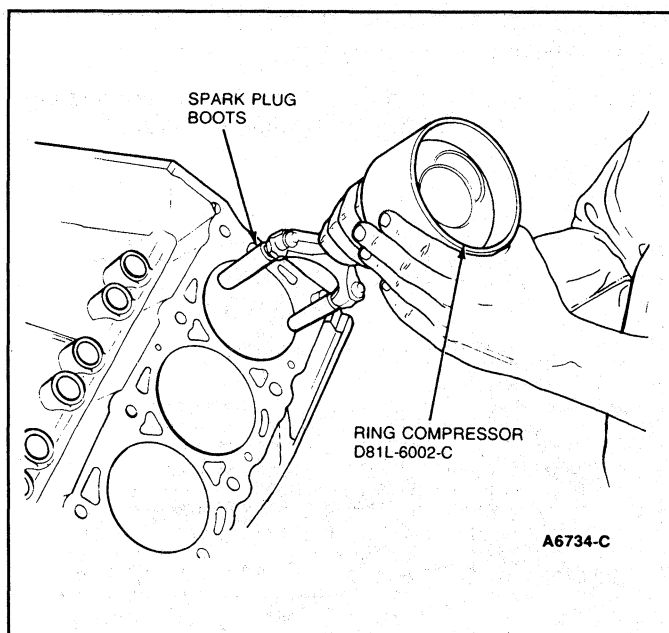


- b. Arrange piston ring gaps around the pistons.

NOTE: Scratching of the crankshaft journal can be prevented by covering the connecting rod bolts with spark plug boots.

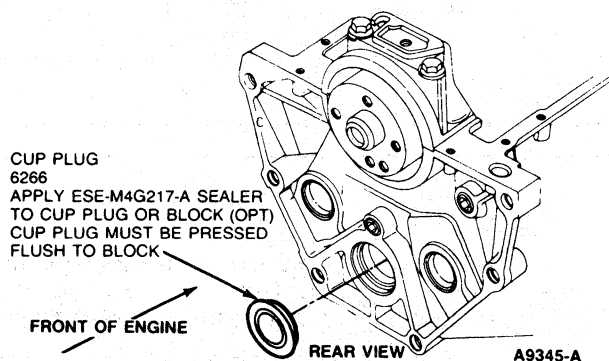
- c. Install pistons using a Piston Ring Compressor D81L-6002-C or equivalent. The notch in the piston dome and button on connecting rod have to face the front of the engine.

## DISASSEMBLY AND ASSEMBLY (Continued)



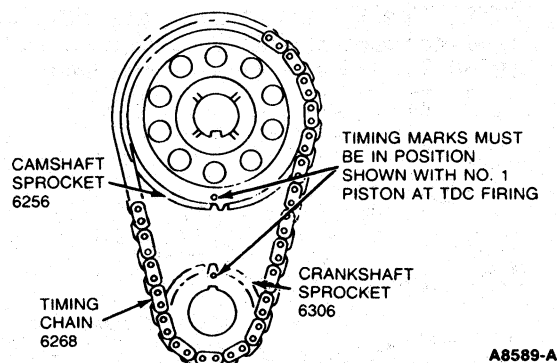
Lubricate the piston and cylinder walls with Oil Conditioner D9AZ-19579-C or equivalent before installation.

- d. Install connecting rod caps and attaching nuts. Tighten attaching nuts to 26-38 N·m (20-28 lb-ft) back off nuts a minimum of two revolutions. Tighten to 28-35 N·m (20-26 lb-ft).
5. Check connecting rod side clearance as outlined.
6. Install camshaft bore plug using a suitable driver. Coat the sealing edge of the plug with Perfect-Seal Sealing Compound D5AZ-19554-A or equivalent, before installation.
7. Install thrust plate.



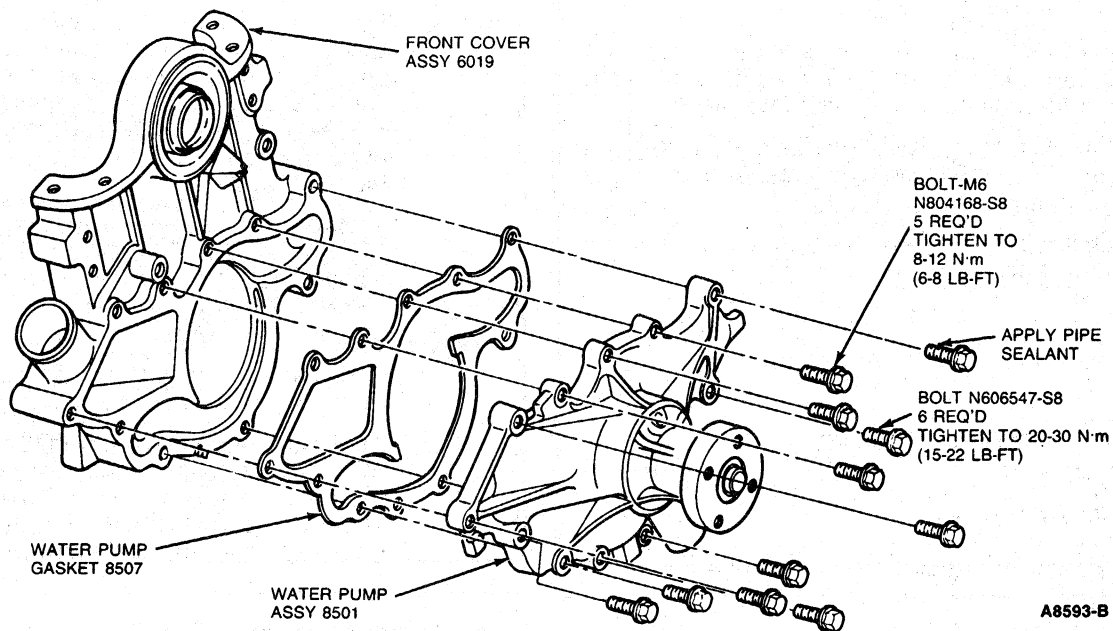
8. Coat camshaft lobes with Oil Conditioner D9AZ-19579-C or equivalent heavy engine oil. Lubricate the camshaft bearings with heavy oil SF. Install camshaft. Use care to prevent damage to bearing surface.

9. Lubricate timing chain with clean engine oil. Rotate crankshaft, as necessary, to position the crank sprocket timing mark in the 6 o'clock position with number one piston at top dead center firing. Install camshaft sprocket with timing mark in the 12 o'clock position, crankshaft sprocket and timing chain. Ensure the crankshaft keyway, cam sprocket timing mark, and crank sprocket timing mark are properly aligned after installation.



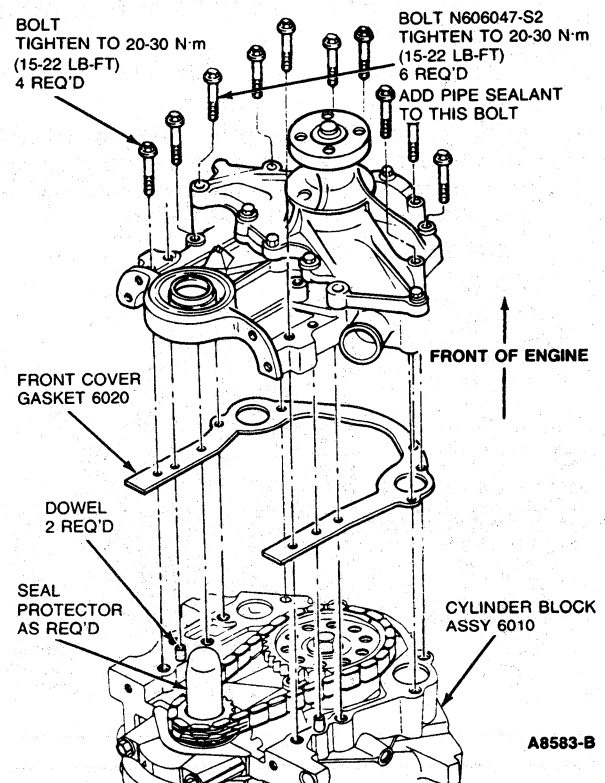
10. Install camshaft sprocket attaching bolt and tighten to 55-70 N·m (40-51 lb-ft). Check the drilled oil passages of the attaching bolt to ensure they are not plugged.
11. If the water pump was removed from the front cover during the engine disassembly, position a new pump gasket on the front cover and install water pump. Tighten pump attaching bolts to 20-30 N·m (15-22 lb-ft).

## DISASSEMBLY AND ASSEMBLY (Continued)



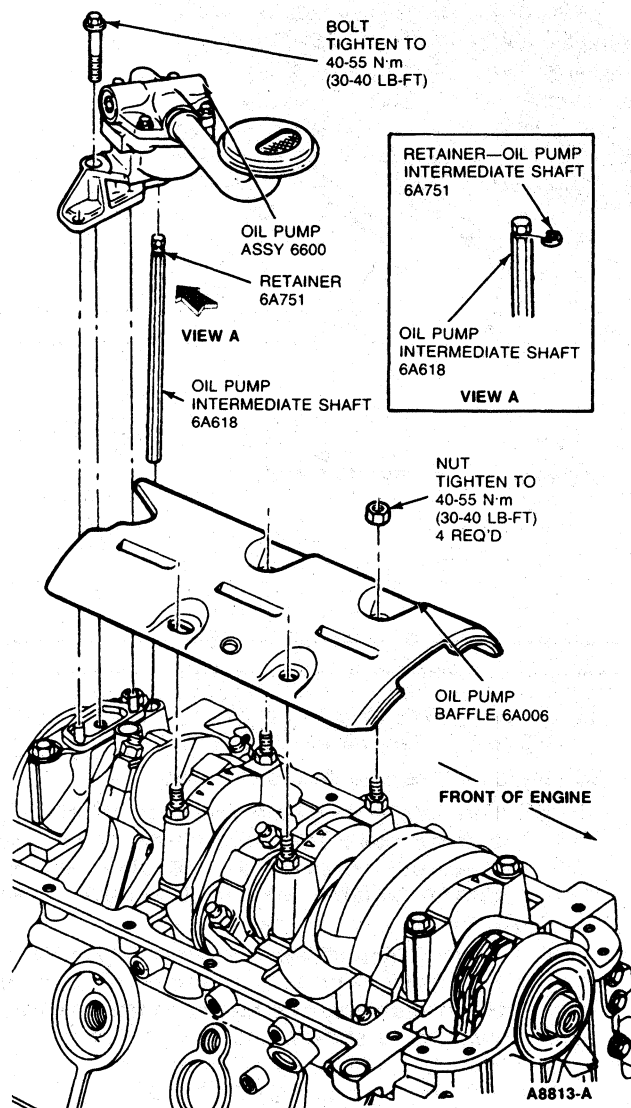
12. Install the thrust plate and attaching bolts in the end of the camshaft. Lubricate with Polyethylene Grease D0AZ-19584-A or equivalent, before installation.
13. Position a new front cover gasket on engine. Install cover. Tighten attaching bolts to 20-30 N·m (15-22 lb-ft).

NOTE: The threads of cover attaching bolts must be covered with Pipe Sealant D8AZ-19558-A or equivalent before installation.



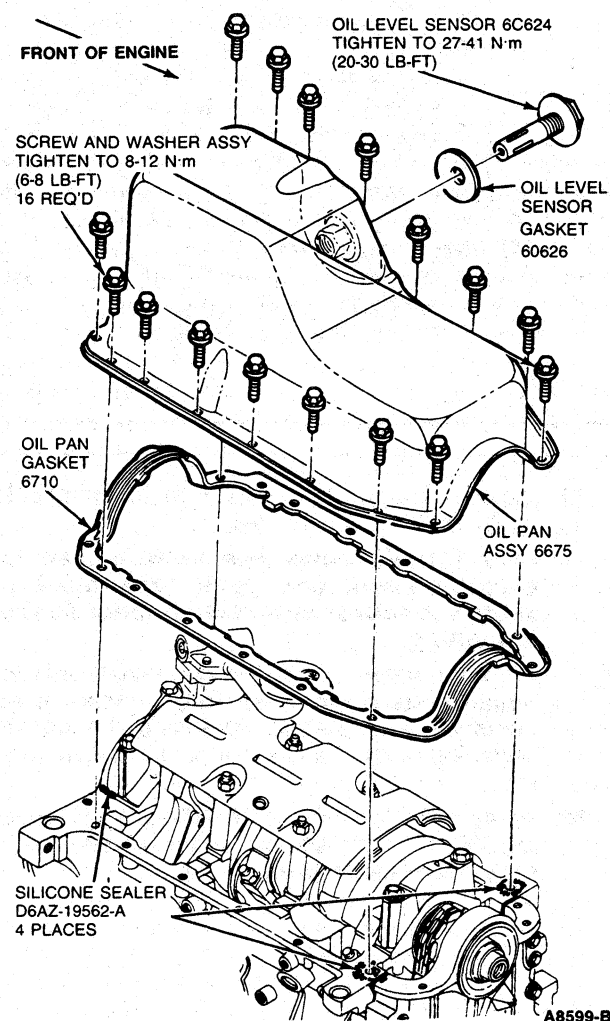
## DISASSEMBLY AND ASSEMBLY (Continued)

14. Install oil pump baffle. Tighten attaching nuts to 40-55 N·m (30-40 lb-ft).
15. Assemble retainer on end of oil pump intermediate shaft and insert shaft into hole in oil pump until retainer clicks into place.
16. Pilot oil pump with intermediate shaft through hole in rear main bearing cap, position pump over pins.
17. Install oil pump attaching bolts. Tighten to 40-55 N·m (30-40 lb-ft).



18. Install the oil pan end seal as follows:

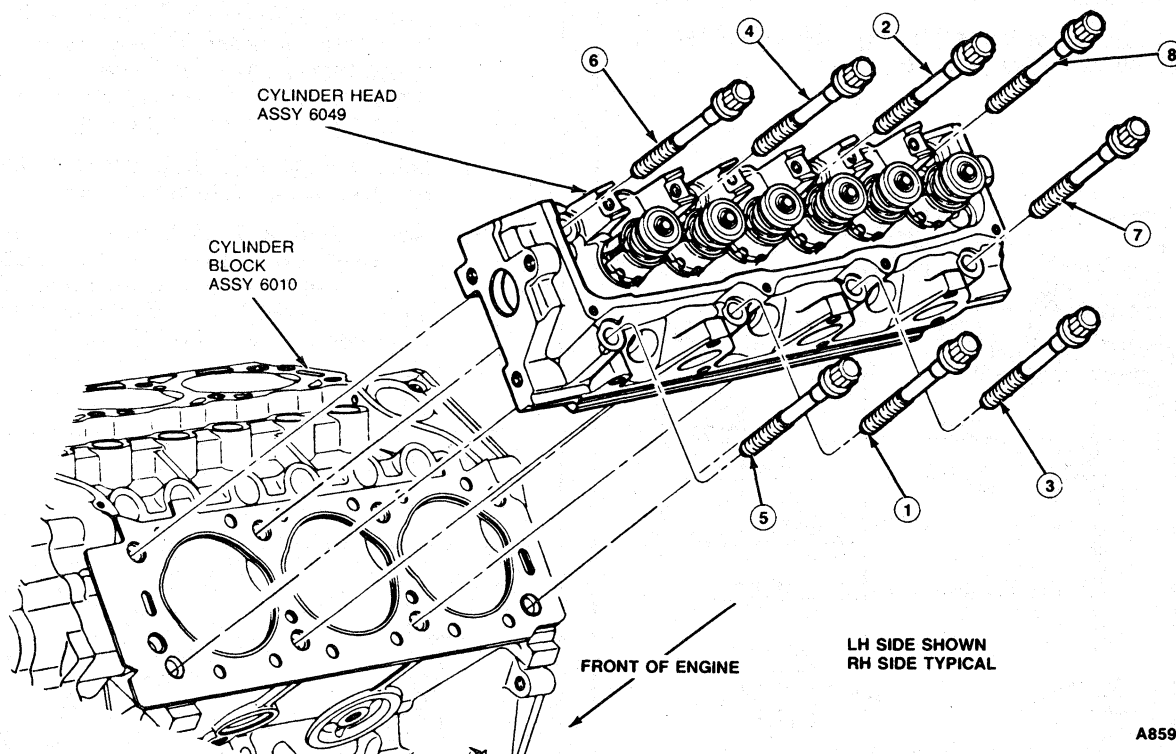
- a. Using a small-blade screwdriver remove any sealer which may have been squeezed into the oil pan sealing area when the rear main bearing cap was installed. Place a 6.35mm (1/4-inch) drop of sealer into seal groove where the bearing cap meets the block.
- b. Apply a 3.0-4.0mm (1/8-inch) bead of Silicone Sealer D6AZ-19561-B or equivalent to the seams where the front cover meets with the cylinder block and to each end of the pan end seal.
- c. Locate oil pan gasket to cylinder block pan rail and secure retaining features.
- d. Apply another 3.0-4.0mm (1/8-inch) bead of Sealer D6AZ-19562-B or equivalent, to the oil pan rails and front cover. As the sealer is applied to the front cover, increase the bead width to 4.0-5.0mm (3/16-inch).



## DISASSEMBLY AND ASSEMBLY (Continued)

- e. Install oil pan and tighten attaching bolts to 9-12 N·m (80-106 lb-in).
19. Lubricate oil filter gasket with engine oil and install.
20. Lubricate tappets with Oil Conditioner D9AZ-19579-C or equivalent, and install.

21. Install new cylinder head gaskets using the dowels to align the gasket.
22. Tighten the cylinder head attaching bolts in two tightening steps in the sequence as shown.
  - 65-75 N·m (48-54 lb-ft).
  - 85-110 N·m (63-80 lb-ft).



23. Install fulcrums. Tighten fulcrum attaching bolts to 26-38 N·m (14-29 lb-ft).

**CAUTION: Fulcrums must be fully seated in cylinder head, and push rods must be seated in rocker arm sockets prior to final tightening.**

For each valve, rotate the crankshaft until the tappet rests on the heel (base circle) of the camshaft lobe, before tightening the fulcrum attaching bolts. Position rocker arms over push rods.

24. Apply Oil Conditioner D9AZ-19579-C (ESE-M2C39F) or equivalent heavy engine oil to rocker arm assemblies.

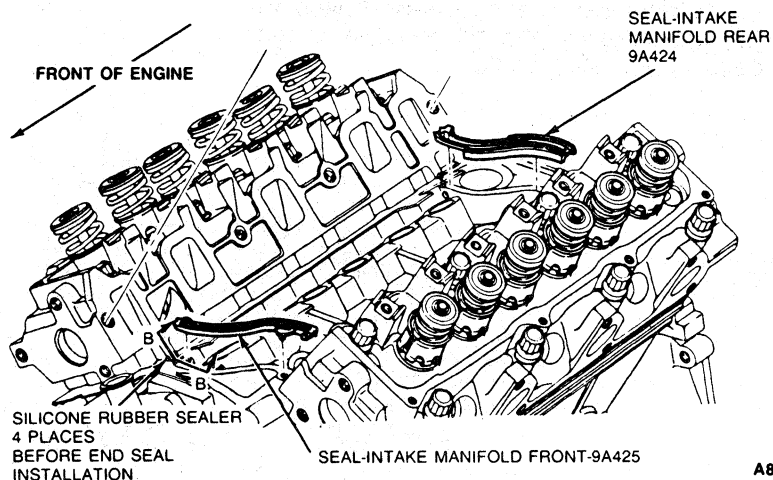
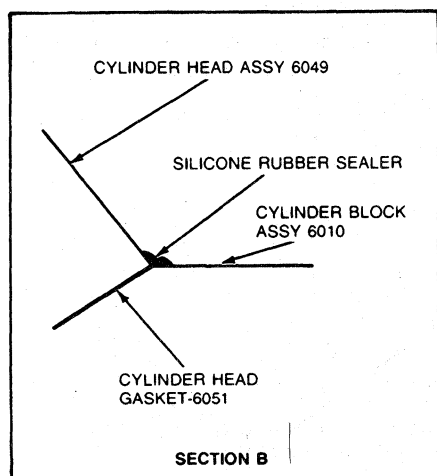
25. Final tighten bolts to 25-35 N·m (19-25 lb-ft). Camshaft may be in any position.

26. Install intake manifold as follows:

- a. The intake manifold, cylinder head and cylinder block mating surfaces should be clean and free of old silicone rubber sealer. Use a suitable solvent to clean these surfaces.
- b. Apply Silicone Rubber Sealer D6AZ-19562-A or equivalent, to intersection of cylinder block assembly and head assembly at four corners as shown.

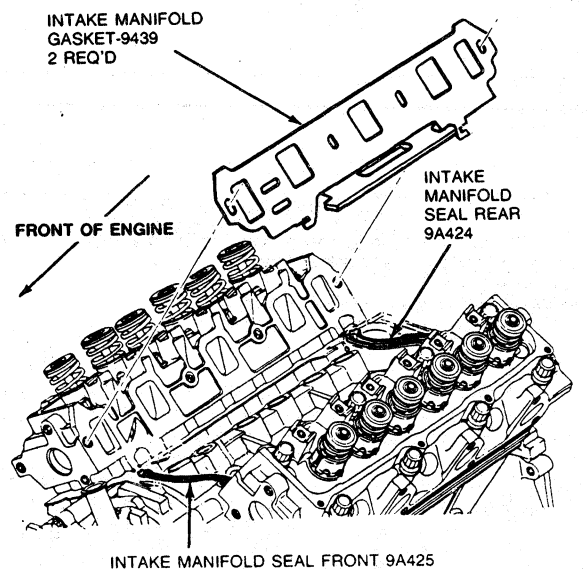


## DISASSEMBLY AND ASSEMBLY (Continued)

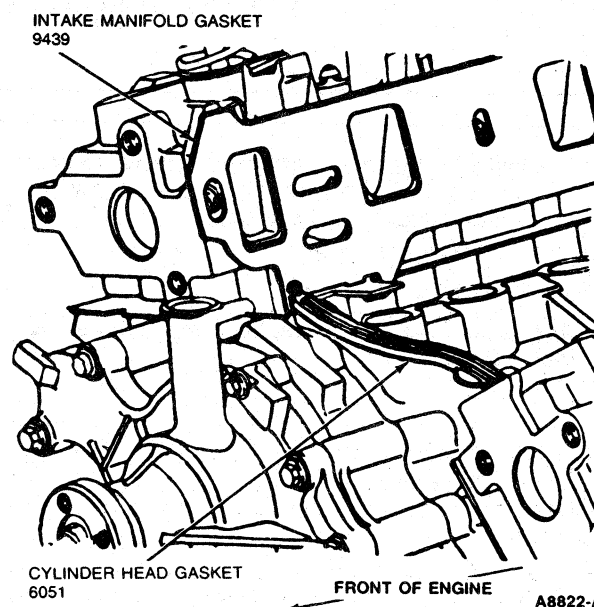


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- c. Install front intake manifold seal and rear intake manifold seal. Secure with retaining features.
- d. Position intake manifold gaskets in place and insert locking tabs over tabs on cylinder head gaskets as shown.



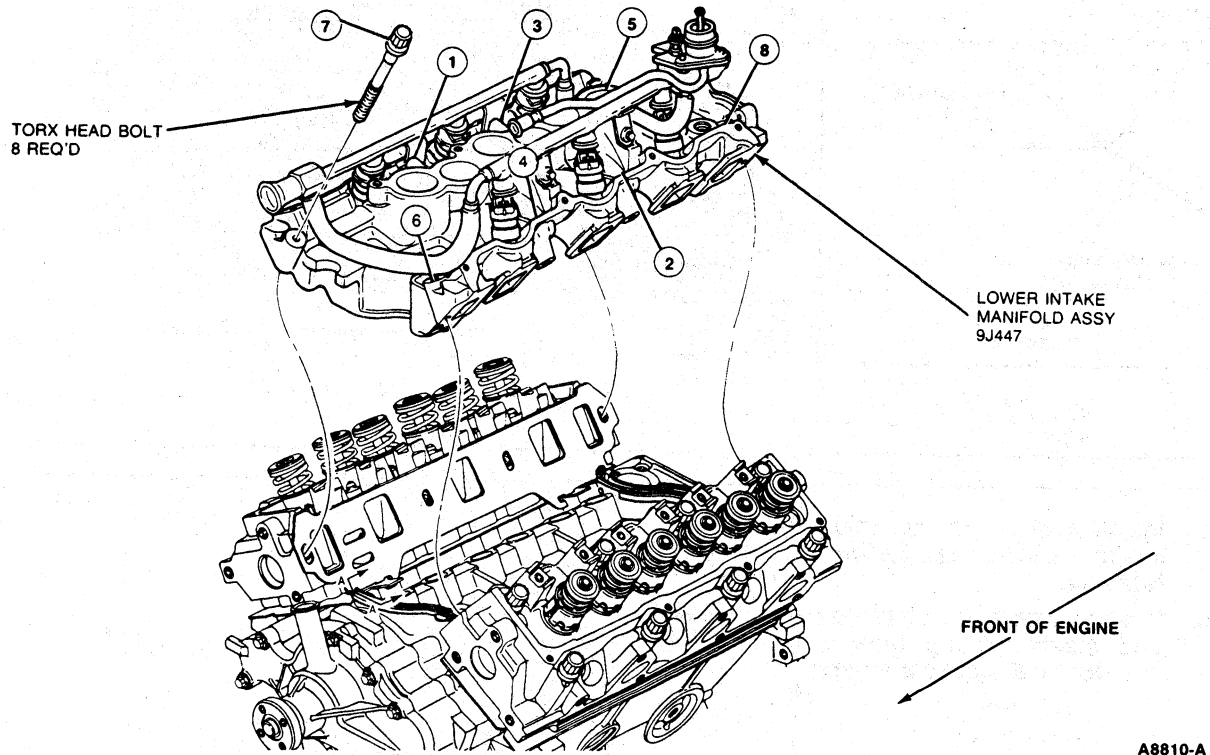
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## DISASSEMBLY AND ASSEMBLY (Continued)

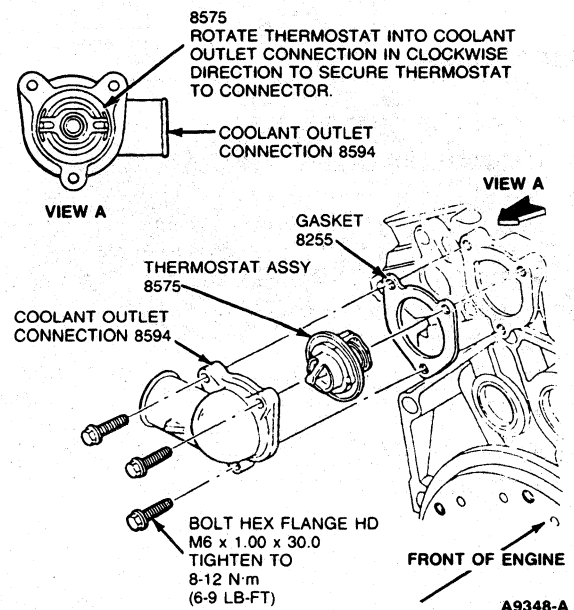
- e. Carefully lower intake manifold into position on cylinder block and cylinder heads to prevent smearing the silicone sealer and causing gasketing voids.



- f. Install bolts and tighten in the numerical sequence shown to the following specifications in two steps:

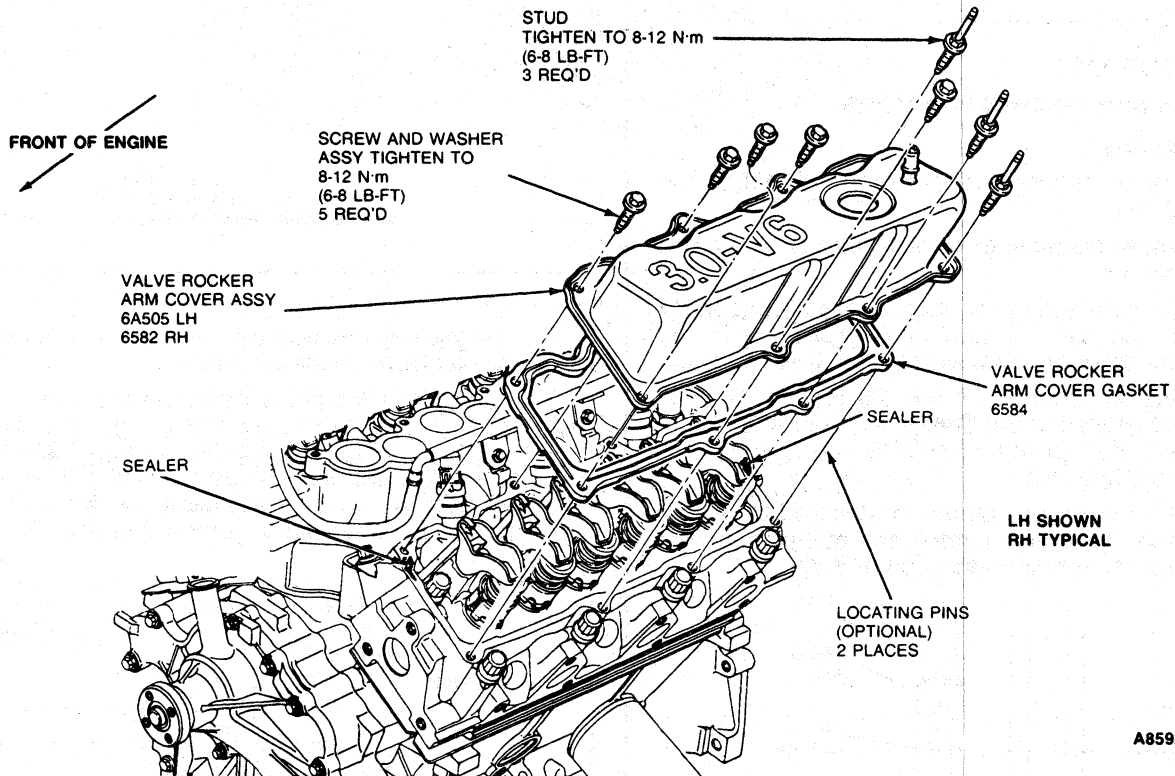
- 15 N·m (11 lb-ft).
- 24 N·m (18 lb-ft).

27. Add water outlet connection and thermostat installation.

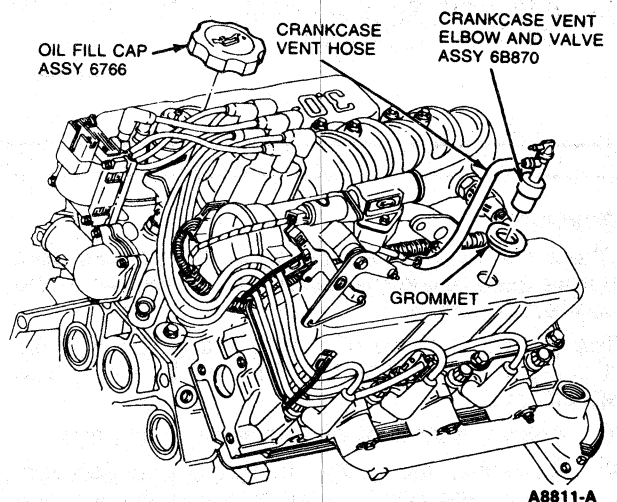


## DISASSEMBLY AND ASSEMBLY (Continued)

28. Install spark plugs. Tighten to 7.0-15.0 N·m (5-10 lb-ft).
29. To install rocker arm covers, clean valve cover and cylinder head sealing surfaces with solvent to remove all gasket material and dirt.
30. Apply Silicone Sealer D6AZ-19562-A or equivalent to intersection of head assembly and intake manifold.
31. Install rocker arm cover gasket and secure with retaining features.
32. Install rocker arm cover. Install five screw and washer assemblies and three stud assemblies. Tighten to 8-12 N·m (6-8 lb-ft).



33. Install distributor and hold-down clamp.
34. Install distributor boot shield and secure strap.
35. Install crankshaft damper using Seal/Damper Installer T82L-6316-A and Seal Installer Adapter T70P-6B070-A or equivalent. Tighten attaching bolts to 26-38 N·m (20-28 lb-ft).
36. Install distributor cap. Connect secondary wires to the spark plugs.
37. Install the following PCV system components:
  - PCV valve and grommet.
  - PCV hoses.
  - Oil filler cap.



**DISASSEMBLY AND ASSEMBLY (Continued)**

38. Install exhaust manifolds. Note the location of the oil dipstick tube support bracket. Tighten exhaust manifold attaching bolts to 20-30 N·m (15-22 lb-in).

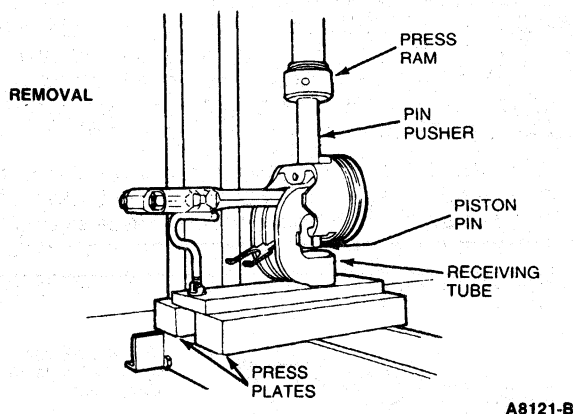
39. Install flywheel.

Tighten the attaching bolts to 73-87 N·m (54-64 lb-ft) in the standard cross-tightening sequence.

**Subassemblies****Pistons and Connecting Rods****Disassembly**

1. Remove bearing inserts from connecting rod and cap.
2. Remove piston rings using a suitable piston ring expander.
3. Mark connecting rod cap to ensure assembly with the same piston and installation in the same cylinders from which they were removed.
4. Using an Arbor Press and Piston Pin Removal and Installation Set T68P-6135-A or equivalent, press the piston pin from the piston and connecting rod.

NOTE: Cylinder number is stamped on top of piston. Matching letters are stamped in the sides of corresponding rod and cap.



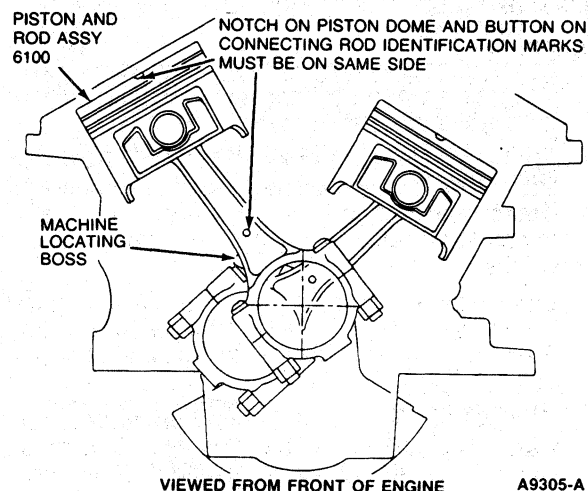
A8121-B

**Assembly**

Check the fit of a new piston in the cylinder bore before assembling the piston and piston pin to the connecting rod.

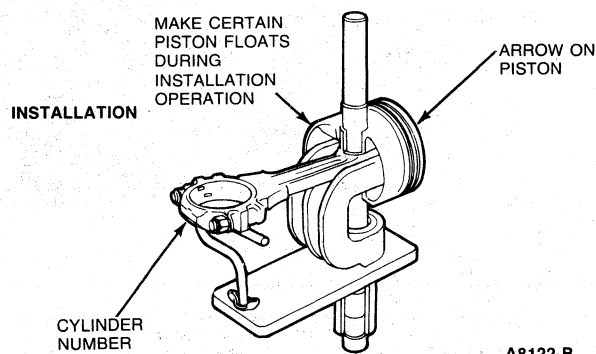
The piston pin bore of a connecting rod and the diameter of the piston pin must be within specification.

1. Apply a light coat of engine oil to all parts.
2. Assemble the piston to the connecting rod, putting the notch in the piston dome and the connecting rod on the same side.



On V-6 engines with one rod per pin, both sides of rod have larger chamfers.

3. Start the piston pin in the piston and connecting rod. (This may require a very light tap with a mallet). Using an Arbor Press and Piston Pin Removal and Installation Set T68P-6135-A or equivalent, press the piston pin through the piston until the pin is centered in the piston.



A8122-B

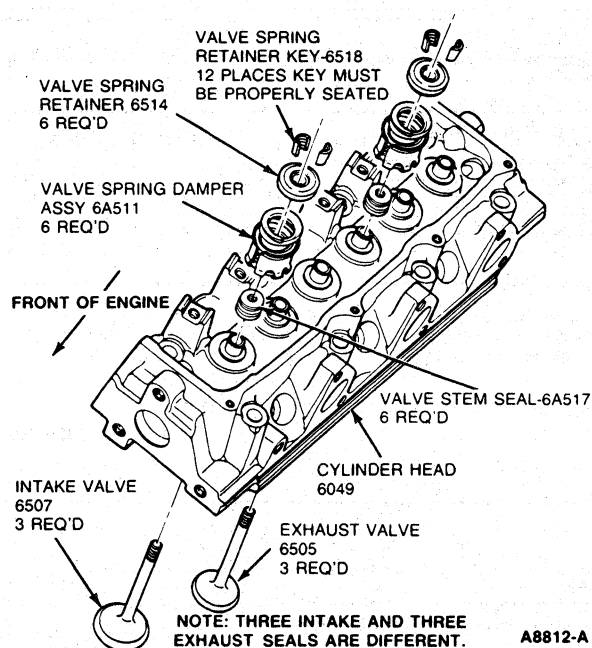
4. Check the end gap of all piston rings. It must be within specification. Follow the instructions contained on the piston ring package and install the piston rings.
5. Check the ring side clearance of the compression rings with Feeler Gauge D81L-4201-A or equivalent, by inserting it between the ring and its lower land. The gauge should slide freely around the entire ring circumference without binding. Any wear that occurs will form a step at the inner portion of the lower land. If the lower lands have high steps, the piston should be replaced.
6. Ensure the bearing inserts and the bearing bore in the connecting rod and cap are clean. Foreign material under the inserts will distort the bearing and cause a failure. Install the bearing inserts in the connecting rod and cap with the tangs fitting in the slots provided.

## DISASSEMBLY AND ASSEMBLY (Continued)

## Cylinder Head

## Disassembly

1. Remove rocker arm fulcrum attaching bolts, fulcrums and rocker arms.
2. Remove exhaust manifolds, if required, and spark plugs.
3. Clean carbon out of the cylinder head combustion chambers before removing the valves.
4. Compress valve springs using Valve Spring Compressor Tool T81P-6513-A or equivalent. Remove spring retainer locks and release spring.
5. Remove spring retainer, spring, stem seal and valve. Discard valve stem seals. Identify all valve parts as to which cylinder they were removed from and whether intake or exhaust.



6. Clean, inspect and service the cylinder head as required, or prepare to transfer all usable parts to a new cylinder head.

## Assembly

All valves, valve stems and valve guides are to be lubricated with heavy oil SF. The valve tips are to have Ford Polyethylene Grease D0AZ-19584-A or equivalent, applied before installation.

1. Install each valve in the port from which it was removed or to which it was fitted.
2. Install valve stem seal. Use a 5/8-inch deep-well socket and a light mallet or hammer to seat seal on valve stem. Ensure intake seals and exhaust seals are on proper stem.
3. Install valve spring over valve and then install spring retainer. Compress spring and install retainer locks.
4. Measure the assembled height of the valve spring from the top of the spring seat to the underside of the spring retainer with dividers. Check the dividers against a scale. If the assembled height is greater than specification, install the necessary 0.030-inch thick spacer(s) between the cylinder head spring pad and the valve spring to bring the assembled height to the recommended height.

**CAUTION: Do not install the spacers unless necessary. Use of spacers in excess of recommendations will result in overstressing the valve springs and overloading the camshaft lobes which could lead to spring breakage and/or worn camshaft lobes.**

5. Position rocker arms and fulcrums on cylinder head and install fulcrum attaching bolt. **Do not tighten bolts.** The bolts must be loose enough to allow the rocker arm to be rotated to the side.
6. Install exhaust manifolds, if removed, and spark plugs.

## SPECIFICATIONS

## TORQUE SPECIFICATIONS

Description	N·m	Lb·Ft	Description	N·m	Lb·Ft
Camshaft Sprocket to Camshaft — Bolt	55-70	40-51	Main Bearing Cap — Bolt	88-110	65-81
Connecting Rod — Nut	Footnote No. 5	—	MCT Sensor (50 State CFI)	8-13	6-9.5
Coolant Temp. Switch	11-16	8-12	Oil Filter Adaptor to Front Cover — Bolt	25-30	18-22
Crankshaft Damper to Crankshaft — Bolt	190-230	141-169	Oil Filter to Oil Filter Adapter (Footnote No. 1)	10-15	89-132 (Lb-In)
Crankshaft Pulley to Damper — Bolt	26-38	20-28	Oil Inlet Tube to Cylinder Block — Bolt	20-30	15-22
Cylinder Head Bolt	—	Footnote No. 2	Oil Inlet Tube to Main Bearing Cap — Nut	40-55	30-40
Distributor Cap (CFI)	2.0-2.6	18-23 (Lb-In)	Oil Pan to Cylinder Block — Bolt	9-12	80-106 (Lb-In)
Distributor Hold-Down Bolt	27-40	20-29	PVS Valve (CFI)	8-13	6-9.5
Distributor Rotor (CFI)	2.8-3.9	25-35 (Lb-In)	PVS Valves (2150-2V)	8-13	6-9.5
ECT Sensor (2150-2V)	16-24	12-17	Rocker Arm Cover to Cylinder Head — Bolts/Studs	9-12	80-106 (Lb-In)
EGR Spacer to Intake Manifold — Bolt	20-30	177-265 (Lb-In)	Rocker Arm Fulcrum to Cylinder Head — Bolt	—	Footnote No. 3
EGR Valve to EGR Spacer — Nut	20-30	15-22	Spark Knock Sensor (Mustang/Capri 50 State CFI)	40-55	29-40
Flywheel to Crankshaft — Bolt	73-87	54-64	Spark Plug to Cylinder Head	7-15	5-11
Front Cover to Cylinder Block — Bolt	20-30	15-22	Thermactor Check Valve to Intake Manifold	22-26	16.5-19
Fuel Pump to Front Cover — Bolt (2150-2V)	20-30	15-22	Thermostat Housing to Intake Manifold — Bolt	8-12	6-8
Fuel Rail to Intake Manifold (4)	8 (Max.)	70 (Lb-In)	Vacuum Fitting to Intake Manifold	35-45	26-33
Heater Elbow	8.5-13.5	6.5-10	Vacuum Tree to Intake Manifold	8-13	6-9.5
Heater Tube to Intake Manifold Stud — Bolt	20-30	15-22	Water Pump to Front Cover — Bolt	8-12	6-8
Intake Manifold to Cylinder Head — Bolt	—	Footnote No. 4	Wiring Retainer Bracket — Nut	20-30	15-22
Low Level Oil Sensor	34-47.5	26-35			

## FOOTNOTES:

(1) Advance half turn after gasket contacts sealing surface.

(2) A. Tighten in two steps:  
65-75 N·m (48-54 Lb-Ft)  
85-110 N·m (63-80 Lb-Ft)(3) Tighten in two steps:  
A. 7-15 N·m (5.1-11.0 Lb-Ft)  
B. 26-38 N·m (20-28 Lb-Ft)(4) Tighten in three steps:  
A. 15 N·m (11 Lb-Ft)  
B. 25 N·m (18 Lb-Ft)  
C. 33 N·m (24 Lb-Ft)(5) A. Tighten to 26-38 N·m (20-28 Lb-Ft)  
B. Back off nuts a minimum of 2 revolutions.  
C. Tighten to 28-35 N·m (20-26 Lb-Ft)

CA8814-B

## TORQUE SPECIFICATIONS

Description	N·m	Lb·Ft	Description	N·m	Lb·Ft
A/C Lower Mounting Bracket to Engine Nuts	41-61	30-45	Idle Bracket to Alternator Top Attaching Flange Bolt	33-46	24-34
Air Pump Pivot Bolt	40-55	30-40	Idle Pulley Adv. Bolts (2 Places)	40-55	30-40
Air Pump to Support Bracket Bolt	40-55	30-40	Nut Brace to Engine, A/C	20-30	15-22
Alternator Pivot Bolt	61-75	45-57	Support A/C Comp. Mounting Bolt to Bracket Assembly (2 Places)	41-61	30-45
Bolt A/C Comp. Mounting (5 Places)	41-61	30-45	<b>POWER STEERING WITH A/C</b>		
Bolt Front Brace to Engine Brace A/C	41-61	30-45	Front Bracket to Power Steering Pump — Bolt (3 Places)	40-62	30-35
Bracket, Idler Front Attach Bolt Lower	40-55	30-40	Power Steering Brace Bolt (Lower)	24-32	18-24
Bracket, Idler Front Attach Bolt Upper	70-95	52-70	Power Steering Brace Bolt (Upper)	40-62	30-45
Bracket, Idler Top Bolt	40-55	30-40	Power Steering Front Bracket Nut (2 Places)	40-62	30-35
Engine Bracket Reinforcement Brace to Engine Bracket — Bolt (Damper)	47-67	35-50	Power Steering Front Bracket to A/C Bracket — Bolt	40-62	30-35
Engine Bracket Reinforcement Brace to Engine Bracket — Nut (Damper)	80-107	60-80	<b>POWER STEERING W/O A/C</b>		
Front A/C Comp. Plate Nut to Engine Stud (2 Places)	41-61	30-45	Power Steering Brace Bolt (2 Places)	40-62	30-45
Front A/C Comp. Plate to Lower A/C Mounting Bracket Bolt	41-61	30-45	Power Steering Front Bracket Bolt (2 Places)	40-62	30-45
Front Brace, A/C To Engine Stud — Nut	20-30	15-22	Power Steering Front Bracket Bolt (3 Places)	40-62	30-45

CA6638-D

## SPECIFICATIONS (Continued)

GENERAL SPECIFICATIONS			
Torque Specifications — Unless Otherwise Noted Values for Parts as Supplied			
Thread Size	Torque Cast Iron & Aluminum	Thread Size	Torque Cast Iron & Aluminum
(1/4-18) Pipe	11-16 N•m (8-12 Lb-Ft)	M6	8-12 N•m (71-106 Lb-In)
(3/8-18) Pipe	16-24 N•m (12-18 Lb-Ft)	M8	20-30 N•m (15-22 Lb-Ft)
		M10	40-55 N•m (30-40 Lb-Ft)
		M12	70-95 N•m (52-70 Lb-Ft)
		M14	110-155 N•m (81-114 Lb-Ft)

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## SPECIFICATIONS (Continued)

## GENERAL SPECIFICATION

DISPLACEMENT .....	3.0L
NUMBER OF CYLINDERS .....	6
BORE AND STROKE	
Bore .....	89.00mm (3.50 in.)
Stroke .....	80.00mm (3.14 in.)
FIRING ORDER .....	1-4-2-5-3-6
OIL PRESSURE (HOT 2500 RPM) .....	40-60 PSI
DRIVE BELT TENSION .....	SEE CHART

## CYLINDER HEAD AND VALVE TRAIN

COMBUSTION CHAMBER VOLUME (cc) .....	61.48-64.48
VALVE GUIDE BORE DIAMETER	
Intake and Exhaust .....	8.011-7.986mm (0.315-0.314 in.)
VALVE SEATS	
Width — Intake .....	1.5-2.0mm (.06-.08 in.)
Exhaust .....	2.0-2.5mm (.08-.10 in.)
Angle .....	45°
Runout (T.I.R.) .....	0.025mm (0.001 in.)
GASKET SURFACE FLATNESS .....	0.018mm (0.007 in.)
VALVE STEM TO GUIDE CLEARANCE	
Intake .....	0.026-0.071mm (0.001-0.0028 in.)
Exhaust .....	0.038-0.083mm (0.0015-0.0033 in.)
VALVE HEAD DIAMETER (GAGE)	
Intake .....	40.0mm (1.57 in.)
Exhaust .....	33.0mm (1.30 in.)
VALVE FACE RUNOUT LIMIT .....	0.05mm (0.002 in.)
VALVE FACE ANGLE .....	44°
VALVE STEM DIAMETER (STD.)	
Intake .....	7.960-7.940mm (0.3134-0.3126 in.)
Exhaust .....	7.948-7.928mm (0.3129-0.3121 in.)
Oversize	
Intake .....	8.340-8.320mm (0.3283-0.3276 in.)
Exhaust .....	8.328-8.308mm (0.3279-0.3271 in.)
Oversize	
Intake .....	8.720-8.700mm (0.3433-0.3425 in.)
Exhaust .....	8.708-8.688mm (0.3428-0.3420 in.)
VALVE SPRINGS	
Compression Pressure (Kg [Lb] @ Spec. Length)	
Loaded	
(Without Damper) .....	822.9N (185 lbs.)
	28.3mm (1.11 in.)
Unloaded	
(Without Damper) .....	324.7N (73 lbs.)
	@ 39.0mm (1.54 in.)
Free Length (Approximate) .....	46.08mm (1.81 in.)
Assembled Height .....	40.08mm (1.58 in.)
Service Limit .....	10% Force Loss @ Specified Height
ROCKER ARM	
Ratio .....	1.61
VALVE TAPPET, HYDRAULIC	
Diameter (Std.) .....	22.206mm (0.874 in.)
Clearance to Bore .....	0.018-0.069mm (0.0007-0.0027 in.)
Service Limit .....	0.127mm (0.005 in.)
Hydraulic Leakdown Rate .....	(a)
Collapsed Tappet Gap (Nominal)	
Intake and Exhaust .....	2.15-4.69mm (0.085-0.185 in.)
Tappet Bore Diameter .....	22.268-22.230mm (0.8767-0.8752 in.)

## CYLINDER HEAD AND VALVE TRAIN — Continued

CAMSHAFT BORE INSIDE DIAMETER	
No. 1 .....	54.688-54.713mm (2.1531-2.1541 in.)
No. 2 .....	54.188-54.213mm (2.1334-2.1344 in.)
No. 3 .....	54.188-54.213mm (2.1334-2.1344 in.)
No. 4 .....	54.688-54.713mm (2.1531-2.1541 in.)

## CAMSHAFT

LOBE LIFT	
INTAKE .....	6.604mm (0.260 in.)
EXHAUST .....	6.604mm (0.260 in.)
Allowable Lobe Lift Loss .....	0.127mm (0.005 in.)
THEORETICAL VALVE LIFT @ ZERO LASH	
Intake .....	10.65mm (0.419 in.)
Exhaust .....	10.65mm (0.419 in.)
ENDPLAY	
Service Limit .....	0.127mm (0.005 in.)
JOURNAL TO BEARING	
CLEARANCE .....	0.025-0.076mm (0.001-0.003 in.)
JOURNAL DIAMETER	
All .....	50.987-51.013mm (2.0074-2.0084 in.)
CAM BEARING I.D. ....	51.038-51.063mm (2.0094-2.0104 in.)
Runout Limit .....	0.127mm (0.005 in.)
	Runout of No. 2 or No. 3 relative to No. 1 and No. 4
Out-of-Round Limit .....	0.010mm (0.0004 in.)

## CYLINDER BLOCK

HEAD GASKET SURFACE	
FLATNESS .....	0.08mm (0.003 in.) in 152.0mm (6.00 in.)
HEAD GASKET SURFACE FINISH (RMS) .....	2.3-3.8 micrometers
CYLINDER BORE	
Diameter .....	89.00mm (3.504 in.)
Surface Finish (RMS) micrometers .....	0.45-0.96
Out-of-Round Limit .....	0.015mm (0.0006 in.)
Out-of-Round Service Limit .....	0.050mm (0.002 in.)
Taper Service Limit .....	0.050mm (0.002 in.)
MAIN BEARING BORE DIAMETER .....	68.905mm (2.713 in.)
	68.885mm (2.712 in.)

## CRANKSHAFT AND FLYWHEEL

MAIN BEARING JOURNAL	
DIAMETER .....	63.973-64.003mm (2.5190-2.5198 in.)
Out-of-Round Limit .....	0.008mm (0.0003 in.)
Taper Limit .....	0.015mm (0.0006 in.) TOTAL
	0.008mm (0.0003 in.) per 25mm (1 in.)
Journal Runout Limit .....	0.05mm (0.002 in.) (2),
	0.05mm (0.002 in.) (3)
Surface Finish (RMS) .....	0.25 micrometers (10.0 micro in.)
THRUST BEARING JOURNAL	
Length .....	25.775-25.825mm (1.0148-1.067 in.)
CONNECTING ROD JOURNAL	
Diameter .....	53.983-54.003mm
	(2.1253-2.1261 in.)
Out-of-Round Limit .....	0.008mm (0.0003 in.) MAX.
	0.015mm (0.0006 in.) TOTAL
Taper Limit .....	0.008mm per 25mm (0.0003 in. per in.)
Surface Limit (RMS) .....	0.25 micrometers (10.0 micro in.)
MAIN BEARING THRUST FACE	
Surface Finish (RMS) 0.4 micrometers (0.157 micro in.) FRONT;	
0.4 micrometers (0.157 micro in.) REAR;	
Runout Limit .....	0.025mm (0.001 in.)

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## SPECIFICATIONS (Continued)

**CRANKSHAFT AND FLYWHEEL — Continued**

<b>FLYWHEEL RING GEAR LATERAL RUNOUT (T.I.R.)</b>	
Automatic Transmission	1.778mm (0.07 in.)
<b>CRANKSHAFT END PLAY</b> 0.10-0.20mm (0.004-0.008 in.)	
<b>CONNECTING ROD BEARINGS</b>	
Clearance to Crankshaft	
Desired	0.025-0.035mm (0.001-0.0014 in.)
Allowable	0.020-0.066mm (0.00086-0.0027 in.)
Bearing Wall Thickness (Std.)	1.557-1.570mm (0.0612-0.0618 in.)

**MAIN BEARINGS**

Clearance to Crankshaft	
Desired	.025-.035mm (0.001-0.0014 in.)
Allowable	.020-.066mm (0.0005-0.0023 in.)
Bearing Wall Thickness (Std.)	N/A

**CONNECTING ROD, PISTON AND RINGS**

<b>CONNECTING ROD</b>	
Piston Pin Bore Diameter	23.105-23.145mm (0.9096-0.9112 in.)
Crankshaft Bearing Bore Diameter	57.15-57.17mm (2.250-2.251 in.)
Length (Center-to-Center)	140.46-140.54mm (5.530-5.533 in.)

**ALIGNMENT (BORE-TO-BORE MAX. DIFF.)**

Twist	0.050 per 25mm (0.002 per in.)
Bend	0.038 per 25mm (0.0015 per in.)

**SIDE CLEARANCE (ASSEMBLED TO CRANK)**

Standard	0.15-0.35mm (0.006-0.014 in.)
Service Limit	0.36mm MAX. (0.014 in. MAX.)

**PISTON**

Diameter	
Coded Red	88.962-88.978mm (3.5024-3.5031 in.)
Coded Blue	88.988-89.004mm (3.5035-3.5041 in.)
Coded Yellow	89.014-89.030mm (3.5045-3.5051 in.)

<b>PISTON-TO-BORE CLEARANCE</b>	0.036-0.056mm (0.0014-0.0022 in.)
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Service Limit	0.081mm MAX.
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**SERVICE PISTON SELECTION (b)**

Piston Bore Diameter	Service Piston Grade Required
89.009-89.035mm (3.5043-3.5053 in.)	RED
89.035-89.060mm (3.5053-3.5063 in.)	BLUE
89.060-89.086mm (3.5063-3.5073 in.)	YELLOW

**RING GROOVE WIDTH**

Compression (Top)	0.520-0.540mm (0.060-0.061 in.)
Compression (Bottom)	0.520-0.540mm (0.060-0.061 in.)
Oil	4.030-4.055mm (0.1587-0.1596 in.)

**PISTON PIN**

Length	69.3-70.1mm (2.728-2.760 in.)
Diameter	23.162-23.175mm (0.9119-0.9124 in.)

<b>PIN TO PISTON CLEARANCE</b>	0.005-0.012mm (0.0002-0.0005 in.)
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<b>PIN TO ROD CLEARANCE</b>	Press Fit 4 KiloNewtons (900 lbs.) Min. to Move
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**PISTON RINGS**

Ring Width	
Compression (Top)	1.460-1.490mm (0.0575-0.0587 in.)
Compression (Bottom)	1.460-1.490mm (0.0575-0.0587 in.)
Oil Ring	Side Seal — Snug Fit
Service Limit	Side Clearance 0.15mm MAX. (0.006 in. MAX.)

**Ring Gap**

Compression (Top) (In Gauge)	0.25-0.50mm (0.01-0.02 in.)
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**PISTON — Continued**

Compression (Bottom) (In Gauge)	0.25-0.50mm (0.01-0.02 in.)
Oil Ring (Steel Rail) (In Gauge)	0.25-1.25mm (0.010-0.049 in.)
Side Clearance	
1st Ring	0.030-0.080mm (0.0012-0.0031 in.)
2nd Ring	0.030-0.080mm (0.0012-0.0031 in.)

**LUBRICATION SYSTEM****OIL PUMP**

Relief Valve Spring Tension (Force @ Length)	44.9-40.5 N (10.1-9.1 lb.) @ 28.2mm (1.11 in.)
Relief Valve to Bore Clearance	0.073-0.043mm (0.0029-0.0017 in.)
Oil Pump Gear Backlash	0.02-0.03mm (0.008-0.012 in.)
Oil Pump Gear Radial Clearance (Idler and Driver)	0.125-0.050mm (0.0055-0.002 in.)
Oil Pump Gear Height Clearance	0.140-0.050mm (0.0055-0.0005 in.)
Idler Shaft to Idler Gear Clearance	0.044-0.010mm (0.0017-0.0004 in.)
Driver Shaft to Housing Clearance	0.048-0.013mm (0.0019-0.0005 in.)

**OIL CAPACITY**

Passenger Car: 4 qt. + 0.5 with filter change.

- 20-200 seconds to leakdown 3.18 (0.125 in.) with 225 Newtons (50 pounds) load and tappet filled with leak-down fluid.
- When replacing pistons, measure the cylinder bore as described in the General Engine Section 21-01 and install the indicated service piston.
- Smaller than pin bore measured along center to center axis.

**BELT TENSION ALLOWABLE LIMITS**

	Specifications		Allowable Minimum
	New Belt (1) Installation Tension	Used Belt (2) Reset Tension	Cold Belt (2) (3) Audit Check
<b>"V" Belts</b>			
1/4 inch Width	50-80	40-60	40-80
1/4 inch Width	120-160	90-120	70-160
1/4 inch Width (Air pump belt only)	90-130	90-120	60-120
<b>"V" Ribbed Belts</b>			
6 rib (non-serpentine)	150-190	140-160	90
6 rib (V-6 serpentine)	160-190	130-160	90-180
6 rib (V-8 serpentine)	85-140	80-140	80-140
5 rib	130-170	120-150	80-150
4 rib	100-140	80-100	60
4 rib (Air pump belt only)	90-130	40-60	40

- New belt installed and tensioned; engine not rotated.
- Used belt is any belt that has rotated on an engine.
- Cold belt (i.e., 3-hour soak; 0 warm-up).

**SPECIAL SERVICE TOOLS**

Tool Number	Description	Tool Number	Description
T50T-100-A	Impact Slide Hammer	T83P-19623-C	Spring Lock Coupling Tool
T59L-100-B	Impact Slide Hammer	TOOL-6331-E	Upper Main Bearing Insert Remover and Replacer
D81L-4201-A	Feeler Gauge	T74P-6375-A	Flywheel Locking Tool
TOOL-4201-C	Dial Indicator	T70L-6500-A	Hydraulic Lifter Puller
D81L-600-A	Lb-In Torque Wrench	T82L-6500-A	Tappet Collapser
D81L-600-B	Lb-Ft Torque Wrench	TOOL-6500-E	Hydraulic Leakdown Tester
T75T-6000-A	Engine Lifting Plate	T81P-6513-A	Valve Spring Compressor
D79P-6000-A	Engine Support Bar	TOOL-6513-DD	Valve/Clutch Spring Tester
D81L-6001-D	Engine Lifting Bracket	T74P-6666-A	Spark Plug Wire Remover
D81L-6002-C	Piston Ring Compressor	T82L-6701-A	Rear Main Seal Installer
T68P-6135-A	Piston Pin Remover and Replacer	T70P-68070-A	Front Cover Seal Installer
T65L-6250-A	Camshaft Bearing Set	T81P-9425-A	Intake Manifold Torque Adaptor
T81P-6254-A	Belt Tensioner Adaptor	T78P-9481-A	Manual Clamp Cutter
T58P-6316-D	Crankshaft Damper Remover	T77L-9533-B	Jet Plug Remover
T82L-6316-A	Damper/Front Cover Seal Installer	Rotunda 107-00901	Rotunda Tapersert Installation Kit
T82L-6316-B	Damper Remover		

CA6797-F

# GROUP IGNITION SYSTEM 23

(12000)

## SECTION 23-05 Ignition System—Service

SUBJECT	PAGE	SUBJECT	PAGE
ADJUSTMENTS .....	23-05-4	REMOVAL AND INSTALLATION	
CLEANING AND INSPECTION		Distributor Assembly .....	23-05-4
Distributor Cap .....	23-05-8	Ignition Module—TFI-IV .....	23-05-4
Ignition Coil .....	23-05-8	Spark Plug Wires .....	23-05-7
Rotor .....	23-05-8	Spark Plugs .....	23-05-7
Spark Plug Wires .....	23-05-8	Stator Assembly .....	23-05-5
Tachometer Connection .....	23-05-8	SPECIAL SERVICE TOOLS .....	23-05-8
DESCRIPTION		SPECIFICATIONS .....	23-05-8
Ignition System Features .....	23-05-1	VEHICLE APPLICATION .....	23-05-1
OPERATION			
Distributor Identification .....	23-05-4		

### VEHICLE APPLICATION

Taurus/Sable.

### DESCRIPTION

This Section is designed to serve as a guide in understanding, testing and servicing the 3.0L (186 CID) EFI and the 2.5L (153 CID) High Swirl Combustion (HSC) engine ignition system.

#### Ignition System Features

- **Distributor:** Is a universal distributor design which is gear driven die cast base that incorporates an integrally mounted TFI-IV module. A Hall effect stator assembly replaces the coil stator. This design deletes the conventional centrifugal/vacuum advance mechanism.

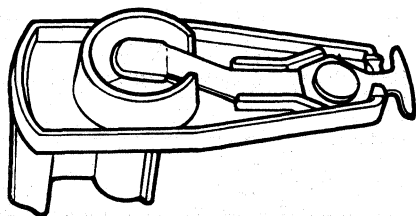
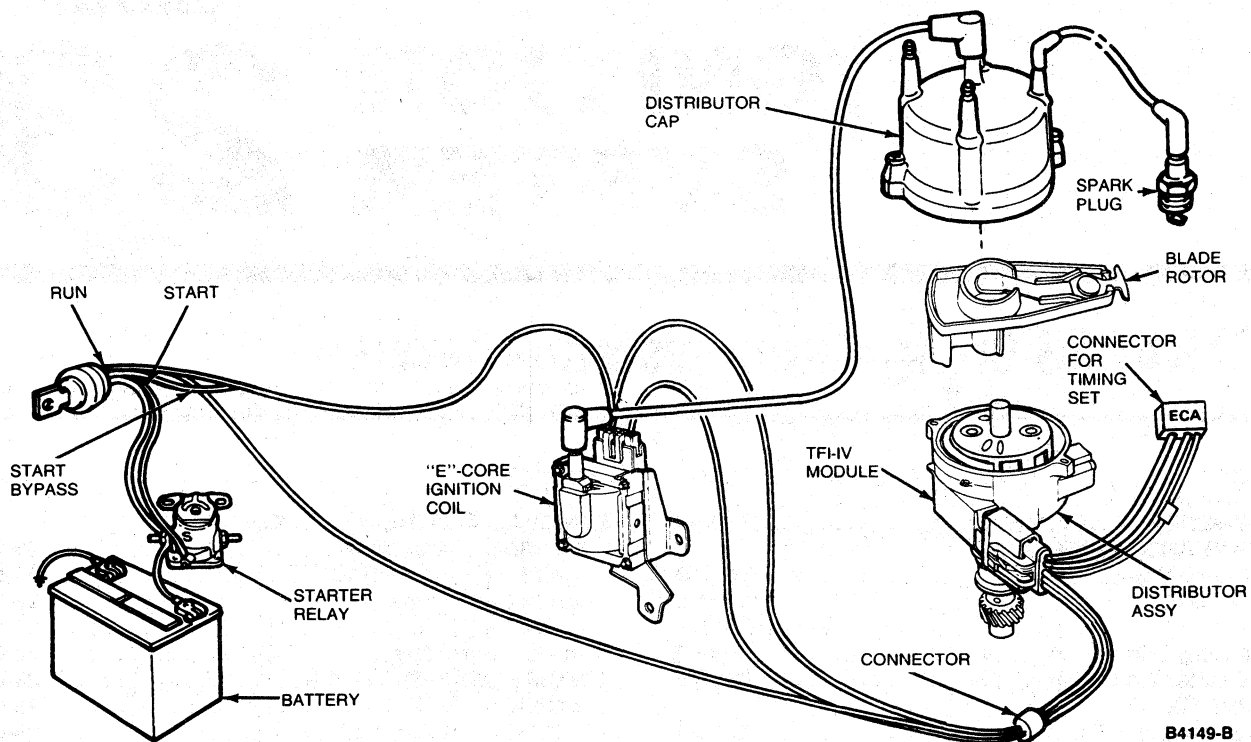
NOTE: Distributor calibration is not required.

- **Rotor:** Uses a blade-type rotor, which requires Dielectric Silicone Compound D7AZ-19A331-A or equivalent, on the rotor blade.

- **Spark Plug:** The 3.0L and 2.5L engines use a 14mm (35/64-inch) standard reach, tapered seat plug.
- **Spark Plug Wires:** The spark plug wires are similar in design to the Duraspark wires.
- **Module:** The module is the Thick Film Integrated IV (TFI-IV) Ignition Module. The module is contained in moulded thermoplastic and is mounted on the distributor base. The TFI-IV module used on the 2.5L HSC engines with manual transaxles features a "push start" mode. This will allow push starting of the vehicle should it be necessary.
- **Coil:** Vehicles equipped with the TFI-IV module use an E-Core ignition coil.

## DESCRIPTION (Continued)

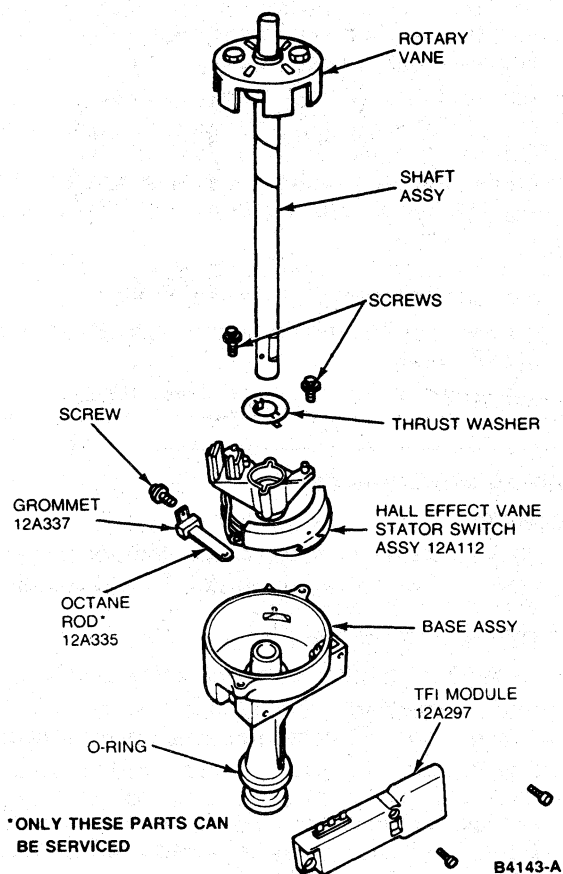
## System Components, Ignition



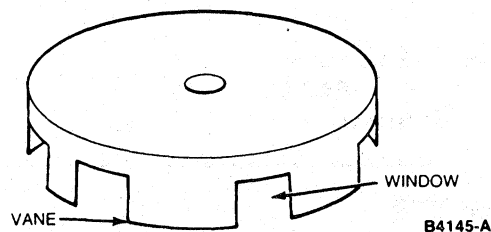
B4138-A

## DESCRIPTION (Continued)

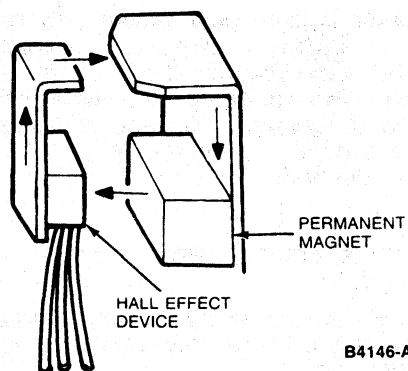
## Distributor Components, Internal



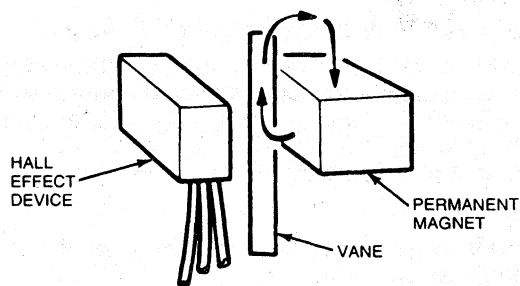
A rotary vane cup, made of ferrous metal, is used to trigger the signal off and on.



When the window of the vane cup is between the magnet and Hall effect device, a magnetic flux field is completed from the magnet through the Hall effect device and back to the magnet.

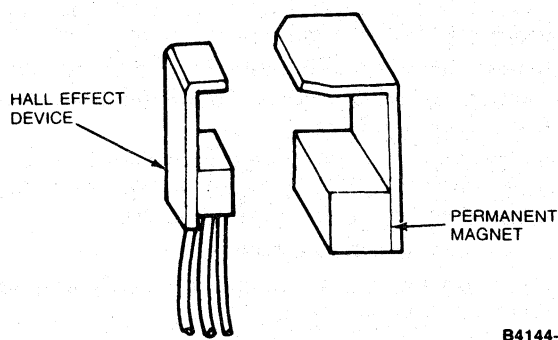


As the vane passes through this opening, the flux lines are shunted through the vane and back to the magnet.



## OPERATION

The operation of the universal distributor is accomplished through the Hall effect vane switch assembly, causing the ignition coil to be switched off and on by the EEC-IV and TFI-IV modules. The vane switch is an encapsulated package consisting of a Hall sensor on one side and a permanent magnet on the other side.



During this time, a voltage is produced as the vane passes through the opening. When the vane clears the opening, the window edge causes the signal to go to 0 volts. The signal is then used by the EEC IV system for crankshaft position sensing and the computation of the desired spark advance based on engine demand and calibration. The conditioned spark advance and voltage distribution is accomplished through a conventional rotor, cap and ignition wires.

**OPERATION (Continued)****Distributor Identification**

The distributor assembly can be identified by the part number information printed on a decal attached to the side of the distributor base.

E6AE-12A332-CA W/MOD

FAD 2

4L 02  
E6AE-12127-CA

B4148-A

**ADJUSTMENTS**

Refer to Engine/Emissions Diagnosis\* manual.

**REMOVAL AND INSTALLATION****Distributor Assembly**

The distributor is cam gear driven and uses no centrifugal or vacuum advance. The distributor contains the vane switch stator assembly and octane rod. The distributor is conventionally mounted on the engine. Replace the distributor assembly if service procedures other than those outlined are required.

**Removal**

1. Disconnect primary wiring connector from distributor.  
NOTE: Before removing distributor cap, mark position of No. 1 wire tower on distributor base for future use.
2. Remove distributor cap and position it and attached wires aside so as not to interfere with distributor removal.
3. Rotate engine until No. 1 piston is at TDC on compression stroke.
4. Remove rotor.
5. Remove TFI-IV harness connector.
6. Remove distributor hold-down bolt and clamp. Remove distributor. Do not disturb intermediate driveshaft on 2.5L engines. (On 3.0L engines the intermediate shaft is removed with the distributor assembly).

**Installation**

1. Rotate engine until No. 1 piston is at TDC on compression stroke.
  - a. Align timing marks for correct initial timing.
  - b. Rotate distributor shaft so the blade on rotor is pointing toward mark previously made on distributor base.
  - c. Continue rotating slightly so leading edge of vane is centered in vane switch stator assembly.
  - d. Rotate distributor in block to align leading edge and vane switch stator assembly and verify rotor is pointing at No. 1 cap terminal.
  - e. Install distributor hold-down bolt and clamp. Do not tighten at this time.

2. If vane and vane switch stator cannot be aligned by rotating distributor in block, pull distributor out of block enough to disengage distributor gear and rotate distributor shaft to engage a different distributor gear tooth. Repeat Step 1 as necessary.
3. Connect distributor to wiring harness.
4. Install distributor cap, rotor and ignition wires. Check that ignition wires are securely connected to distributor cap and spark plugs. Tighten distributor capscrews to 2.0-2.6 N·m (18-23 lb-in).
5. Set initial timing with a timing light. Refer to Vehicle Emission Control Information decal.
6. Tighten distributor hold-down bolt to 23-34 N·m (17-25 lb-ft).
7. Check initial timing. Adjust if necessary.

**Ignition Module—TFI-IV****Removal**

1. Using a screwdriver, remove distributor cap and position it and attached wires aside so as not to interfere with work area.
2. Remove TFI-IV harness connector.
3. Remove distributor from engine as outlined.
4. Place removed distributor on work bench. Remove two TFI-IV module attachment screws.
5. Pull RH side of module down toward distributor mounting flange and back up to disengage module terminals from connector in distributor base. The module may be pulled toward flange and away from distributor.

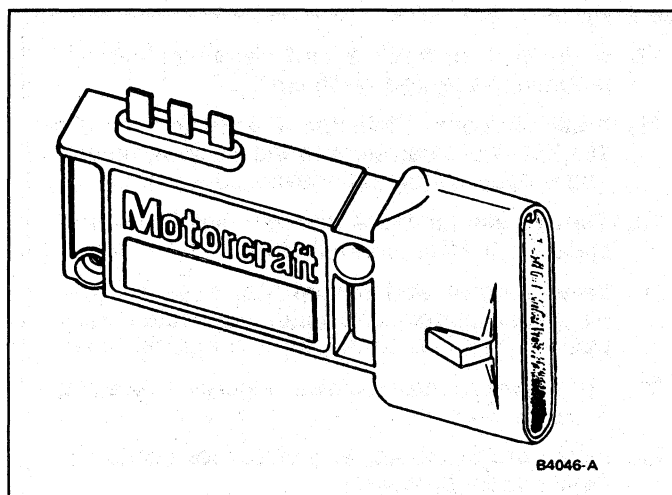
**CAUTION: Do not attempt to lift module from mounting surface prior to moving entire TFI-IV module toward distributor flange as pins will break at distributor/module connector.**

**Installation**

1. Coat metal base plate of TFI-IV ignition module with a 0.79mm (1/32-inch) thick ribbon of Dielectric Silicone Compound D7AZ-19A331-A (ESE-M1C171-A) or equivalent.
2. Place TFI-IV module on distributor base mounting surface.
3. Carefully position TFI-IV module assembly toward distributor bowl and securely engage three distributor connector terminals.
4. Install two TFI-IV module mounting screws. Tighten to 1.8-4.0 N·m (16-35 lb-in) starting with upper RH screw.
5. Install distributor on engine as outlined.
6. Install distributor cap. Tighten cap mounting screws to 2.0-2.6 N·m (18-23 lb-in).
7. Install TFI-IV harness connector.
8. Using an induction timing light, verify engine timing per engine decal.
9. If engine was originally timed with "positive buy" timing, deface or destroy "positive buy" timing label.

\*Can be purchased as a separate item.

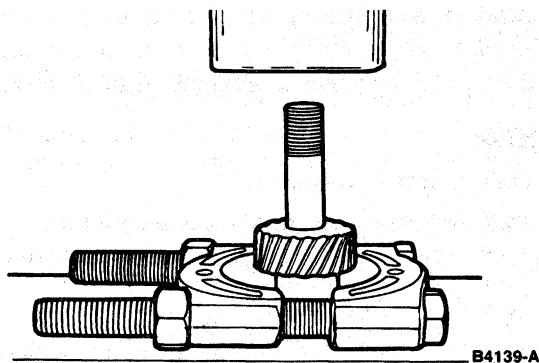
## REMOVAL AND INSTALLATION (Continued)

**Stator Assembly**

NOTE: Do not attempt to replace the stator without an arbor press.

**Removal**

1. Using a screwdriver, remove the distributor cap. Position cap and wires aside so as not to interfere with work area. Remove TFI module connector.
2. Remove distributor from block. Refer to distributor removal.
3. Remove rotor.
4. Remove two screws holding TFI module to base.
5. Remove module, wipe grease from base and module, keeping surfaces free of dirt.
6. Remove two screws holding the armature. Remove armature.  
NOTE: Hold gear to loosen armature screws, do not hold armature.
7. To ease assembly, mark armature and gear with a felt tip pen to note orientation.
8. Remove and discard pins in gear.
9. Invert distributor and place in Axle Bearing/Seal Plate T75L-1165-B or equivalent, and press off gear using Pinion Bearing Cone Remover Tool D79L-4621-A or equivalent.

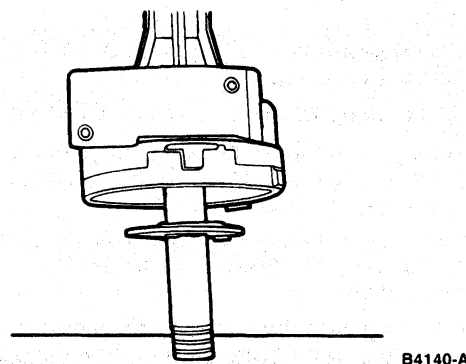


10. Deburr and polish shaft with emery paper and wipe so that the shaft slides out freely from distributor base.

11. Remove shaft assembly.
12. Remove thrust washer from distributor shaft and retain (3.0L engine only).
13. Remove octane rod retaining screw and retain.
14. Remove octane rod assembly and retain.
15. Remove two stator assembly screws and retain.
16. Remove stator assembly from top of bowl.
17. Inspect base bushing for wear or signs of excess heat concentration, replace complete distributor assembly if damaged.
18. Inspect base O-ring for cuts or damage and replace O-ring if necessary.
19. Inspect base for cracks and wear. Replace complete distributor assembly if damage is found.

**Assembly and Installation**

1. Place stator assembly over bushing and press down to seat.
2. Place stator connector in position. Tab should fit in notch on base and fastening eyelets aligned with screw holes.
3. Position wires away from moving parts.
4. Install two stator screws. Tighten to 2.8-3.9 N·m (25-35 lb-in).
5. Install octane rod, inserting rod through base hole.
6. Place end of octane rod onto same post as original stator. Only one post should easily fit in rod hole.
7. Firmly seat octane rod seal into housing.
8. Install octane rod screw. Tighten to 2.8-3.9 N·m (25-35 lb-in).
9. Apply a light coat of ESF-M2C70-A or equivalent, to distributor shaft below armature.
10. Insert shaft through the base bushing.
11. Place a 1/2-inch deep well socket over shaft, invert and place on arbor plate.



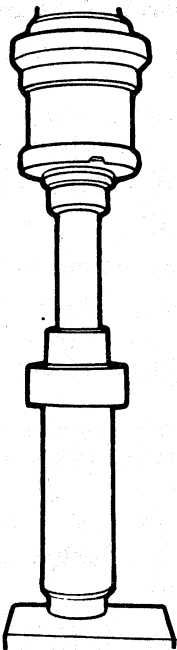
**REMOVAL AND INSTALLATION (Continued)**

12. Place distributor gear on shaft and line up mark on armature and gear.

NOTE: Hole in shaft and gear must be lined up as accurately as possible to ensure ease of roll pin insertion.

13. Place a 5/8-inch deep well socket over shaft and gear and press gear to align with original drill hole.

NOTE: If gear holes do not align, gear must be removed and repressed on. A drift punch will not align holes.



B4142-A

14. Insert new roll pin through gear and shaft.
15. Replace and tighten armature screws to 2.8-3.9 N·m (25-35 lb-in).
16. Check distributor for free movement over full rotation of shaft.

NOTE: If armature hits stator, replace entire distributor.

17. Wipe back of module and distributor module mounting face free of all dirt.
18. Apply Silicone Dielectric Compound D7AZ-19A331-A or equivalent to the back of module and spread evenly (thin, even coverage).
19. Turn distributor base upside down such that stator connector is in full view.
20. Insert module and ensure that three module pins are inserted into stator connector. Fully seat module into connector and against base.
21. Install two module screws. Tighten to 2.8-3.9 N·m (25-35 lb-in).
22. Install the distributor into block per distributor replacement procedure.
23. Connect TFI module to wiring harness.
24. Replace rotor.
25. Replace cap and tighten screws to specification.
26. Retime engine.

**Distributor Cap****Removal**

Loosen distributor cap hold-down screws. Remove the cap straight off the distributor to prevent damage to the rotor blade and spring.

**Installation**

1. Position distributor cap on distributor noting square alignment locator. Tighten hold-down screws to 2.0-2.6 N·m (18-23 lb-in). Care should be taken to prevent damage to rotor blade and spring.
2. Install secondary wires, noting correct locations on distributor cap.

**Distributor Rotor****Removal**

1. Remove secondary wire and cap from distributor as outlined.
2. Remove rotor by pulling straight off distributor.

**Installation**

1. Install rotor on distributor.
2. Install distributor cap and secondary wires.

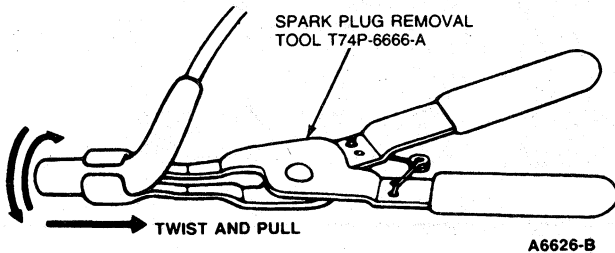


## REMOVAL AND INSTALLATION (Continued)

### Spark Plug Wires

#### Removal

1. When removing wires from spark plugs, use Spark Plug Removal Tool T74P-6666-A or equivalent. Grasp and twist the boot back and forth on plug insulator to free boot. Use special tool to pull boot from plug. Do not pull on wire directly, or it may become separated from connector inside boot.



2. When removing wires from distributor cap or coil, grasp boot by hand and remove with twisting and pulling motion. **Do not pull on wire.**

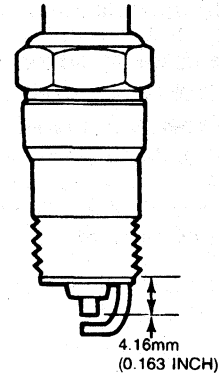
#### Installation

1. Whenever a high tension wire is removed for any reason from a spark plug, coil or distributor cap, or a new high tension wire is installed, Motorcraft Silicone Dielectric Compound D7AZ-19A331-A (ESE-M1C171-A) or equivalent must be applied to boot before it is reconnected. Using a small clean tool, coat entire interior surface of boot with Motorcraft Silicone Dielectric Compound D7AZ-19A331-A (ESE-M1C171-A) or equivalent.
2. Insert each wire on proper terminal of distributor cap. Ensure wires are all the way down over their terminals. The No. 1 terminal is identified on cap. Install wires starting with No. 1 terminal. The firing order is 1-3-4-2, clockwise.
3. Remove wire retaining brackets from old high tension wire set and install them on new set in same relative position. Install wires in brackets on valve rocker arm covers.
4. Connect wires to proper spark plugs.
5. Install coil wire.

### Spark Plugs

Both engines use standard reach plugs.

STANDARD  
REACH



### Spark Plug Hole Tapersert Installation

**CAUTION: Use protective eye glasses at all times.**

**NOTE:** Cylinder head must be removed from vehicle to prevent metal shavings from entering engine.

Refer to Section 21-12 or Section 21-10 for cylinder head removal and installation.

#### Tap

1. Thoroughly clean spark plug counterbore walls and seat of all dirt and foreign material.
2. Lubricate cutting threads of tap with cutting oil.
3. Engage top pilot into spark plug port threads.
4. Using ratchet wrench and keeping tap aligned, rotate tap until depth stop collar bottoms on face of port and tightens against retaining ring.

**NOTE:** Use of power tools is not approved for installation of taperserts.

5. Using an air hose, blow out as many shavings as possible.
6. If stop collar is loose, tap has not penetrated to full depth.
7. Remove tap from hole.
8. Clear shavings from hole and cylinder with air hose.

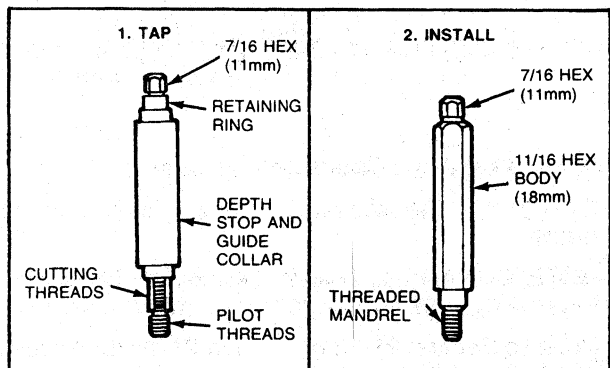
#### Installation

**CAUTION: Repeat Steps 1 through 8 to ensure a clean bore.**

1. Lubricate mandrel threads and tapersert with aluminum cutting oil. Then thread tapersert onto mandrel with larger counterbore end toward 18mm (11/16-inch) hex body until one thread of mandrel shows beyond tip of tapersert.
2. Install tapersert into tapped hole. Tighten 18mm (11/16-inch) hex to 68 N·m (50 lb-ft).

## REMOVAL AND INSTALLATION (Continued)

3. Holding 11mm (7/16-inch) hex mandrel to prevent rotation, loosen 18mm (11/16-inch) hex body approximately one-half turn to achieve breakaway action.
4. Remove tool from installed tapersert.  
NOTE: Tapersert should be flush to 1mm (0.039 inch) below spark plug gasket seat.
5. Thoroughly clean cylinder head before installing spark plug. Tighten spark plugs to 7-20 N·m (5-14 lb-ft).



B4031-B

## CLEANING AND INSPECTION

### Distributor Cap

Wash the distributor cap with soap and water. Dry the cap with compressed air. Inspect the cap for cracks, broken carbon button, carbon tracks or dirt or corrosion on the terminals. Replace the cap if it is damaged. Refer to Distributor Cap Removal and Installation.

### Rotor

Wipe the rotor with a clean, damp cloth. Dry with compressed air. Inspect and replace rotor if cracks, carbon tracks, burns, damaged points or spring is observed.

### Ignition Coil

Wipe coil tower with a clean cloth dampened with soap and water. Remove any soap film and dry with compressed air. Inspect for cracks, carbon tracking and dirt.

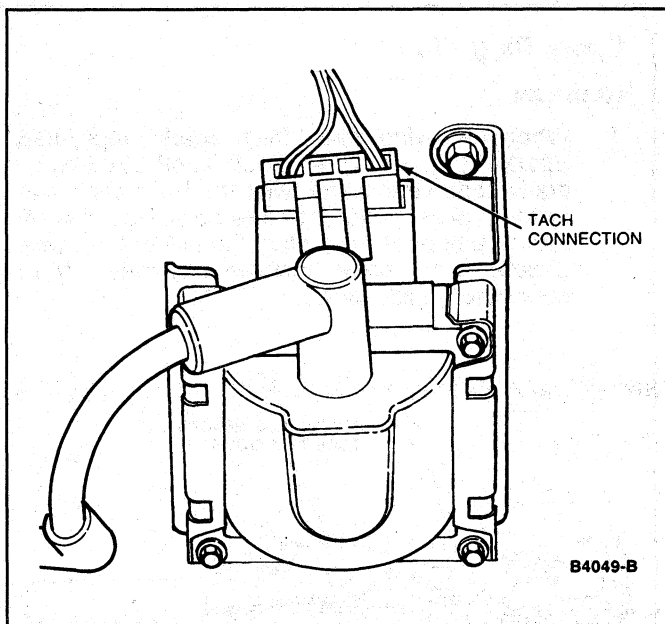
### Spark Plug Wires

Without removing the high tension wires from the spark plugs, distributor cap or coil, wipe the wires with a clean, damp cloth and inspect them for visible damage such as cuts, pinches, cracks or torn boots. Replace only wires that are damaged. Refer to Spark Plug Wire Removal and Installation.

### Tachometer Connection

The ignition coil connector allows a tachometer connection using an alligator clip without removing the coil connector. This is accomplished by inserting the alligator clip into the back of the connector, onto the dark green/yellow dotted wire.

**CAUTION:** Do not allow this clip to accidentally ground to a metal surface. It may permanently damage the coil.



B4049-B

## SPECIFICATIONS

### TORQUE SPECIFICATIONS — 2.5L HSC ENGINE

Description	N·m	Lb-Ft
Distributor Holddown Bolts	23-34	17-25
Distributor Cap Holddown Screws	2.0-2.6	18-23 lb-in
Spark Plugs	9-20	7-15
TFI-IV Ignition Module Mounting Screws	1.1-1.8	9-16 lb-in
Octane Rod Retaining Screw	1.8-4.3	15-35 lb-in

CB4151-B

### TORQUE SPECIFICATIONS — 3.0L ENGINE

Description	N·m	Lb-Ft
Distributor Holddown Bolts	5.0-7.0	3.7-5.2
Stator Assembly Retainer Plate Screws	2.5-4.0	1.8-3.0
Connector Holddown Plate Screws	2.5-4.0	1.8-3.0
Spark Plugs	9-20	7-15
TFI Ignition Module Mounting Screws	1.8-4.0	16-35 lb-in

CB4152-B

## SPECIAL SERVICE TOOLS

Tool Number	Description
T75L-1165-B	Axle Bearing/Seal Plate
D79L-4621-A	Pinion Bearing Cone Remover
T74P-6666-A	Spark Plug Wire Removal Tool
T82L-12270-A	Distributor Hold-Down Wrench

CB4402-A

# GROUP

# 24

## (9000)

# FUEL SYSTEM

SECTION TITLE	PAGE	SECTION TITLE	PAGE
AIR CLEANER AND DUCT SYSTEMS .....	24-41-1	FUEL PUMP—ELECTRIC .....	24-35-1
FUEL INJECTION, CENTRAL .....	24-03-1	FUEL SYSTEM—SERVICE .....	24-01-1
FUEL INJECTION, ELECTRONIC .....	24-05-1	FUEL TANKS AND LINES .....	24-50-1
FUEL FILTER .....	24-51-1	THROTTLE LINKAGE .....	24-60-1

## SECTION 24-01 Fuel System—Service

SUBJECT	PAGE	SUBJECT	PAGE
CLEANING AND INSPECTION		SPECIFICATIONS .....	24-01-2
Fuel Injection, Electronic .....	24-01-2	TESTING AND ADJUSTMENTS .....	24-01-2
DESCRIPTION		VEHICLE APPLICATION .....	24-01-1
Fuel Metering Assembly Identification .....	24-01-1		

### VEHICLE APPLICATION

Taurus/Sable.

### DESCRIPTION

All engines use a closed-type positive crankcase ventilation system and an exhaust emission system to control engine emissions within Government specifications.

To maintain the required exhaust emission levels, the fuel metering system must be kept in good operating condition and adjusted to specifications listed in the applicable Section of the Engine/Emissions Diagnosis\* manual, the applicable Section of this Group, the Engine/Emissions Facts Book, or on the engine decal.

Additional engine performance checks are required to keep the exhaust emissions at the specified minimum pollutant level. Refer to the Pre-Delivery manual, Section 50-02, for these performance checks and recommended intervals.

This Section covers cleaning and inspection procedures.

For fuel system component removal, disassembly, assembly, installation and major service operations, refer to the applicable Section of this Group.

Always refer to the Master Parts List for parts usage and interchangeability before replacing a throttle body or a component part of a throttle body.

### Fuel Metering Assembly Identification

The base part number of the fuel metering assembly is 9E926. On 2.5L CFI engines the base part number is located on the bar code tag on the upper throttle body. The base part number on 3.0L engines is located underneath the fuel runners on the upper intake manifold next to the EGR valve.

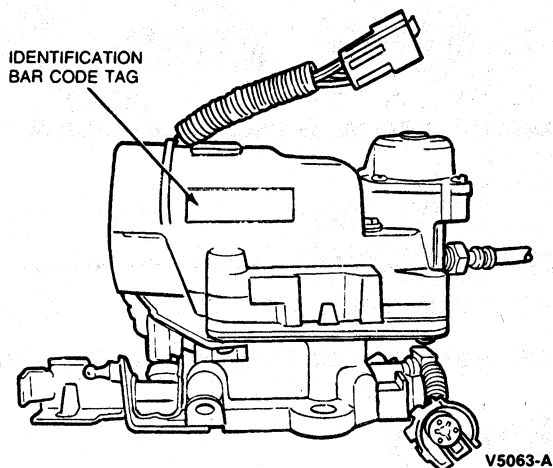
\*Can be purchased as a separate item.

## DESCRIPTION (Continued)

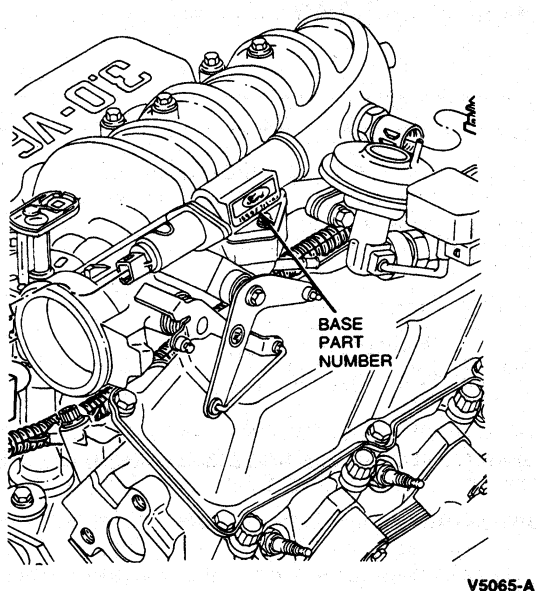
The "Unleaded Fuel Only" nomenclature must appear:

1. Near the fuel filler opening.
2. On the instrument cluster.

## 2.5L Engine



## 3.0L Engine



## CLEANING AND INSPECTION

## Fuel Injection, Electronic

**WARNING: DO NOT SMOKE OR CARRY LIGHTED TOBACCO OR OPEN FLAME OF ANY TYPE WHEN WORKING ON OR NEAR ANY FUEL RELATED COMPONENT. HIGHLY FLAMMABLE MIXTURES ARE ALWAYS PRESENT AND MAY BE IGNITED, RESULTING IN POSSIBLE PERSONAL INJURY.**

## Air Bypass Valve

Remove the air bypass valve from the vehicle. Remove the electrical solenoid assembly from the mechanical portion of the air bypass valve by removing the two screws, then sliding the mechanical portion away from the solenoid.

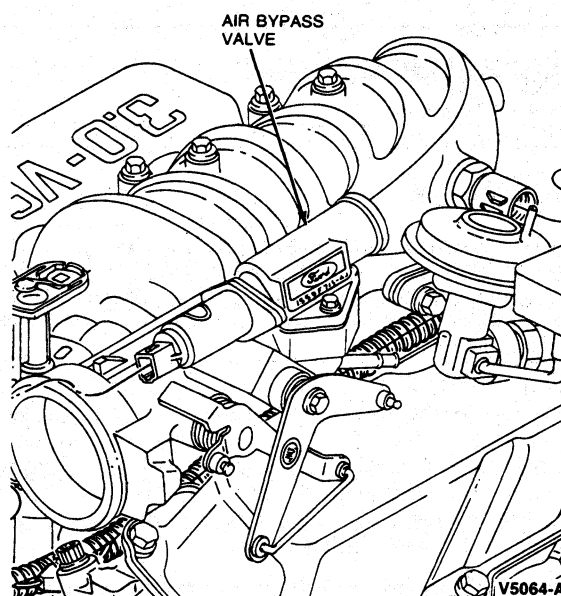
Soak the mechanical portion in Carburetor and Combustion Chamber Cleaner D9AZ-19579-B or equivalent for two to three minutes maximum.

**CAUTION: Do not exceed three minutes soak time, and do not use choke cleaner, as an internal O-ring may begin to deteriorate.**

With the mechanical portion completely submerged, shake in all directions-up, down, right, and left. Then push in on the rod that mates with the solenoid assembly, and again shake in all directions with the unit submerged and the rod held in as far as possible.

Remove the mechanical portion from the cleaning fluid and dry out thoroughly using shop air. Assemble and install the air bypass valve and set idle to specification, if necessary. Refer to the Engine/Emissions Diagnosis\* manual.

## 3.0L Engine



## TESTING AND ADJUSTMENTS

Refer to the Engine/Emissions Diagnosis\* manual for testing and adjustment procedures.

## SPECIFICATIONS

Refer to the Engine/Emissions Facts Book and Calibration number.

\*Can be purchased as a separate item.

# SECTION 24-03 Fuel Injection, Central

SUBJECT	PAGE	SUBJECT	PAGE
DESCRIPTION .....	24-03-1	OPERATION (Cont'd.)	
DISASSEMBLY AND ASSEMBLY		Throttle Position Sensor .....	24-03-3
Fuel Charging Assembly .....	24-03-4	REMOVAL AND INSTALLATION	
Throttle Body .....	24-03-4	Fuel Charging Assembly .....	24-03-3
OPERATION		Fuel Injector .....	24-03-4
Air and Fuel Control .....	24-03-1	Fuel Pressure Regulator .....	24-03-4
Air Control Components .....	24-03-2	SPECIAL SERVICE TOOLS .....	24-03-6
Fuel Charging Assembly .....	24-03-3	SPECIFICATIONS .....	24-03-6
Fuel Injector Nozzle .....	24-03-2	TESTING	
Fuel Pressure Regulator .....	24-03-3	Pressure Check .....	24-03-3
Throttle Actuator ISC DC Motor Actuator ....	24-03-3	VEHICLE APPLICATION .....	24-03-1

## VEHICLE APPLICATION

Taurus/Sable with 2.5L (153 CID) engine.

## DESCRIPTION

The central fuel injection (CFI) system is a single-point, pulse time modulated injection system. Fuel is metered into the air intake stream according to engine demands by a single solenoid injection valve, mounted in a throttle body on the intake manifold.

**WARNING: DO NOT SMOKE, CARRY LIGHTED TOBACCO, OR OPEN FLAME OF ANY TYPE WHEN WORKING ON OR NEAR ANY FUEL RELATED COMPONENT. HIGHLY FLAMMABLE MIXTURES ARE ALWAYS PRESENT AND MAY BE IGNITED, RESULTING IN POSSIBLE PERSONAL INJURY.**

## OPERATION

Fuel is supplied from the fuel tank by a low-pressure, electric fuel pump mounted in the fuel tank. The fuel is filtered and sent to the fuel charging assembly injector fuel cavity and then to the regulator where

the fuel delivery pressure is maintained at a nominal value of 100 kPa (14.5 psi). A single injector nozzle is mounted vertically above the throttle plate and connected in series with the fuel pressure regulator. Excess fuel supplied by the pump, but not needed by the engine, is returned to the fuel tank by a fuel return line.

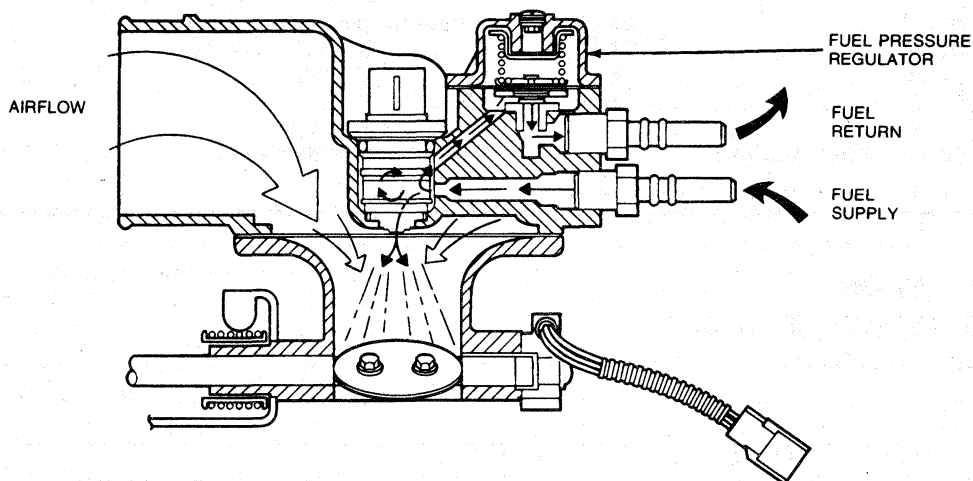
### Air and Fuel Control

The fuel charging assembly mounts to the intake manifold. It provides packaging of five major components which perform the fuel and air metering function to the engine:

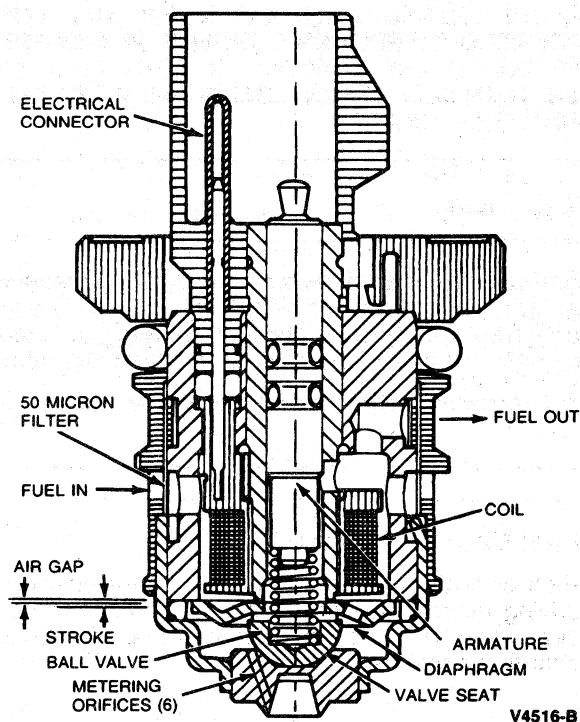
- Air Control Components
- Fuel Injector Nozzle
- Fuel Pressure Regulator
- Idle Speed Control Motor
- Throttle Position Sensor

**OPERATION (Continued)****Air Control Components**

Airflow to the engine is controlled by a single butterfly valve mounted in a two-piece, die cast aluminum housing called the throttle body. The butterfly valve is identical in configuration to the throttle plate of a conventional carburetor and is actuated by a similar linkage and pedal cable arrangement.

**Fuel Injector Nozzle**

The fuel injector nozzle is mounted vertically above the throttle plate and is an electro-mechanical device which meters and atomizes the fuel delivered to the engine. The injector valve body consists of a solenoid-actuated ball and seat assembly. An electrical control signal from the EEC processor activates the solenoid causing the ball to move inward off its seat, and allows fuel to flow. The injector flow orifices are fixed, and the fuel supply pressure is constant, therefore, fuel flow to the engine is controlled by how long the solenoid is energized.



**OPERATION (Continued)****Fuel Pressure Regulator**

The pressure regulator is integral to the fuel charging main body and located near the rear of the air horn. It is located so as to nullify the effects of supply line pressure drops. Its design is such that it is not sensitive to back-pressure in the return line to the tank.

One function of the pressure regulator is to maintain fuel supply pressure upon engine and fuel pump shutdown. The regulator functions as a downstream check valve and traps the fuel between itself and the fuel pump. The maintenance of fuel pressure upon engine shutdown precludes fuel line vapor formation and allows for rapid restarts and for stable idle operation immediately thereafter. The nominal regulated pressure is 100 kPa (14.5 psi). However, this valve may vary from unit to unit. Pressure is adjusted at the factory to compensate for differences in fuel flow among injectors.

**Throttle Actuator ISC DC Motor Actuator**

The DC motor actuator controls idle speed by moving the throttle lever. It regulates airflow to maintain the desired engine rpm for both warm and cold engine idles.

An idle tracking switch (ITS), integral to the DC motor, is utilized to determine when the throttle lever has contacted it, thereby signaling the need to control engine rpm.

The DC motor extends or retracts a linear shaft through a gear reduction system. The motor direction is determined by the polarity of the applied voltage.

**Throttle Position Sensor**

This sensor (non-adjustable) is mounted to the throttle shaft and is used to supply a voltage output change proportional to the change in the throttle position. The TP sensor is used by the computer (EEC) to determine engine operation mode (closed throttle, part throttle, and wide-open throttle). The proper fuel mixture, spark and EGR will be output only when the operation mode has been determined correctly.

**Fuel Charging Assembly**

Rich or lean conditions on acceleration and other driving modes may be caused by the presence of dirt, water or other foreign material in the fuel charging assembly.

**TESTING****Pressure Check**

NOTE: The fuel pressure regulator is factory adjusted. Do not attempt to reset fuel pressure by adjusting it.

Refer to the Engine/Emissions Diagnosis\* manual prior to any attempted service.

1. Disconnect electrical connection to inertia switch on LH side of luggage compartment.
2. Crank engine for 15 seconds to reduce system pressure.
3. Remove clip on fuel supply line at the fuel charging assembly. Refer to the illustration under Air Control Components.

**CAUTION: Use care to prevent combustion from fuel spillage.**

4. Disconnect fuel supply line at CFI throttle body. Connect Adapter T85L-9974-C or equivalent, in-line. Connect Fuel Pressure Gauge T80L-9974-B or equivalent, to adapter.
5. Connect inertia switch in luggage compartment.
6. Start engine and check fuel system pressure. Then accelerate engine. Pressure should remain stable throughout acceleration.

**Pressure Check Gauge Removal**

1. Disconnect electrical connection to inertia switch.
2. Crank engine 15 seconds.
3. Remove gauge.
4. Install original fuel line.
5. Connect inertia switch.
6. Crank engine and check for leaks.

**REMOVAL AND INSTALLATION****Fuel Charging Assembly****Removal**

1. Remove air tube clamp at fuel charging assembly air inlet.
2. Remove electrical connector at inertia switch located on LH side of luggage compartment.
3. Release fuel system pressure by cranking engine for 15 seconds.
4. Disconnect throttle cable (and transmission throttle valve lever on ATX applications).
5. Disconnect electrical connector at idle speed control (ISC), throttle position TP sensor and fuel injector.
6. Disconnect fuel inlet, outlet connections, and PCV vacuum line at fuel charging assembly.
7. Remove two retaining nuts and remove fuel charging assembly.
8. Remove mounting gasket from intake manifold.

\*Can be purchased as a separate item.



**REMOVAL AND INSTALLATION (Continued)****Installation**

1. Clean mounting surface and position new gasket on intake manifold.
2. Position fuel charging assembly on intake manifold and secure with two attaching nuts. Tighten to 18-21 N·m (14-16 lb-ft).
3. Connect electrical connectors to ISC, TP sensor, and fuel injector.
4. Connect fuel inlet and outlet connections, and PCV vacuum line at fuel charging assembly.
5. Connect throttle cable and transmission throttle valve lever.
6. Connect electrical connector at inertia switch.
7. Install air tube and clamp at fuel charging assembly.
8. Start engine and check for leaks. Check idle speed and reset to specification if necessary. Refer to engine decal and Engine/Emissions Diagnosis\* manual.

**Fuel Pressure Regulator****Removal**

1. Remove four fuel pressure regulator retaining screws.

**CAUTION: Fuel pressure regulator cover is spring loaded. Apply downward pressure when removing to contain pieces.**

2. Remove cover assembly, cup, spring and diaphragm assembly.
3. Remove regulator valve seat.

**Installation**

1. Install fuel pressure regulator valve seat.
2. Install fuel pressure regulator diaphragm assembly, spring and spring cup cover.
3. While applying downward pressure to cover, install four retaining screws and tighten to 3-3.6 N·m (28-32 lb-in).

**Fuel Injector****Removal**

1. Remove fuel injector retaining screw and retainer.
2. Remove injector and lower O-ring. Discard O-ring.

**Installation**

1. Lubricate a new lower O-ring and the injector seat area with clean engine oil. (Do not use transmission oil.)
2. Install lower O-ring on injector.
3. Lubricate upper O-ring, clean and lubricate throttle body O-ring seat.
4. Install injector by centering and applying a steady downward pressure with a slight rotational force.
5. Install injector retainer and retaining screw.
6. Tighten retainer screw to 2.0-2.5 N·m (18-22 lb-in).

**DISASSEMBLY AND ASSEMBLY****Fuel Charging Assembly****Disassembly**

NOTE: To prevent damage to throttle plates, place assembly on a stand or on a pad.

1. Turn fuel charging assembly over and remove four retaining screws attaching throttle body to main body.
2. Separate throttle body from main body and set aside.
3. Remove and discard gasket. If scraping is necessary, be careful not to damage gasket surface.
4. Remove fuel pressure regulator, as outlined.
5. Remove fuel injector, as outlined.
6. Remove fuel fittings and filter screen from fuel inlet channel.

**Assembly**

1. Install fuel injector, as outlined.
2. Install fuel pressure regulator, as outlined.
3. Attach throttle body, with new gasket, to main body. Tighten retaining screws to 4.3-5.0 N·m (38-44 lb-in).
4. Clean and install screen in fuel inlet channel.
5. Clean loose material from fuel fittings and coat with Loctite 290 or equivalent. Install fuel fittings. Tighten to 18.9-23.0 N·m (14-17 lb-ft).

**Throttle Body****Disassembly**

Refer to exploded view under Fuel Charging Assembly, Assembly.

1. Remove throttle position TP sensor attaching screws and remove TP sensor.
2. Remove ISC motor and bracket assembly from throttle body.
3. If ISC is to be removed from bracket, remove three retaining screws.

**Assembly**

1. Attach ISC motor, if removed, to bracket with three retaining screws. Tighten to 4.9-5.6 N·m (44-50 lb-in).
2. Install ISC motor and bracket assembly, if removed, to throttle body with two retaining screws. Tighten to 4.3-4.9 N·m (38-44 lb-in).
3. Position TP sensor with connector facing upward toward main body. Rotate **counterclockwise ONLY** and align screw holes. Install retaining screws. Tighten to 1.5-1.8 N·m (14-16 lb-in).

**CAUTION: Failure to install the TP sensor in this manner may result in excessive idle speeds.**

4. Position main body to throttle body gasket. Install throttle body to main body with four retaining screws. Tighten to 4.2-4.9 N·m (38-44 lb-in).

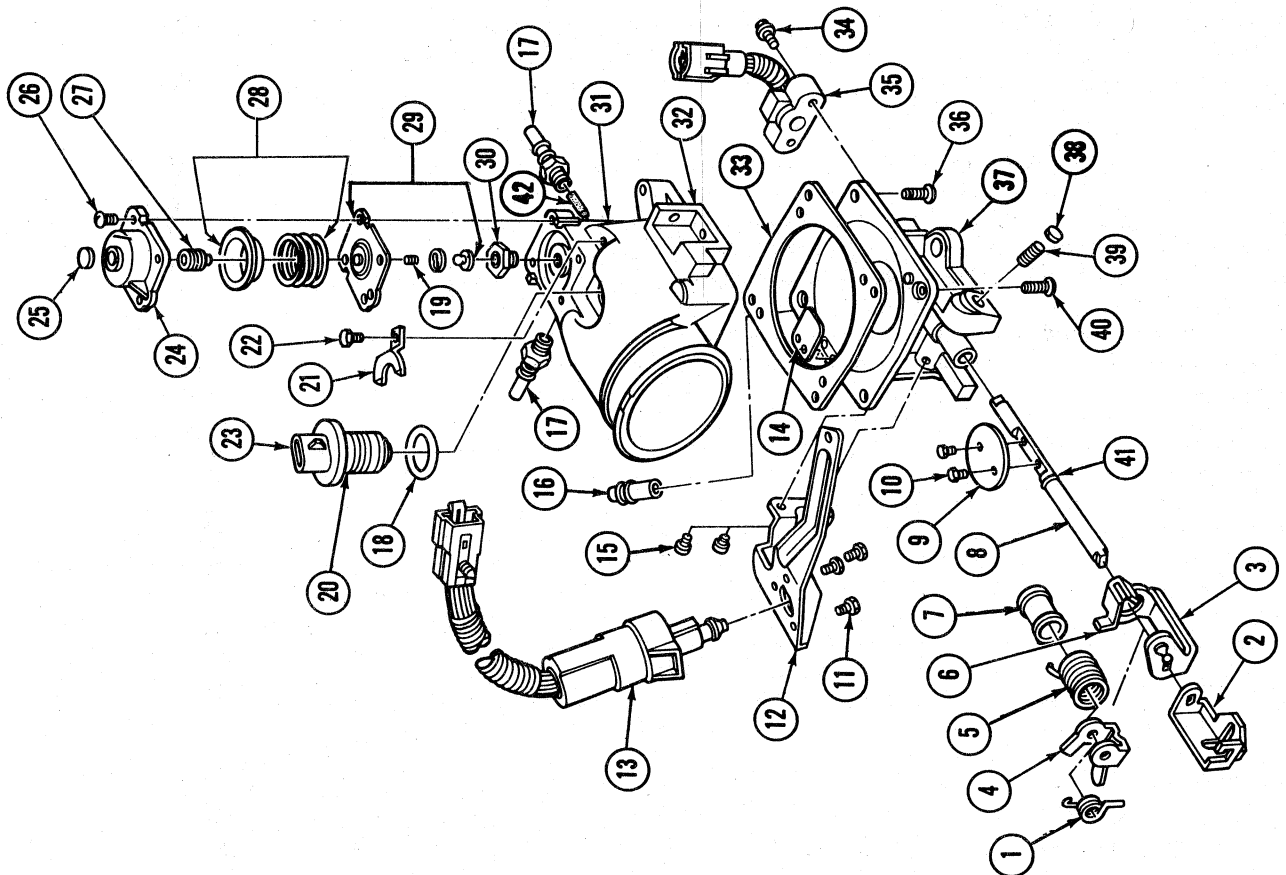
\*Can be purchased as a separate item.



## DISASSEMBLY AND ASSEMBLY (Continued)

V4514-C

ITEM	PART NO.	PART NAME
1.	9C531-A	SPRING—ENGINE IDLE SPEED-UP
2.	9G542-A	CONTROL ACTUATOR
3.	9E551-A	LEVER—CARB. TRANSMISSION LINKAGE
4.	9D549-A	BALL—CARB. THROTTLE LEVER
5.	9B569-A	LEVER—CARB. IDLE SPEED-UP
6.	9E583-AA	CONTROL
7.	9C634-A	SPRING—CARB. THROTTLE RETURN
8.	9E951-A	LEVER—CARB. THROTTLE
9.	9E950-A	BEARING—THROTTLE CONTROL
10.	603076-S100	LINKAGE
11.	384755-S2	SHAFT—AIR INTAKE CHARGE THROTTLE
12.	9S555-A	SCREW—M4 x 7 x 8.0
13.	9N825-A	SCREW—M4.2 x 1.41 x 15.9 (SELF TAPPING)
14.	9F553-A	BRACKET—ENGINE THROTTLE POSITIONER
15.	N603253-S100	ACTUATOR ASSY—THROTTLE CONTROL
16.	6B608-B	PLATE—ENGINE AIR DISTRIBUTION
17.	9F681-A	SCREW—M5 x .8 x 14.0
18.	87021-S100	TUBE—CARB. EMISSION INLET
19.	9D920-A	CONNECTOR—QUICK CONNECT FUEL
20.	87049-S100	INJECTION (5/16 x 1/4 NPTF)
21.	9C976-A	O-RING—20.4 ID x 1.78 WIDE
22.	N603078-S100	SPRING—FUEL PRESSURE REG. VALVE
23.	9F593-A	O-RING—18.6 ID x 3.50 WIDE
24.	9D911-B	RETAINER—FUEL INJECTOR
25.	383191-S	SCREW—M4 x .7 x 12.0
26.	N603245-S100	INJECTOR ASSY—FUEL
27.	9D932-A	COVER—FUEL PRESSURE REGULATOR
28.	9D923	PLUG—EXPANSION
29.	9D919	SCREW—M4 x .7 x 16.0
30.	9D909-A	SCREW—FUEL PRESSURE REGULATOR ADJUSTING
31.	9C974-B	CUP AND SPRING ASSY—FUEL PRESSURE REGULATOR
32.	9C973-A	DIAPHRAGM ASSY—FUEL PRESSURE REGULATOR
33.	9C983-B	TUBE—FUEL PRESS. REG. OUTLET
34.	N600885-S	BODY ASSY—FUEL CHARGING MAIN
35.	9B989-B	BODY—FUEL CHARGING MAIN
36.	N603256-S100	GASKET—FUEL CHARGING BODY
37.	9C981-A	SCREW—M4 x .7 x 22.0
38.	383191-S	POTENTIOMETER ASSY—CARBURETOR THROTTLE
39.	NN800545-S52	SCREW—M5 x .8 x 25.0
40.	N603257-S100	BODY—FUEL CHARGING THROTTLE
41.	9F791-A	PLUG—EXPANSION
42.	9F525-AA	SCREW—M5 x .8 x 19.0
		SCREW—M5 x .8 x 30.0
		SEAL—FUEL CHARGING SHAFT
		SCREEN—FUEL INLET



**SPECIFICATIONS****TORQUE SPECIFICATIONS**

Description	N·m	Lb·In
Fuel Charging Assembly to Intake Manifold	1.6-1.8	14-16
Fuel Fitting to Main Body	18.9-23.0	14-17 Lb·Ft
Regulator Cover	3.2-3.6	28-32
Throttle Position Sensor	1.2-1.8	11-16
ISC Bracket to Throttle Body	4.3-5.0	38-44
ISC Motor to Mounting Bracket	5.0-5.6	44-50
Main Body to Throttle Body	4.3-5.0	38-44

**CV4713-B****SPECIAL SERVICE TOOLS**

Tool Number	Description
T80L-9974-B	Fuel Pressure Gauge
D85L-9974-C	Adapter

**CV4714-B**

# SECTION 24-05 Fuel Injection, Electronic

SUBJECT	PAGE	SUBJECT	PAGE
DESCRIPTION .....	24-05-1	REMOVAL AND INSTALLATION (Cont'd.)	
OPERATION		Fuel Injection Wiring Harness .....	24-05-11
Air Intake Throttle Body Assembly .....	24-05-4	Fuel Injector Manifold Assembly .....	24-05-9
Air Intake Throttle Body Manifold—		Fuel Metering and Air Intake/Throttle	
Assembly .....	24-05-4	Body Components .....	24-05-5
Components .....	24-05-3	Fuel Pressure Regulator .....	24-05-10
Fuel Injectors .....	24-05-3	Pressure Relief Valve .....	24-05-9
Fuel Pressure Regulator .....	24-05-3	Throttle Position (TP) Sensor .....	24-05-9
Fuel Supply Manifold Assembly .....	24-05-4	SPECIAL SERVICE TOOLS .....	24-05-11
REMOVAL AND INSTALLATION		SPECIFICATIONS .....	24-05-11
Air Bypass Valve Assembly .....	24-05-8	VEHICLE APPLICATION .....	24-05-1

## VEHICLE APPLICATION

Taurus/Sable.

## DESCRIPTION

The Electronic Fuel Injection System (EFI) is classified as a multi-point, pulse time, mass airflow fuel injection system. Fuel is metered into the intake air stream in accordance with engine demand through six injectors mounted on a tuned intake manifold.

An on-board vehicle Electronic Engine Control (EEC) computer accepts input from various engine sensors to compute the required fuel flow rate necessary to maintain a prescribed air/fuel ratio throughout the entire engine operational range. The computer then outputs a command to the fuel injectors to meter the appropriate quantity of fuel.

## OPERATION

The EFI system can be subdivided into four distinct categories:

- Fuel Delivery.
- Air Induction.
- Sensors.
- Electronic Control Unit.

The fuel delivery sub-system consists of a high-pressure, fuel tank-mounted, electric fuel pump

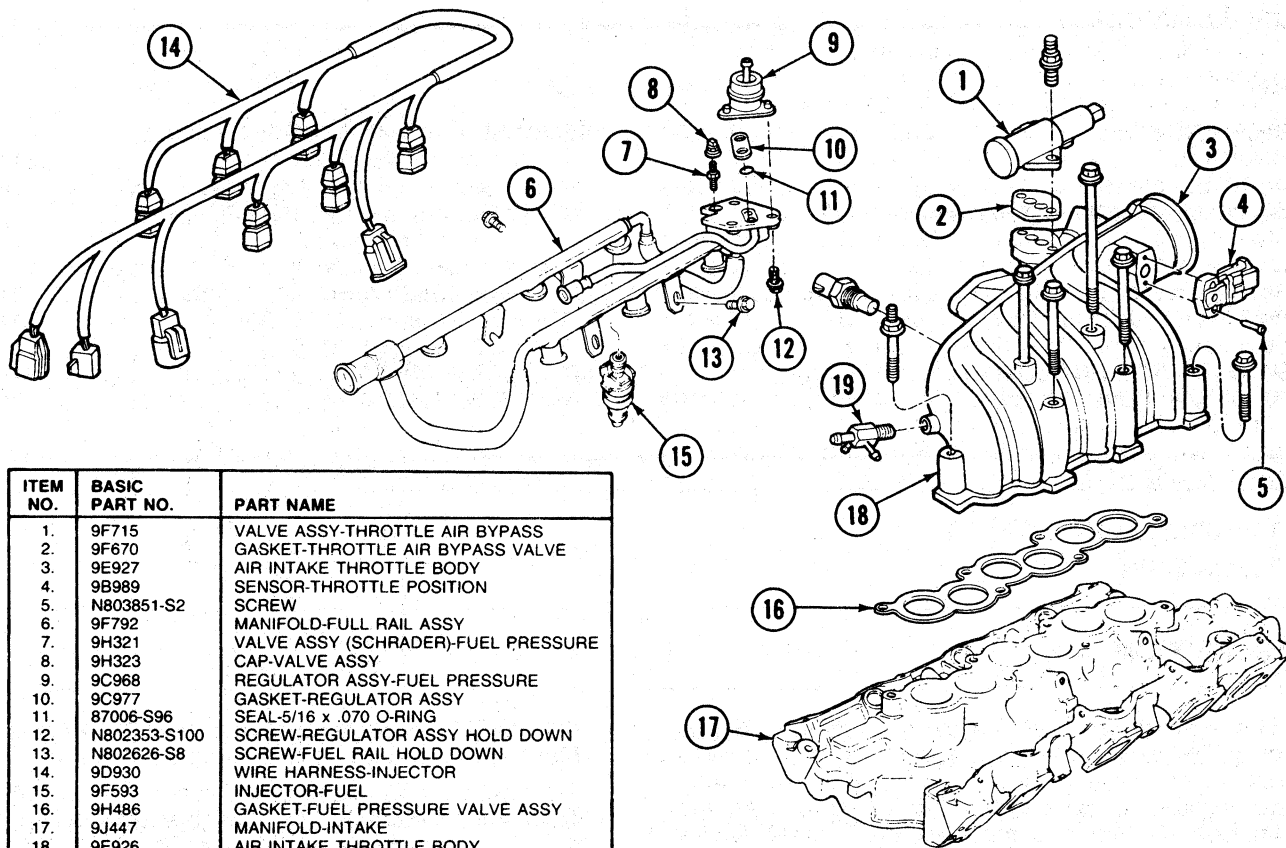
delivering fuel from the fuel tank through a 20 micron fuel filter to a fuel charging manifold assembly.

The fuel charging manifold assembly incorporates electrically actuated fuel injectors directly above each of the engine's six intake ports. The injectors, when energized, spray a metered quantity of fuel into the intake air stream.

A constant fuel pressure drop is maintained across the injector nozzles by a pressure regulator. The regulator is connected in series with the fuel injectors and positioned downstream from them. Excess fuel supplied by the pump, but not required by the engine, passes through the regulator and returns to the fuel tank through a fuel return line.

The injectors are energized in two groups of three injectors. Each group is activated once every other crankshaft revolution. The period of time that the injectors are energized (injector "on" time or the pulse width) is controlled by the vehicles' Engine Electronic Control (EEC) computer. Air entering the engine is measured by speed, pressure and temperature sensors. The resultant airflow information and input from various other engine sensors is used to compute the required fuel flow rate necessary to maintain a prescribed air/fuel ratio for the given engine operation. The computer determines the needed injector pulse width and outputs a command to the injector to meter the exact quantity of fuel.

## OPERATION (Continued)

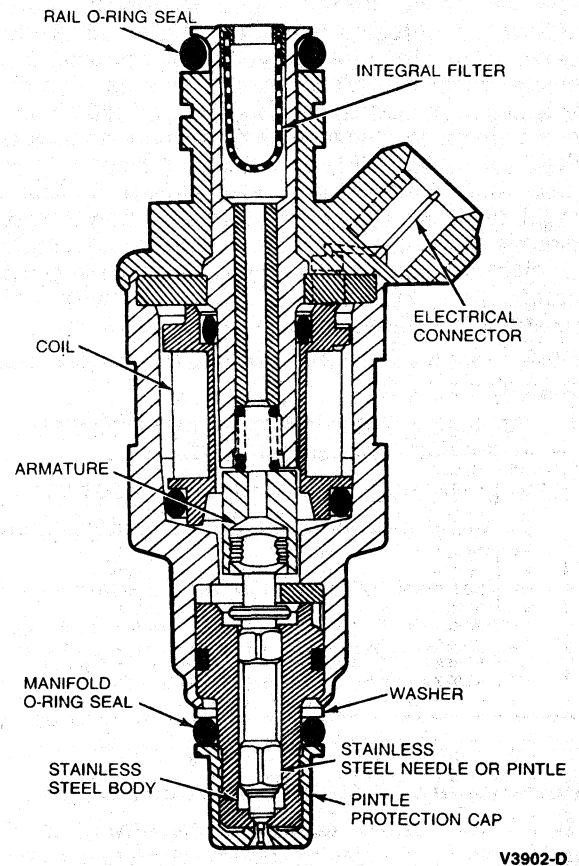


ITEM NO.	BASIC PART NO.	PART NAME
1.	9F715	VALVE ASSY-THROTTLE AIR BYPASS
2.	9F670	GASKET-THROTTLE AIR BYPASS VALVE
3.	9E927	AIR INTAKE THROTTLE BODY
4.	9B989	SENSOR-THROTTLE POSITION
5.	N803851-S2	SCREW
6.	9F792	MANIFOLD-FULL RAIL ASSY
7.	9H321	VALVE ASSY (SCHRADER)-FUEL PRESSURE
8.	9H323	CAP-VALVE ASSY
9.	9C968	REGULATOR ASSY-FUEL PRESSURE
10.	9C977	GASKET-REGULATOR ASSY
11.	87006-S96	SEAL-5/16 x .070 O-RING
12.	N802353-S100	SCREW-REGULATOR ASSY HOLD DOWN
13.	N802626-S8	SCREW-FUEL RAIL HOLD DOWN
14.	9D930	WIRE HARNESS-INJECTOR
15.	9F593	INJECTOR-FUEL
16.	9H486	GASKET-FUEL PRESSURE VALVE ASSY
17.	9J447	MANIFOLD-INTAKE
18.	9E926	AIR INTAKE THROTTLE BODY
19.	9A474	VACUUM TREE

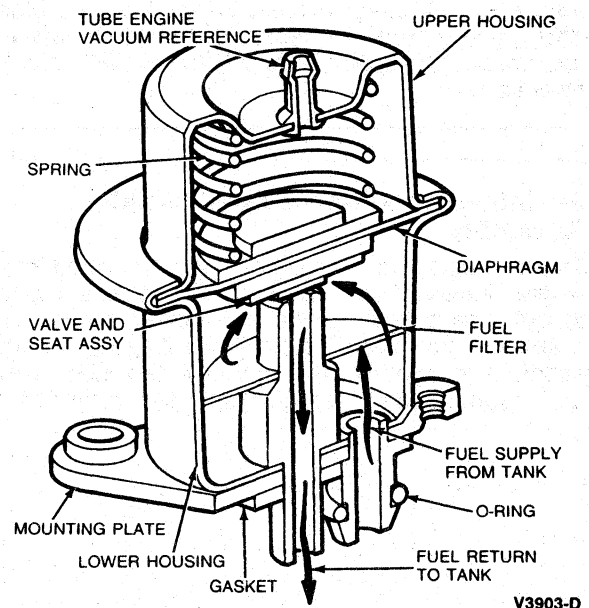
V4715-B

**OPERATION (Continued)****Components****Fuel Injectors**

The six fuel injector nozzles are electro-mechanical devices which both meter and atomize fuel delivered to the engine. The EFI injectors are mounted in the lower intake manifold and positioned so that their tips are directing fuel just ahead of the engine intake valves. The valve body consists of a solenoid actuated pintle or needle valve assembly that sits on a fixed size orifice. The fuel pressure, maintained by a regulator is also a constant. Therefore, fuel flow to the engine is regulated only by how long the solenoid is energized. An electrical signal from the Electronic Engine Control unit activates the injector solenoid causing the pintle to move inward off the seat, allowing fuel to flow through the orifice. Atomization of the fuel is obtained by contouring the pintle at the point where the fuel separates.

**Fuel Pressure Regulator**

The fuel pressure regulator is attached to the fuel supply manifold assembly downstream of the fuel injectors. It regulates the fuel pressure supplied to the injectors. The regulator is a diaphragm-operated relief valve in which one side of the diaphragm senses fuel pressure and the other side is subjected to intake manifold pressure. The nominal fuel pressure is established by a spring preload applied to the diaphragm. Balancing one side of the diaphragm with manifold pressure maintains a constant fuel pressure drop across the injectors. Fuel, in excess of that used by the engine, is bypassed through the regulator and returns to the fuel tank.



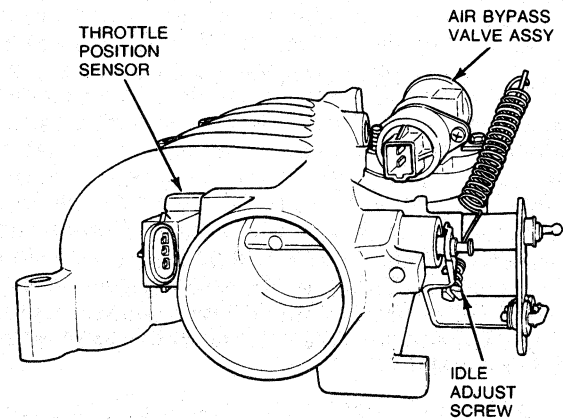
## OPERATION (Continued)

### Air Intake Throttle Body Assembly

The air intake throttle body assembly controls airflow to the engine through a single butterfly-type valve. The throttle position is controlled by conventional cable/cam throttle linkage. The body is a single-piece die casting made of aluminum. It has a single bore with an air bypass channel around the throttle plate. This bypass channel controls both cold and warm engine idle airflow control as regulated by an air bypass valve assembly mounted directly to the throttle body. The valve assembly is an electro-mechanical device controlled by the EEC computer. It incorporates a linear actuator which positions a variable area metering valve.

Other features of the air intake throttle body assembly include:

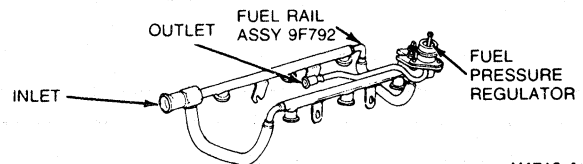
1. An adjustment screw to set the throttle plate at a minimum idle airflow position.
2. A preset stop to locate the WOT position.
3. A throttle body-mounted throttle position sensor.
4. A PCV fresh air source located upstream of the throttle plate.
5. Individual ported vacuum taps (as required) for PCV and EVAP control signals.



V4716-B

### Fuel Supply Manifold Assembly

The fuel supply manifold assembly is the component that delivers high-pressure fuel from the vehicle fuel supply line to the six fuel injectors. The assembly consists of a single preformed tube or stamping with one injector connector for each injector, a mounting flange for the fuel pressure regulator, a pressure relief valve for diagnostic testing or field service fuel system pressure bleed down, and mounting attachments which locate the fuel manifold assembly and provide fuel injector retention.



V4718-A

### Air Intake Throttle Body Manifold—Assembly

The air intake and throttle body are integrated into a single aluminum casting. Runner lengths are tuned to optimize engine torque and power output. The manifold provides mounting flanges for the accelerator control bracketry and the EGR valve and supply tube. Vacuum taps are provided to

support various engine accessories. The lower manifold contains machined pockets for the fuel injectors to prevent both air and fuel leakage. The pockets, in which the injectors are mounted, are placed to direct the injector fuel spray immediately in front of each engine intake valve.

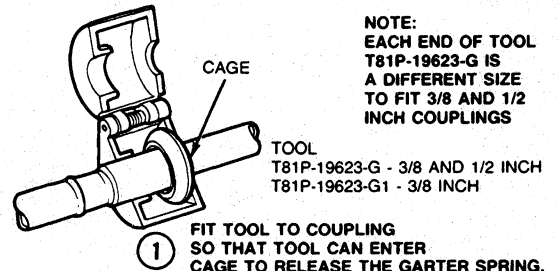
## REMOVAL AND INSTALLATION

### Fuel Metering and Air Intake/Throttle Body Components

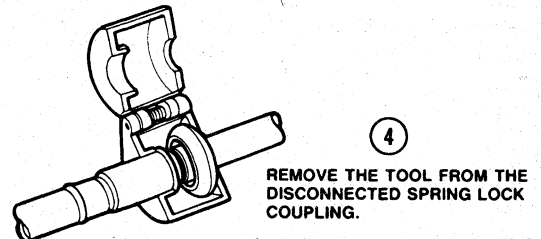
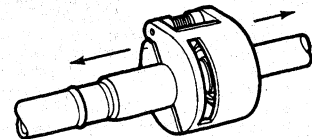
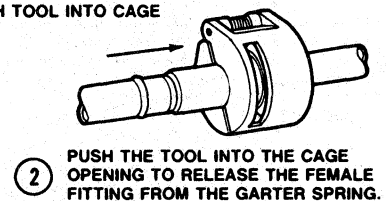
NOTE: If subassemblies are to be serviced and/or removed, with the assemblies mounted to the engine, the following Steps must be taken:

1. Open hood and install protective covers.
2. Ensure ignition key is in OFF position.
3. Disconnect battery ground cable and secure it out of the way.
4. Remove fuel cap to relieve fuel tank pressure.
5. Release pressure from fuel system at fuel pressure relief valve (Schrader) on fuel rail assembly. Use Fuel Pressure Gauge T80L-9974-B or equivalent. To gain access to fuel pressure relief valve, valve cap must first be removed.
6. Disconnect push connect fuel supply line using Fuel Line Coupling Disconnect Tool T81P-19623-G or equivalent.

TO DISCONNECT COUPLING  
WARNING - RELIEVE FUEL SYSTEM PRESSURE BEFORE  
DISCONNECTING COUPLING



PUSH TOOL INTO CAGE



V4699-A

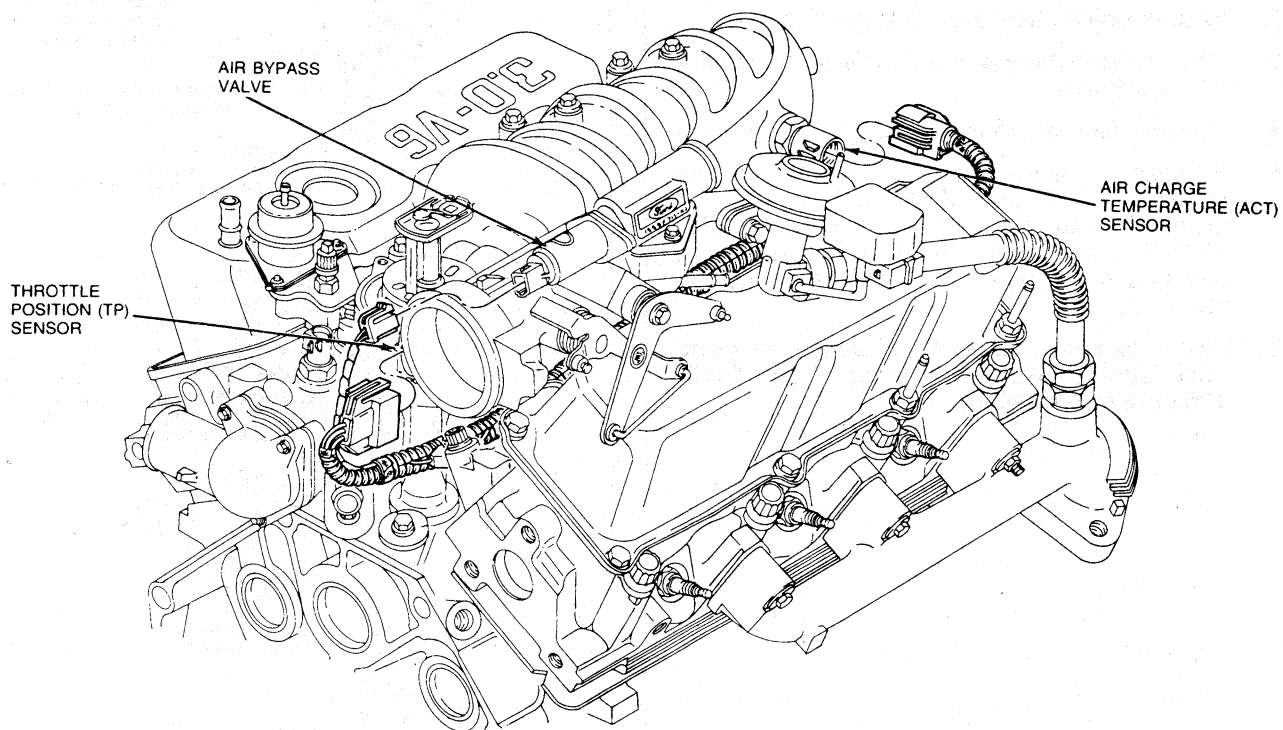
**REMOVAL AND INSTALLATION (Continued)**

**WARNING: CARE MUST BE TAKEN TO AVOID COMBUSTION FROM FUEL SPILLAGE.**

7. Disconnect wiring harness at the fuel injectors.

**NOTE:** If only the air intake is being removed, this Step is not required.

8. Disconnect wiring harness at throttle position (TP) sensor, air bypass valve and air charge temperature (ACT) sensor.



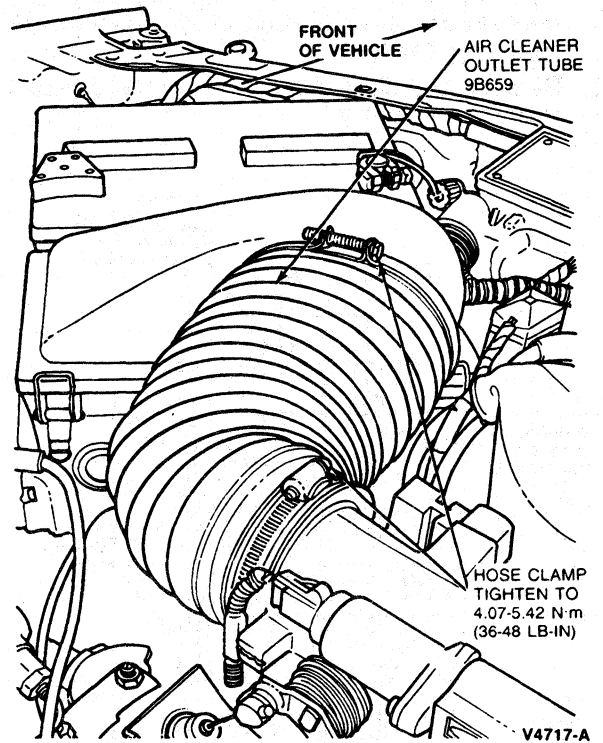
V4719-A



## REMOVAL AND INSTALLATION (Continued)

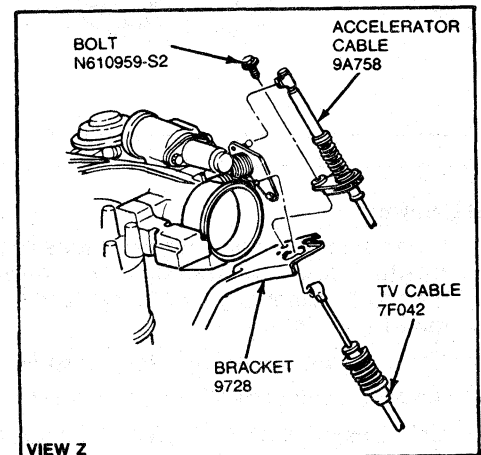
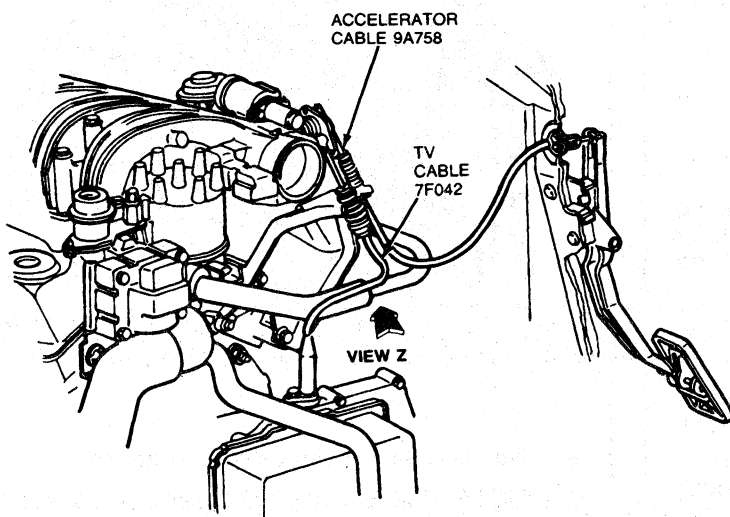
**Removal**

1. Remove engine air cleaner outlet tube between air cleaner and air throttle body by loosening two clamps.



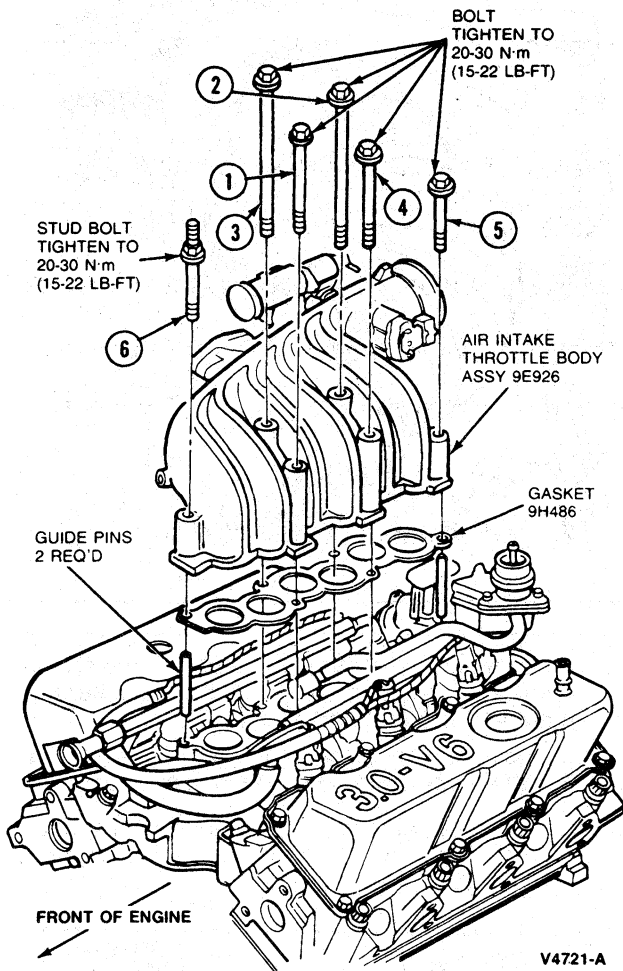
**NOTE:** If the fuel rail assembly or injectors must be removed for service, the snow shield and the air intake throttle body must be removed.

2. If required, remove snow shield by removing the retaining nut on top of shield and two bolts on the side.
3. Disconnect vacuum hoses at vacuum fittings on intake manifold.
4. Disconnect and remove accelerator and speed control cables, if so equipped, from accelerator mounting bracket and throttle lever.
5. Remove transmission valve (TV) linkage from throttle lever (automatic transmission only).



## REMOVAL AND INSTALLATION (Continued)

6. Remove six retaining bolts and lift air intake throttle body assembly from guide pins on lower intake assembly.
7. Remove and discard gasket from lower intake manifold assembly.



### Installation

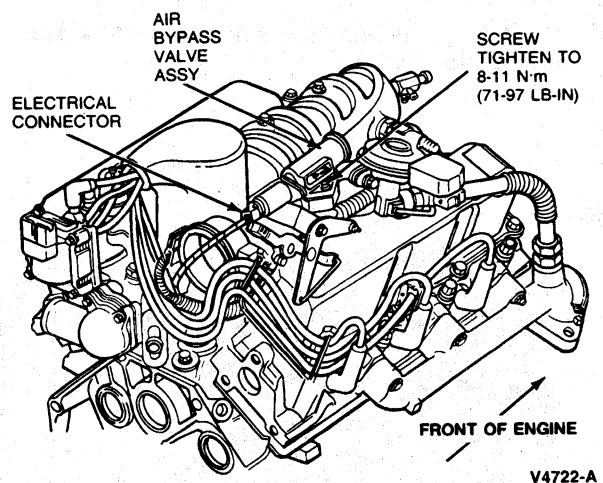
1. Clean and inspect mounting faces of air intake throttle body assembly and lower intake manifold assembly. Both surfaces must be clean and flat.
2. Clean and oil manifold stud threads.
3. Install a new gasket.
4. Using guide pins as locators, install air intake throttle body assembly to lower intake manifold.
5. Install stud bolt and five retaining bolts in positions shown in illustration under Removal, Step 7. Hand tighten.
6. Tighten bolts to 20-30 N·m (15-22 lb-ft) in sequence as numbered.

7. Push connect fuel supply line (1/2-inch) and fuel return line (3/8-inch) to fuel rail.
8. Connect wiring harness to TP sensor, ACT sensor and air bypass valve.
9. Install accelerator cable and, if so equipped, speed control cable.
10. Install vacuum hoses to vacuum fittings.
11. Install throttle valve linkage to throttle lever (with automatic transmission only).
12. Connect battery ground cable.
13. Use EEC self-test to check for proper sensor function as described in the Engine/Emissions Diagnosis\* manual.
14. Install fuel tank cap.
15. Install snow shield and air cleaner outlet tube.
16. Run engine and check idle. Adjust as necessary, as described in the Engine/Emissions Diagnosis\* manual.
17. Remove protective covers and close hood.

### Air Bypass Valve Assembly

#### Removal

1. Disconnect air bypass valve assembly connector from wiring harness.
2. Remove two air bypass valve retaining screws.



3. Remove air bypass valve and gasket.

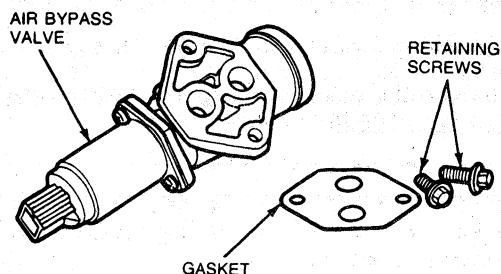
NOTE: If scraping is necessary, be careful not to damage air bypass valve or throttle body gasket surfaces, or drop material into throttle body.

\*Can be purchased as a separate item.

## REMOVAL AND INSTALLATION (Continued)

### Installation

1. Ensure that both throttle body and air bypass valve gasket surfaces are clean.



V3917-B

2. Install gasket on throttle body surface and mount air bypass valve assembly, securing it with two retaining screws. Tighten to 8-11 N·m (71-97 lb-in).
3. Connect electrical connector for air bypass valve.

### Throttle Position (TP) Sensor

#### Removal

1. Disconnect throttle position sensor from wiring harness.
2. Make scribe marks on air throttle body and on throttle position sensor to indicate proper alignment during installation.
3. Remove two throttle position sensor retaining screws.
4. Remove throttle position sensor.

#### Installation

1. Install throttle position sensor. Ensure that rotary tangs on sensor are in proper alignment and that the red seal is inside the connector housing.

**CAUTION:** Slide rotary tangs into position over throttle shaft blade, then rotate TP sensor clockwise to installed position only. Failure to install the TP sensor in this manner may result in excessive idle speeds.

2. Align scribe marks on air throttle body and throttle position sensor. Secure sensor to throttle body assembly with two retaining screws. Tighten to 1.2-1.8 N·m (11-16 lb-in).

NOTE: This throttle position sensor is not adjustable.

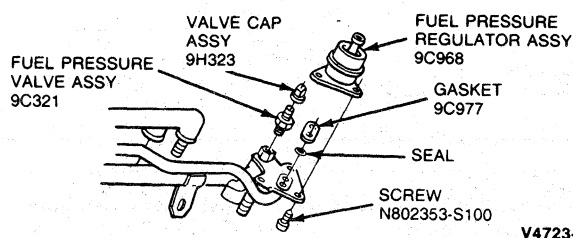
3. Connect electrical connector to harness.
4. When all fuel injection system service has been completed, make final adjustment of TP sensor as outlined in Engine/Emissions Diagnosis\* manual.

### Pressure Relief Valve

#### Removal

1. If fuel rail assembly is mounted to engine, remove fuel tank cap, then release pressure from system at pressure relief valve on fuel injection manifold using Fuel Pressure Gauge T80L-9974-B or equivalent.

NOTE: Cap on relief valve must be removed.



V4723-A

2. Using an open-end wrench or suitable deep well socket, remove pressure relief valve from fuel injection manifold.

#### Installation

Install pressure relief valve and cap. Tighten valve to 6-10 N·m (48-84 lb-in) and the cap to 0.5-0.7 N·m (4-6 lb-in).

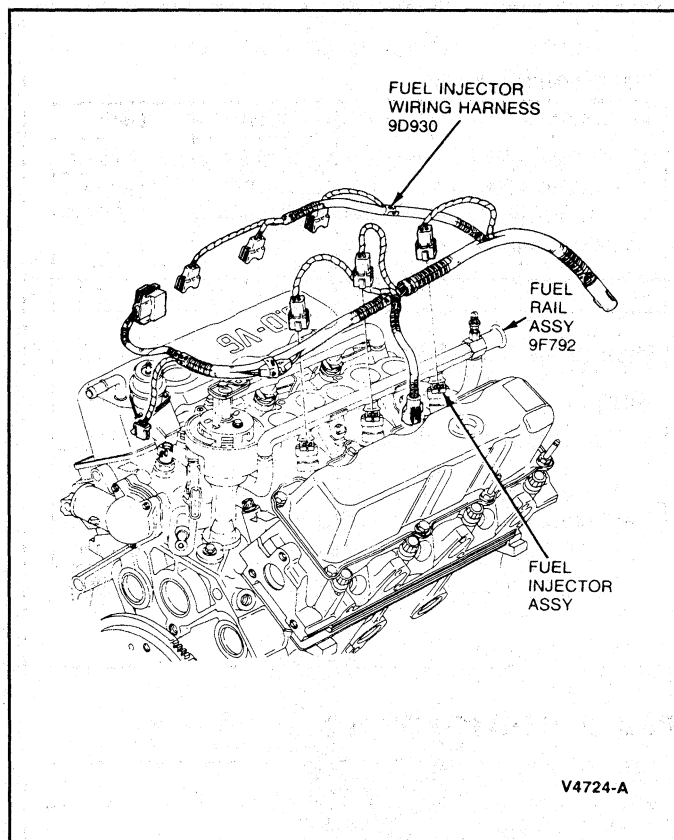
### Fuel Injector Manifold Assembly

#### Removal

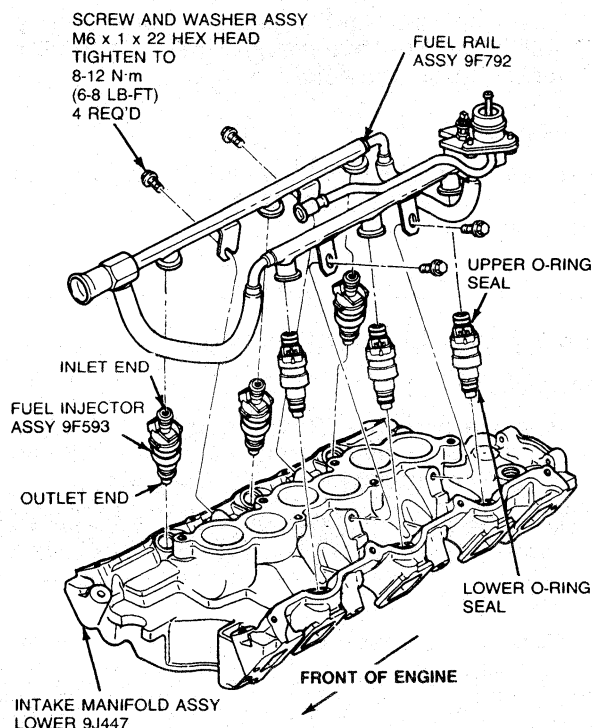
1. Remove air intake throttle body as described under Fuel Metering and Air Intake/Throttle Body Components Removal and Installation.
2. Disconnect fuel supply and fuel return lines as described under Fuel Metering and Air Intake/Throttle Body Components Removal and Installation.
3. Carefully disconnect wiring harness from injectors.

\*Can be purchased as a separate item.

## REMOVAL AND INSTALLATION (Continued)



4. Disconnect vacuum line from fuel pressure regulator valve.
5. Remove four fuel injector manifold retaining bolts (two on each side).



6. Carefully disengage fuel rail assembly from fuel injectors by lifting and gently rocking the rail.
7. Remove injectors by lifting while gently rocking side to side.
8. Place removed components in a clean container to avoid dirt or other contamination.

**CAUTION: Injectors and fuel rail must be handled with extreme care to prevent damage to sealing areas and sensitive fuel metering orifices.**

## Installation

1. Examine O-ring for deterioration. Install new O-ring if required.
2. Lubricate new O-rings and install two on each injector using light grade oil ESE-M2C39-F or equivalent.
3. Ensure injector caps are clean and free of contamination or damage.
4. Install injectors in fuel rail using light twisting-pushing motion.
5. Carefully install rail assembly and injectors into lower intake manifold, one side at a time. To ensure that O-rings are seated, push down on fuel rail.
6. While holding fuel rail assembly in place, install two retaining bolts finger-tight.
7. Repeat Steps 5 and 6 for other side of fuel rail.
8. Tighten fuel rail assembly retaining bolts to 8-12 N·m (6-8 lb-ft).
9. Connect fuel supply (1/2-inch) and fuel return (3/8-inch) lines.
10. Connect fuel injector wiring harness at injectors.
11. Connect vacuum line to fuel pressure regulator.
12. Install air intake throttle body as outlined.

## Fuel Pressure Regulator

## Removal

1. Verify fuel rail assembly is depressurized by removing fuel tank cap and releasing pressure from fuel system at pressure relief valve on fuel rail assembly using Fuel Pressure Gauge T80L-9974-A or equivalent.
2. Remove vacuum line at pressure regulator.
3. Remove three Allen retaining screws from regulator housing.
4. Remove pressure regulator assembly, gasket and O-ring. Discard gasket and inspect O-ring for signs of cracks or deterioration.

**NOTE: If scraping is necessary, be careful not to damage fuel pressure regulator or fuel supply line gasket surfaces.**

**REMOVAL AND INSTALLATION (Continued)****Installation**

1. Lubricate fuel pressure regulator O-ring with clean engine oil.
2. Ensure gasket surfaces of fuel pressure regulator and fuel rail assembly are clean.
3. Install O-ring and new gasket on regulator.
4. Install fuel pressure regulator on fuel rail assembly. Tighten three retaining screws to 3.0-4.5 N·m (27-40 lb-in).

**Fuel Injection Wiring Harness****Removal**

NOTE: Ensure ignition is off and fuel system is depressurized.

1. Disconnect electrical connectors from fuel injectors.
2. Disconnect connectors from main wiring harness and throttle position sensor, ACT sensor and air bypass valve.
3. Remove wiring assembly.

**Installation**

1. Position wiring harness alongside fuel injectors.
2. Snap electrical connectors into position on injectors.
3. Connect throttle position sensor, ACT sensor air bypass valve and main harness connectors.
4. Verify that all electrical connectors are firmly seated.
5. Use EEC Self-Test connector and procedure to check for sensor function.

**SPECIFICATIONS****TORQUE SPECIFICATIONS**

Description	N·m	Lb·ft
Lower Intake Manifold to Head	26-38	20-28
Air Supply Tube Clamps	2-3	17-26 Lb-In
Air Intake Throttle Body Lower Intake Manifold Bolts	20-30	15-22
Air Bypass Valve to Throttle Body	8-11	71-97 Lb-In
Throttle Position Sensor to Throttle Body	1.2-1.8	14-16 Lb-In
Fuel Pressure Relief (Schrader) Valve	6-10	48-84 Lb-In
Fuel Pressure Relief Valve Cap	0.5-0.7	4-6 Lb-In
Fuel Rail Assembly to Charging Assembly	8-12	6-8
Fuel Pressure Regulator to Fuel Rail	3-4.5	27-40 Lb-In

CV5051-A

**SPECIAL SERVICE TOOLS**

Tool Number	Description
T80L-9974-B	Fuel Pressure Gauge
T81P-19623-G/G1	Fuel Line Coupling Disconnect Tool

CV3935-C

# SECTION 24-35 Fuel Pump—Electric

SUBJECT	PAGE	SUBJECT	PAGE
DESCRIPTION AND OPERATION		SPECIAL SERVICE TOOLS .....	24-35-5
Inertia Switch .....	24-35-2	TESTING	
DIAGNOSIS .....	24-35-3	Fuel Pump .....	24-35-3
REMOVAL AND INSTALLATION .....	24-35-4	VEHICLE APPLICATION .....	24-35-1

## VEHICLE APPLICATION

Taurus/Sable.

## DESCRIPTION AND OPERATION

### Conventional Vehicles

The 3.0L Electronic Fuel Injection (EFI) and 2.5L Central Fuel Injection (CFI) systems have a fuel pump control relay controlled by the Electronic Engine Control (EEC) module, which provides power to the fuel pump under various operating conditions. When the ignition switch is in the OFF position, the contacts of the EEC power and fuel pump relays are open.

When the ignition switch is first turned to the ON position, the EEC power relay is energized, closing its contacts. Power is provided to both the fuel pump relay and a timing device in the EEC module. The fuel pump runs through the contacts of the fuel pump relay and the inertia switch. If the ignition switch is not turned to the START position, the timing device in the EEC module will open the ground circuit (No. 57) after approximately one second. Opening the ground circuit de-energizes the fuel pump relay (opening its contacts), which in turn de-energizes the fuel pump. This circuitry provides for pre-pressurization of the fuel system.

When the ignition switch is turned to the START position, the EEC module operates the fuel pump relay to provide fuel for starting the engine while cranking.

After the engine starts, the ignition switch is returned to the ON position, and power to the fuel pump is again supplied through the fuel pump relay. The EEC module senses engine speed and shuts off the fuel pump by opening the ground circuit to the fuel pump relay when the engine stops, or is below 120 rpm.

The electric fuel system uses a new design fuel tank and a fuel pump and sender assembly. The fuel tank has an internal pump cavity in which the fuel pump and sender assembly rest. This design provides satisfactory operation during extreme vehicle maneuvers and steep vehicle attitudes with low tank fill levels.

### All-Wheel Drive Vehicles

The 2.3L plus Central Fuel Injection (CFI) on the All-Wheel Drive uses a new fuel tank, a new fuel pump and sender assembly, and a jet pump. The fuel tank has an internal reservoir in which the fuel pump and sender assembly rest. This design provides satisfactory operation during extreme vehicle maneuvers and steep vehicle attitudes with low tank fill levels.

The "saddle-tank" design requires a jet pump to draw fuel from the left side of the fuel tank and discharge it into the reservoir on the right side. Pressure from the main pump is used to create a vacuum to draw the fuel through. An additional sender float attached to the jet pump is required to ensure a correct indication of fuel level in the tank.

The electric fuel pump is mounted on the fuel sender assembly inside the fuel tank. This assembly includes a check valve which is between the fuel pump and the outlet tube of the assembly. The function of this valve is to maintain pressure in the system after the vehicle is shut down. The pressure retention helps prevent hot starting problems. This pump is capable of supplying 96 liters (25.4 gallons) of fuel per hour at 115 kPa (16.7 psi). The fuel pump does not have an internal pressure relief valve. However, the maximum pressure the unit will produce is limited to 260 kPa (37.7 psi). The system pressure is controlled by a pressure regulator on the engine.

### Conventional and All-Wheel Drive Vehicles

The fuel pump is mounted on the fuel sender assembly inside the fuel tank. This assembly includes a check valve which is inside the fuel pump outlet. The function of this valve is to maintain pressure in the system after the vehicle is shut down.

## DESCRIPTION AND OPERATION (Continued)

The pressure retention helps prevent hot starting problems. This pump is capable of supplying 60 liters (15.8 gallons) of fuel per hour at 269 kPa (39 psi) (EFI engine) or 100 kPa (14.5 psi) (CFI engine). The EFI fuel pump has an internal pressure relief valve to provide overpressure protection in the event the fuel flow becomes restricted (damaged lines, clogged, filter, etc.) Overpressure is restricted to 850 kPa (123 psi) and reduced fuel flow will result. The CFI fuel pump has no pressure relief valve, however, maximum pressure is limited to 260 kPa (37.7 psi). The system pressure is controlled by a pressure regulator on the engine.

The fuel pump is protected at its inlet by a nylon pickup element. This nylon element filters dirt and contaminants which could plug or damage the internal pump components, while at the same time allowing passage of small quantities of water which may accumulate within the fuel tank sump.

The electrical system has a fuel pump control relay controlled by the Electronic Engine Control (EEC) module, which provides power to the fuel pump under various operating conditions.

When the ignition switch is off, the contacts of the EEC and fuel pump relays are open.

When the ignition switch is first turned to the ON position, the EEC power relay is energized, closing its contacts. Power is provided to both the fuel pump relay and to a timing device in the EEC module. The fuel pump runs through the contacts of the fuel pump relay. If the ignition switch is not turned to the START position, the timing device in the EEC module will open the ground circuit (No. 57) (after approximately one second). Opening the ground circuit de-energizes the fuel pump relay (opening its contacts) which, in turn, de-energizes the fuel pump. This circuitry provides for pre-pressurization of the fuel system.

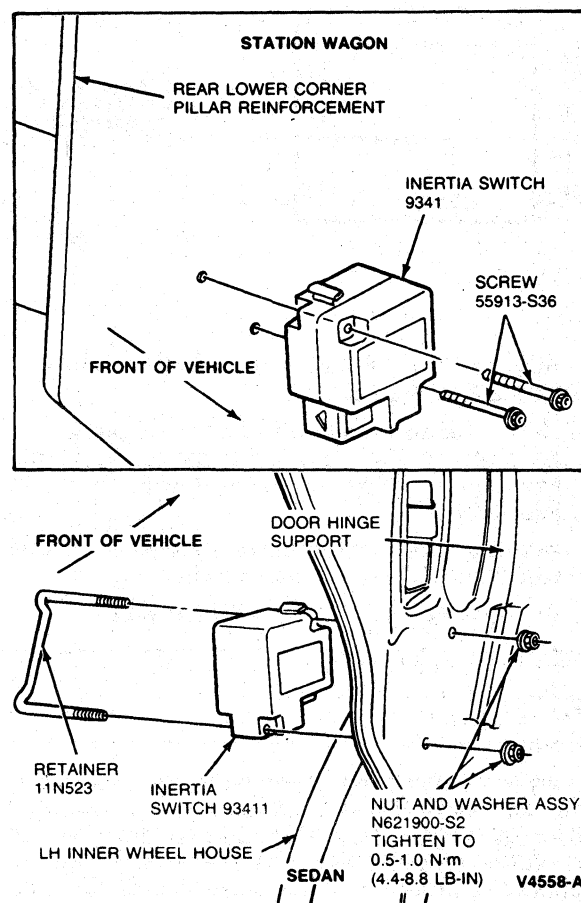
When the ignition switch is turned to the START position, the EEC module operates the fuel pump relay to provide fuel for starting the engine while cranking. After the engine starts, and the ignition switch is returned to the ON position, power to the fuel pump is again supplied through the fuel pump relay. The EEC module senses engine speed and shuts off the fuel pump by opening the ground circuit to the fuel pump relay when the engine stops, or is below 120 rpm.

## Inertia Switch

In the event of a collision, the electrical contacts in the inertia switch open and the fuel pump automatically shuts off. The fuel pump will shut off even if the engine does not stop running. However, the engine will stop a few seconds after the fuel pump stops. It is not possible to restart the engine until the inertia switch is manually reset. The inertia switch is located on the door hinge support above the LH inner wheel house on the sedan and on the rear lower corner pillar reinforcement on the station wagon.

**CAUTION: Do not reset the inertia switch until the fuel system has been inspected for leaks.**

To reset the inertia switch, depress the button on switch.





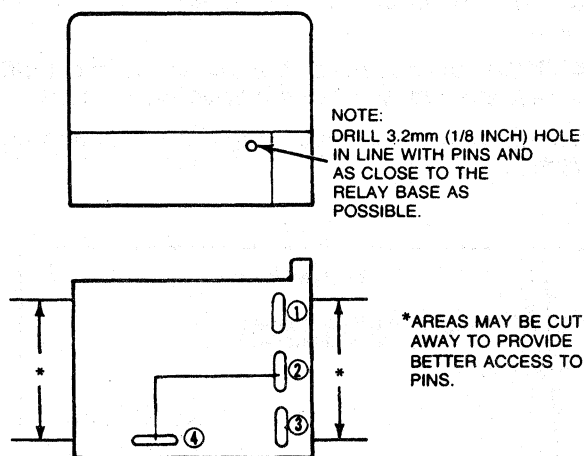
## TESTING

## Fuel Pump

## Relay Modification

NOTE: Use one of the following relays: E3EB-9345-BA, CA, DA or E3TF-9345-AA.

1. Modify relay case by drilling a 3.2mm (1/8-inch) hole and cutting skirt as indicated.



2. Add 16- and 18-gauge jumper wire between pins 2 and 4 as shown.

NOTE: Leads should be soldered in place and as close to the base as possible, to permit insertion of relay into socket with minimum interference.

3. Add 2.4 to 3.0 meters (8 to 10 feet) of flexible wire through hole in case to pin 1.
4. Add ground clip to end of added wire.

## DIAGNOSIS

Almost any electric fuel pump malfunction that can occur will result in a loss or reduction of fuel flow and/or pressure. This diagnosis procedure will concentrate on determining if the electric fuel pump is operating properly. Other diagnosis procedures will cover the analysis of other malfunctions that can cause loss or reduction of engine performance.

Refer to the Electrical and Vacuum Troubleshooting Manual for the fuel pump system schematic.

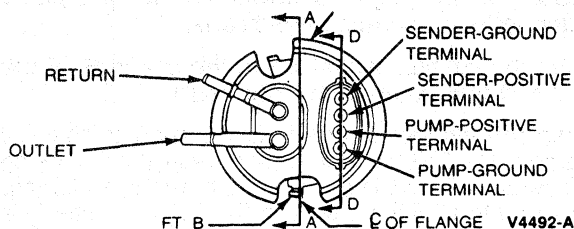
NOTE: Refer to Section 24-50 for push connect fitting service procedure.

Perform the following tests to determine if the electric fuel pump is operating properly:

1. Check fuel tank for adequate fuel supply.
2. Check for fuel leakage at all fittings and lines.

3. Check for electrical continuity to fuel pump:

- a. Locate inertia switch. The inertia switch is located in luggage compartment.
- b. Remove electrical connector from inertia switch and connect a continuity tester to one lead at wiring harness.
- c. Check for continuity between wire and ground. If no continuity is detected, switch to other wire and recheck for continuity. If continuity is not present at either lead, fuel tank must be removed from vehicle and continuity must be checked between wiring harness and the switch leads. If leads check OK, check continuity across pump terminals. If no continuity is present across terminals, replace fuel pump and sender assembly. If continuity is present across pump terminals, check ground circuit or connections to pump from body connector.



- d. Reconnect electrical connector to inertia switch and attach a voltmeter to wiring harness on pump side of switch (the side which showed continuity).
- e. Turn ignition key to ON position while monitoring voltage to fuel pump. The meter should read 10 volts or more for one second and then return to zero.
- f. If voltage is not as specified, check inertia switch to ensure that it is not open by depressing reset button, and then check electrical circuit to find fault.

4. Check electric fuel pump operation:

- a. Disconnect electrical connector at inertia switch.
- b. Crank vehicle for a minimum of 15 seconds to reduce fuel pressure in lines.
- c. Disconnect fuel return line at throttle body. Use care to avoid fuel spillage.
- d. Connect hose from fuel return fitting to a calibrated container of at least one liter (one quart).
- e. Disconnect jumper hose between throttle body and fuel filter in engine compartment.

**CAUTION: The fuel system contains pressurized fuel after vehicle is shut down and will maintain this pressure for a long period of time.**



**DIAGNOSIS (Continued)**

- f. Attach a pressure gauge between throttle body and fuel filter.
- g. Locate fuel pump relay (behind glove compartment) and remove and replace it with modified relay. The ground lead should be brought outside vehicle and located nearby.
- h. Energize fuel pump (ground the ground lead from the relay) for 10 seconds. Observe pressure while energized. If there is no pressure, monitor voltage past inertia switch to determine whether pump is getting proper voltage. Correct any faults as necessary.
- i. The fuel pump is operating properly if:
  - The fuel pump pressure reaches 90-110 kPa (13-16 psi) (CFI engine) and 241-310 kPa (35-45 psi) (EFI engine).
  - The fuel flow is a minimum of 178ml (6 ounces) (CFI engines) and 170ml (5.6 ounces) (EFI engine) in ten seconds.
  - Fuel pressure remains at a minimum of 80 kPa (11.6 psi) (CFI engines) and 207 kPa (30 psi) (EFI engines) immediately after shutdown.
- j. If all three conditions are met, fuel pump is operating properly. Check for engine and electrical problems.
- k. If pressure condition is met, but flow is not, check for blocked filters and fuel supply lines and connection at jet pump (All-Wheel Drive Vehicles only). After correcting any blockages, recheck. If flow conditions are still not met, replace fuel pump-sender assembly.

NOTE: On All Wheel Drive Vehicles, the following conditions may indicate that the jet pump is not operating properly:

- Vehicle stumbles during right turns when fuel level is low.
  - Fuel gauge indicates a low level of fuel, however, there is no fuel in the line.
  - Customer complains of erratic fuel fill readings.
- l. If both pressure and flow conditions are met, but pressure will not maintain after de-energization, check for leaking injectors or regulator. If both check OK, replace fuel pump-sender assembly.
  - m. If no flow or pressure is seen, fuel system should be rechecked as in Step k. If no trouble is found, remove fuel tank and replace fuel pump-sender assembly.
  - n. After procedure is complete, replace modified fuel pump relay with original relay.

**REMOVAL AND INSTALLATION****WARNING: FUEL SUPPLY LINES WILL REMAIN PRESSURIZED FOR LONG PERIODS OF TIME AFTER ENGINE SHUTDOWN.**

This pressure must be relieved before servicing fuel system. A valve is provided on fuel rail assembly for this purpose. Remove air cleaner. Attach Fuel Pressure Gauge T80L-9974-B or equivalent to fuel diagnostic valve on fuel rail assembly. Pressure in fuel system may now be released.

**Removal**

1. Place vehicle on hoist, do not raise.
2. Depressurize fuel system as outlined.
3. Remove fuel from fuel tank by pumping out through filler. Use care to prevent combustion from fuel spillage.
4. Raise vehicle on hoist.
5. Disconnect and remove fuel filler tube.
6. Remove exhaust system (All-Wheel Drive Vehicles only). Refer to Section 26-07.
7. Remove rear axle assembly (All-Wheel Drive Vehicles only). Refer to Section 15-25.
8. Support fuel tank and remove fuel tank support straps. Lower fuel tank partially and remove fuel lines, electrical connectors and vent lines from tank. Remove fuel tank to bench.
9. Remove any dirt that has accumulated around fuel pump attaching flange so that it will not enter fuel tank during removal and installation.
10. Turn fuel pump locking ring counterclockwise with tool and remove locking ring.

NOTE: Perform Steps 11 and 12 for conventional vehicles and Steps 13 through 17 for All-Wheel Drive Vehicles.

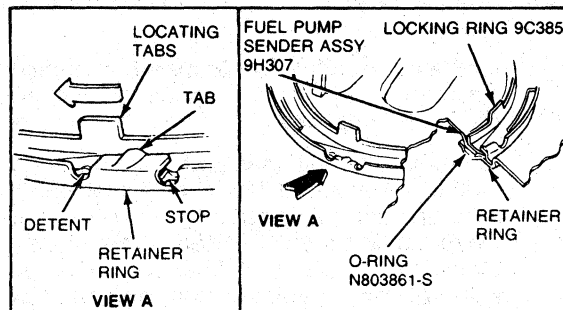
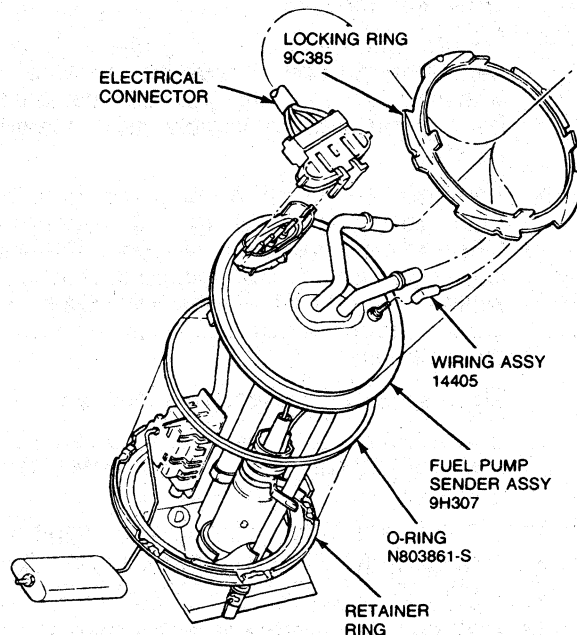
11. Remove fuel pump and bracket assembly.
12. Remove seal gasket and discard.
13. Partially lift up sender unit. Disconnect jet pump line and electrical connector to resistor.
14. Remove fuel pump and bracket assembly.
15. Remove seal gasket and discard.
16. Remove jet pump assembly attaching screw.
17. Remove jet pump assembly.

**Installation**

1. Clean fuel pump mounting flange and fuel tank mounting surface and seal ring groove.
2. Put a light coating of Multi-Purpose Long-Life Lubricant C1AZ-19590-B (ESA-M1C75-B) or equivalent, on a new seal ring to hold it in place during assembly and install it in fuel ring groove.
3. Install jet pump assembly and attaching screw (All-Wheel Drive Vehicles only). Tighten screw to 14-20 N·m (10-15 lb-ft).

**REMOVAL AND INSTALLATION (Continued)**

4. Install fuel pump and sender assembly carefully to ensure that filter is not damaged. Ensure that locating keys are in keyways and seal ring remains in place.
5. Connect jet pump line and electrical connector to resistor (All-Wheel Drive Vehicles only). Ensure locating keyways and seal ring remain in place.
6. Hold assembly in place and install locking ring finger-tight. Ensure that all locking tabs are under tank lock ring tabs.
7. Secure unit with locking ring by rotating ring clockwise with a tool until ring stops against stops.
8. Remove fuel tank from bench to vehicle and support tank while connecting fuel lines, vent line, and electrical connectors to appropriate places.
9. Install tank in vehicle and tighten straps.
10. Install rear axle assembly. Refer to Section 15-25 (All-Wheel Drive Vehicles only).
11. Install exhaust system. Refer to Section 26-07 (All-Wheel Drive Vehicles only).
12. Lower vehicle.
13. Install filler tube and attaching screws.
14. Install a minimum of 38 liters (10 gallons) of fuel and check for leaks.
15. Turn ignition key to ON position for three seconds repeatedly (5 to 10 times) until pressure gauge shows at least 90 kPa (13 psi) (CFI engines) and 270 kPa (30 psi) (EFI engines). Check for leaks at fittings.
16. Remove pressure gauge, start engine, and recheck for leaks.



V4559-A

**SPECIAL SERVICE TOOLS**

Tool Number	Description
T80L-9974-B	Fuel Pressure Gauge

CV2950-D

# SECTION 24-41 Air Cleaner and Duct Systems

SUBJECT	PAGE	SUBJECT	PAGE
REMOVAL AND INSTALLATION		TESTING	
Air Cleaner .....	24-41-2	Vacuum Motor and Valve Function Check .....	24-41-1
Vacuum Motor and Valve Assembly .....	24-41-4	Vacuum-Operated Systems Check .....	24-41-1
SPECIAL SERVICE TOOLS .....	24-41-4	VEHICLE APPLICATION .....	24-41-1
SPECIFICATIONS .....	24-41-4		

## VEHICLE APPLICATION

Taurus/Sable.

## TESTING

### Vacuum-Operated Systems Check

**CAUTION:** This check must be performed in ambient temperature of not less than 16°C (60°F). Do not immerse any part of the vacuum-operated duct and valve assembly in water.

NOTE: On vehicles equipped with a cold weather modulator, bypass the modulator by connecting the two vacuum lines from the modulator. The modulator is located under the air cleaner tray.

1. Apply parking brake and block wheels.
2. Remove air cleaner cover and element. Inspect heat riser tube and zip tubes for proper installation and/or damage. Service or replace as required.
3. Ensure that valve door is in open (heat off, no vacuum) position when engine is not running. If door is closed, check for binding and sticking. Service or replace as required.
4. Place Temperature Indicator T75L-9601-A or equivalent as near as possible to temperature sensor in air horn or air cleaner outlet tube to throttle body.

**CAUTION:** Carefully position temperature indicator tool to prevent ingestion into the carburetor.

5. Start engine. If valve door has closed, go to Step 7. If valve door has not closed, turn off engine. Cool temperature sensor by spraying with liquid from a small can of Refrigerant R-12, D4AZ-19B519-A (ESA-M17B2-A) or equivalent using a Rotunda Refrigerant Can Adapter 023-00009 or equivalent for 30 seconds after liquid contacts the air horn.

**WARNING: DO NOT COOL TEMPERATURE SENSOR WHILE ENGINE IS RUNNING. IF R-12 REFRIGERANT IS DRAWN INTO THE CARBURETOR WHILE ENGINE IS RUNNING, POISONOUS PHOSGENE GAS WILL BE EXHAUSTED INTO TEST AREA. CONDUCT THIS PROCEDURE ONLY IN A WELL VENTILATED AREA.**

Start engine. If valve door has closed, proceed to Step 7. If valve door is open during idle, perform Vacuum Motor Valve Function Check.

6. Install air cleaner cover and tighten two retaining clips.
7. Run engine for 5 minutes. Remove cover and observe door. If door does not start to open within a 5 minute period, note temperature.
  - a. If temperature is greater than 32°C (90°F), replace sensor.
  - b. If temperature is less than 32°C (90°F), temperature is insufficient to operate valve door. Install air cleaner cover, tighten retaining clips and run engine for an additional 5 minutes. If valve door has not started to open, replace sensor.
8. Turn off engine. Remove all test instruments and install all system components. Start engine and check for vacuum leaks. Service as required.

### Vacuum Motor and Valve Function Check

1. Check air cleaner vacuum system integrity. Service or replace as required.
2. Remove air cleaner cover to see valve door.
3. Check valve door for sticking or binding by applying an external vacuum source of 54 kPa (16 in.-Hg.) and allow internal vacuum motor spring to return door to normal position. Correct any sticking or binding before proceeding with test.
4. Using an external vacuum source, apply a minimum of 54 kPa (16 in.-Hg.) vacuum to vacuum motor and retain. The vacuum motor should remain closed for 60 seconds. If not, replace vacuum motor assembly.

## REMOVAL AND INSTALLATION

## Air Cleaner

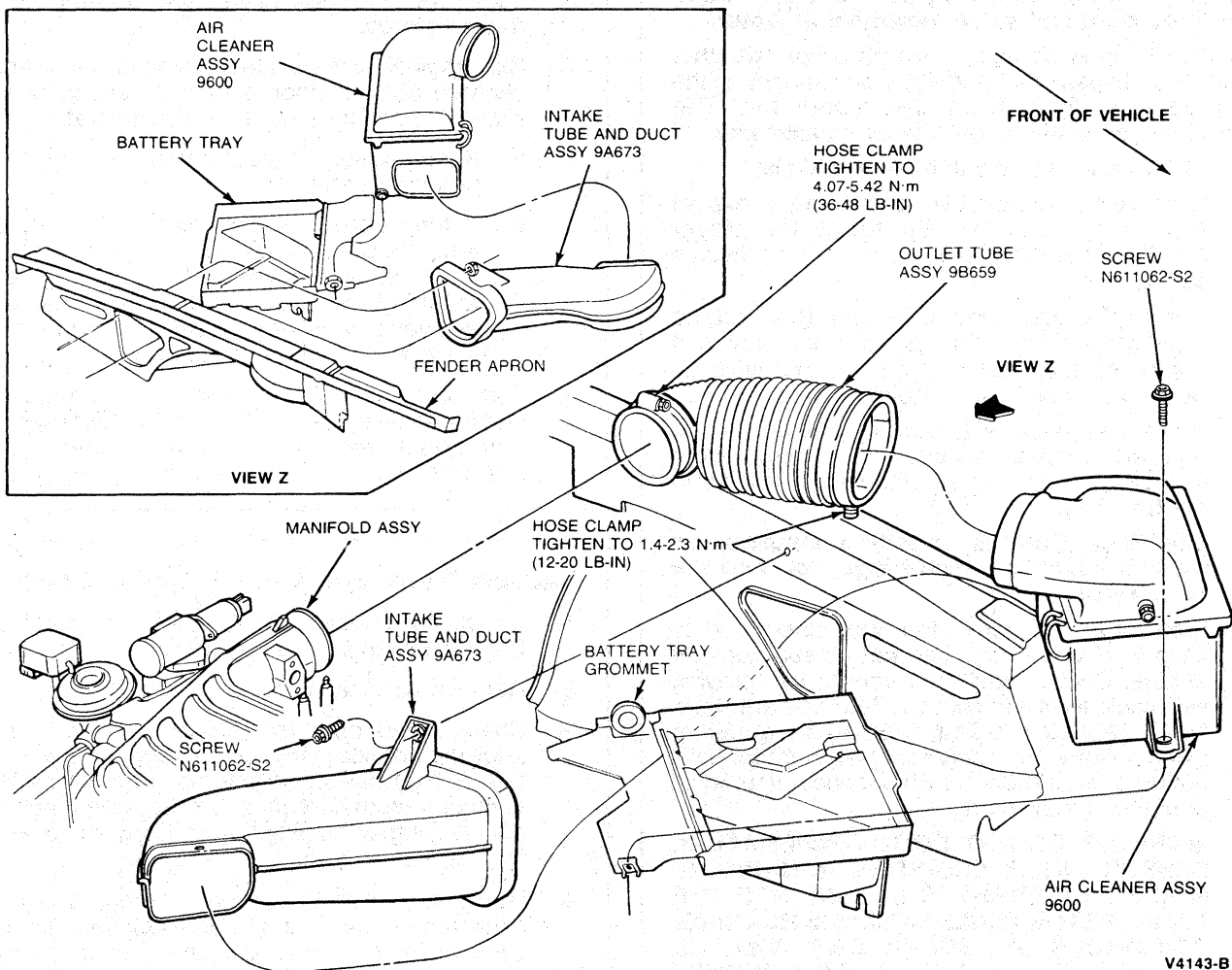
## Removal

1. Loosen air cleaner outlet tube clamp and disconnect tube.
2. Disconnect hot air tube (2.5L engine only), PCV inlet tube and zip tube.
3. Disconnect cold weather modulator vacuum hose at temperature sensor (2.5L engine only).
4. Remove air cleaner, retaining screws and air cleaner assembly.
5. Inspect inside surfaces of cover for traces of dirt leakage past element as a result of damaged element seals, wrong element usage, or inadequate torque on cover retaining clips.
6. Remove air cleaner element and clean sealing surfaces on tray and cover. Install a new element after visually inspecting element for possible damage in handling such as deformed seals or holes in paper.

## 3.0L Engine

## Installation

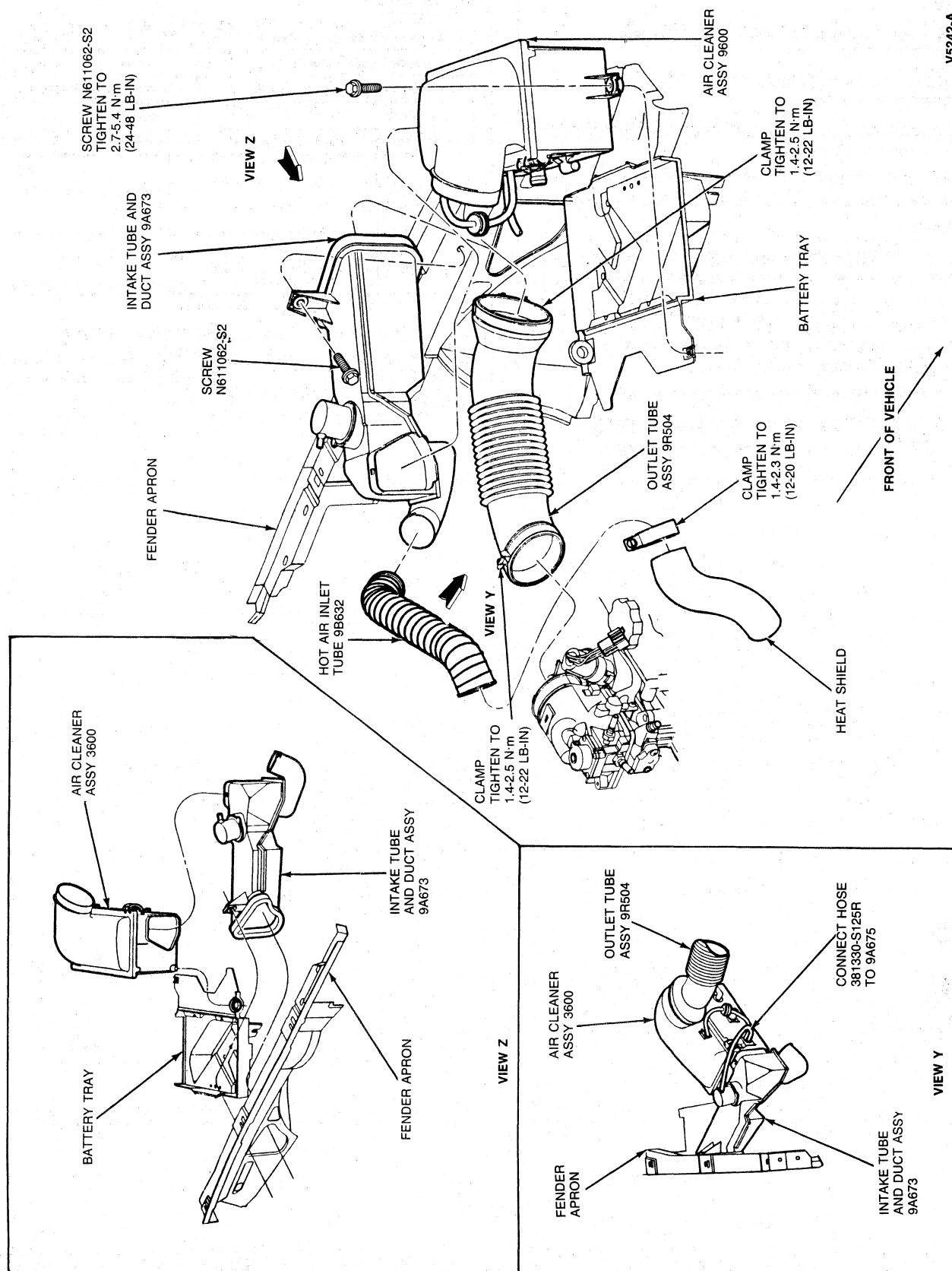
1. Position air cleaner assembly on battery tray. Ensure that mounting grommet is installed with metal side up and battery tray grommet is fully seated in tray. Check air cleaner cover hinge assembly. Tighten retaining clips.
- NOTE: The air cleaner assembly mounting tab must be engaged with the battery tray grommet.
2. Connect cold weather modulator vacuum hose to temperature sensor (2.5L engine only).
  3. Connect hot air inlet tube (2.5L engine only), PCV inlet tube, pulse air tube and zip tube.
  4. Install air cleaner outlet air tube. Tighten clamp to 1.4-2.3 N·m (12-20 lb-in).
  5. Connect vent hoses to air cleaner cover.
  6. Start engine and check for vacuum leaks around both ends of tube from air cleaner to throttle body. Service as required.



V4143-B

## REMOVAL AND INSTALLATION (Continued)

## 2.5L Engine



V5242-A

**REMOVAL AND INSTALLATION (Continued)****Vacuum Motor and Valve Assembly****Removal**

1. Remove air cleaner assembly from vehicle and place on a work bench.
2. Loosen retaining clips holding air cleaner cover to air cleaner tray.
3. Disconnect vacuum hose from vacuum motor and valve assembly.
4. Remove vacuum motor retaining rivet and remove vacuum motor from air cleaner tray.

**Installation**

1. Connect vacuum motor rod to valve door and position motor in air cleaner. Verify that vacuum motor gasket is positioned correctly under motor. Install new retaining rivet.
2. Check vacuum motor and valve for sticking or binding. Service as required.
3. Connect vacuum motor vacuum hose.
4. Install air cleaner cover. Tighten retaining clips.
5. Install air cleaner assembly in vehicle.

**SPECIFICATIONS****TORQUE SPECIFICATIONS**

Description	N·m	Lb·In
Air Cleaner Assembly to Bracket Screw	2.7-5.4	24-48
Air Cleaner Outlet Tube Clamp	1.4-2.4	12-22
Nut — Shroud to Exhaust Manifold	13.5-20.5	10-15 (lb-ft)
Nut — Wing	2.2-3.4	20-30
Air Cleaner Inlet Tube to Air Cleaner	2.7-5.4	24-48

**CV4566-B****SPECIAL SERVICE TOOLS**

Tool Number	Description
T75L-9601-A	Temperature Indicator
Rotunda 023-00009	Refrigerant Can Adapter

**CV3033-D**

# SECTION 24-50 Fuel Tanks and Lines

SUBJECT	PAGE	SUBJECT	PAGE
DESCRIPTION AND OPERATION		MAJOR SERVICE OPERATIONS	
Fill Control/Vapor Vent System .....	24-50-2	Fuel Lines .....	24-50-13
Fuel Cap .....	24-50-2	Fuel Tanks .....	24-50-13
Fuel Injected Engines .....	24-50-1	REMOVAL AND INSTALLATION	
Fuel Lines .....	24-50-1	Fuel Lines—Nylon .....	24-50-9
Fuel Tank Vapor Orifice and Rollover Valve .....	24-50-2	Fuel System Pressure Relief .....	24-50-5
Fuel Tanks and Fillers .....	24-50-1	Fuel Tank .....	24-50-5
Fuel Vapor Emission Control System .....	24-50-2	Fuel Tank Straps .....	24-50-9
Pressure and Vacuum Relief System .....	24-50-3	Push Connect Fittings .....	24-50-10
Push Connect Fittings .....	24-50-1	Spring Lock Coupling .....	24-50-11
DIAGNOSIS		SPECIAL SERVICE TOOLS .....	24-50-15
Fuel Tank Evaporative Emission System .....	24-50-3	SPECIFICATIONS .....	24-50-14
		VEHICLE APPLICATION .....	24-50-1

## VEHICLE APPLICATION

Taurus/Sable.

## DESCRIPTION AND OPERATION

### Fuel Injected Engines

#### Electronic Fuel Injection (EFI)

Taurus/Sable vehicles may be equipped with a 3.0L EFI (Electronic Fuel Injection) engine. These engines are fuel injected through an engine mounted, fuel rail to the intake port at each cylinder. The fuel systems which are used with fuel injected engines have electric fuel pumps to provide high pressure fuel to the injectors. The high-pressure pump is located in the fuel tank.

The fuel lines leading from the fuel tank to the engine are under pressure during vehicle operation. When fuel injected engines are turned off, the fuel in the fuel lines remains pressurized for long periods of time to provide quick start-ups. Special procedures for servicing these pressurized fuel systems are described in this Section.

#### Central Fuel Injection (CFI)

All 2.5L CFI engines are fuel injected through the throttle body. The fuel is supplied to the throttle body injectors by means of an electric fuel pump mounted in the fuel tank. The fuel lines leading from the fuel tank to the engine are under pressure during engine operations. Some residual pressure may remain in fuel lines when engine is turned off. Special procedures for servicing these pressurized fuel systems are described in this Section.

### Fuel Lines

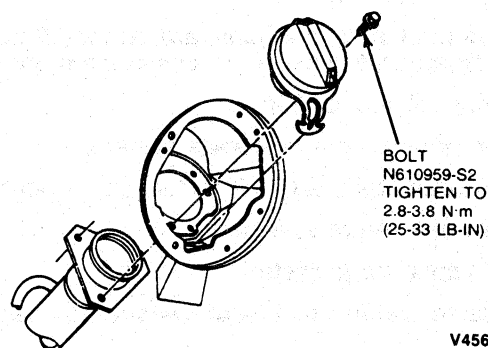
Fuel injected engines use nylon fuel lines with push connect fittings.

### Push Connect Fittings

Push connect fittings are used to make most fuel line connections in EFI fuel systems. These fittings must be serviced using the procedures outlined. Service is not possible if the fitting is damaged, except to replace a damaged retaining clip.

### Fuel Tanks and Fillers

All vehicles are equipped with a restricted fuel filler opening that allows only a non-leaded fuel nozzle to be inserted.



V4564-A

**DESCRIPTION AND OPERATION (Continued)**

The restrictor consists of a narrow opening in the filler, covered by a spring steel trap door. The smaller non-leaded fuel nozzle will fit through the narrow opening and push the trap door aside, allowing normal filling. Leaded fuel nozzles will not fit through the narrow opening. The trap door being closed causes a fuel backup, and automatic nozzle shut-off.

The restricted fuel filler is serviced as an assembly, and cannot be serviced.

**Fuel Cap**

The fuel cap is a threaded screw-on design and is secured to the vehicle by means of a tether. The fuel cap assembly provides pressure and vacuum relief functions and should be replaced with the proper pressure/vacuum relief cap to prevent possible system malfunction.

**Fuel Vapor Emission Control System**

As a part of the fuel system, vehicles are equipped with a fuel evaporative emission control system designed to meet federal and state requirements in effect at the time of production.

The system consists of:

- Sealed fuel tank.
- Pressure vacuum relief fuel cap.
- Fuel tank vapor valve.
- Carbon canister.
- Fuel bowl vent, solenoid or mechanical (carburetor).
- Vacuum purge valve.
- Thermal vent valve.
- Purge solenoid.

Not all of these components are used on any one system, since usage depends on the calibration of the complete vehicle.

System control and operation are accomplished through six separate basic functions in the system:

1. Fill control vent system.
2. Tank vapor vent and storage system.
3. Carburetor fuel bowl vent and storage system.
4. Fuel vapor return system.
5. Fuel vapor purge system.
6. Pressure and vacuum relief system (fuel cap).

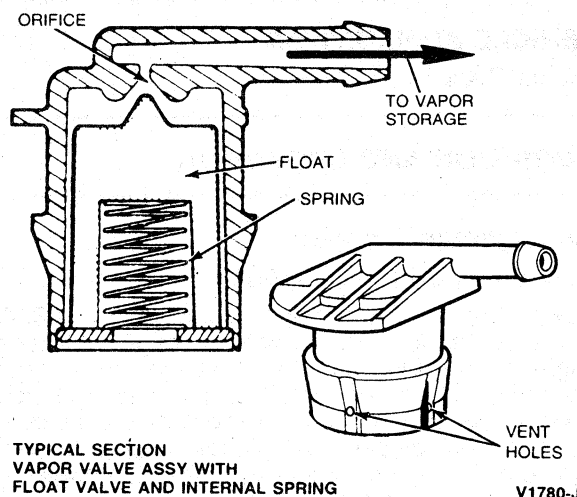
**Fill Control/Vapor Vent System**

Fill control is accomplished through the filler pipe configuration and a vent line, attached to the filler

pipe, which extends inside the fuel tank. The vent system is designed to provide an air space, approximately 10 percent of the tank volume, above the fuel level in a full tank. The air space allows for thermal expansion of fuel and provides clearance between the fuel level and the vapor orifice and rollover valve assembly, which is mounted in the top panel of the fuel tank. The clearance is sufficient to allow vapor venting through the orifice under all static and most dynamic vehicle conditions.

**Fuel Tank Vapor Orifice and Rollover Valve Assembly**

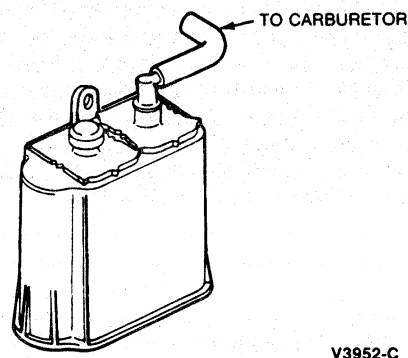
The fuel tank vapor orifice and rollover valve assembly make use of a small orifice and shut-off valve that tends to allow only fuel vapor, not liquid, to pass into the line routed forward to the vapor storage canister. This assembly mounts directly to the fuel tank, using a rubber grommet.



Fuel vapors in the sealed tank are vented through the orifice in the top of the tank. The vapors are transmitted through a single vapor tube to the carbon canister at the front of the vehicle.

**Carbon Canister**

Fuel vapor generated from the fuel tank is stored in a carbon-filled canister.





## DESCRIPTION AND OPERATION (Continued)

**Pressure and Vacuum Relief System****Sealed Fill Cap**

The fill cap is a sealed cap with a built-in pressure-vacuum relief valve. Fuel system vacuum relief is provided after negative 3.45 kPa (0.50 psi) and pressure relief above 12.41 kPa (1.8 psi). Under

normal operating conditions, the fill cap operates as a check valve, allowing air to enter the tank as gasoline is used, while preventing vapors from escaping the tank through the cap.

**DIAGNOSIS**

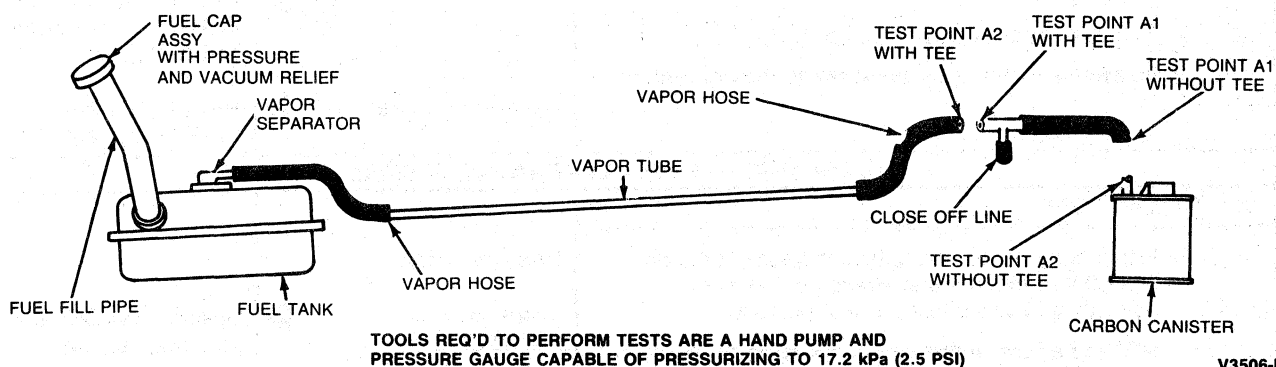
Physical damage, leaks, contaminated fuel, and missing items are the major answers to diagnosis of fuel tank and fuel line complaints.

Refer to the Engine/Emissions Diagnosis\* manual for diagnosis of Engine Evaporative Emission System.

**Fuel Tank Evaporative Emission System**

The following is a diagnostic guide for check and/or servicing concerns of internal fuel tank pressure buildup. A typical concern may be a rush of air as the fuel cap is removed.

The basic fuel tank venting system is typical for all vehicles.



The fuel evaporative emission system allows for controlled release of fuel tank pressure through a carbon vapor storage canister. Under normal operating conditions, this system will allow sufficient venting to prevent a build-up of internal fuel tank pressure.

Some operating conditions may cause temporary internal fuel tank pressure. In a normally functioning system, pressure will be relieved through vapor venting. Some of these conditions are:











- On warm or hot days, parking the vehicle after filling the fuel tank, the fuel is cool from underground storage and vaporizes rapidly when warmed.

- Parking after driving over rough roads, washboard, etc., after filling the fuel tank. Agitation of fuel increases vaporization.
- Parking after driving long distances in high temperature conditions.

No service is required if these conditions caused the customer complaint. A blocked fuel evaporative emission system can cause abnormal fuel tank pressure and must be serviced. Refer to the chart for diagnosis and flow test.

\*Can be purchased as a separate item.

## DIAGNOSIS (Continued)

TEST STEP		RESULT	ACTION TO TAKE
1.0	FUNCTIONAL TEST		
	<ul style="list-style-type: none"> <li>Test canister hose and inlet nipple for blockage.</li> </ul>		GO to A1.
2.0	FUNCTIONAL TEST		
	<ul style="list-style-type: none"> <li>Test fuel evaporative emission system for blockage.</li> </ul>		GO to A2.
3.0	VISUAL INSPECTION		
	<ul style="list-style-type: none"> <li>Inspect vapor tube and hoses for kinks or pinched areas.</li> </ul>	(OK)  Servicing required 	GO to 4.0. SERVICE. VERIFY service.
4.0	VISUAL INSPECTION		
	<ul style="list-style-type: none"> <li>Inspect vapor hose routing between fuel tank and body for pinch.</li> </ul>	(OK)  Servicing required 	GO to 5.0. LOOSEN fuel tank and reroute hose. VERIFY service.
5.0	VISUAL INSPECTION		
	<ul style="list-style-type: none"> <li>Remove fuel tank.</li> <li>Remove vapor separator valve.</li> <li>Inspect valve for open air passage through orifice.</li> </ul>	(OK)  Servicing required 	INSTALL valve in tank. INSTALL tank system test complete. REPLACE valve. VERIFY service.
FLOW TEST — FUEL EVAPORATIVE SYSTEM			
A1	FLOW TEST		
	<ul style="list-style-type: none"> <li>Install hand pump and pressure gauge Rotunda 059-00008 Vacuum and Pressure Tester or equivalent in vapor hose at test point A1.</li> </ul> <p><b>NOTE: Failure to remove fuel cap may result in damage to fuel tank.</b></p> <p><b>CAUTION: Do not use other high pressure air supplies. Will result in damage to fuel tank.</b></p> <ul style="list-style-type: none"> <li>Hand pump to maximum of 17.2 kPa (2.5 psi).</li> </ul>	Pressure drop: Drops to zero immediately  Holds pressure or leaks down slowly 	System flow OK, no servicing required. GO to 3.0.
A2	FLOW TEST		
	<ul style="list-style-type: none"> <li>Remove fuel cap from fuel filler pipe.</li> <li>Install hand pump and pressure gauge onto tee or canister nipple at test point A2.</li> </ul> <p><b>CAUTION: Do not use other high pressure air supplies. May result in damage to canister.</b></p> <ul style="list-style-type: none"> <li>Hand pump to a maximum of 17.2 kPa (2.5 psi).</li> </ul>	Pressure Drop: Drops to zero immediately  Holds pressure or leaks down slowly 	System OK, no servicing required. GO to 2.0. SERVICE. VERIFY service.

## REMOVAL AND INSTALLATION

Most component parts of the standard fuel system are serviced by a simple nut, bolt, or screw for removal and installation. Refer to individual system illustrations for specific part references.

**CAUTION:** Fuel supply lines on all vehicles equipped with fuel injected engines will remain pressurized for long periods of time after engine shutdown. The pressure must be relieved before servicing these fuel systems.

### Fuel System Pressure Relief

To relieve fuel system pressure on CFI engines, refer to Section 24-03.

Electronic fuel injected engines are equipped with a pressure relief valve in the fuel supply line in the engine compartment to relieve fuel pressure. Refer to Section 24-05.

### Fuel Tank

#### Removal

1. Fuel should be drained from tank as completely as possible prior to tank removal. This is accomplished by disconnecting fuel filler pipe from rubber hose and siphoning or pumping fuel out through remaining rubber hose.

Vehicles with fuel injected engines have reservoirs inside fuel tank to maintain fuel near fuel pickup during vehicle cornering maneuvers and under low fuel operating conditions. These reservoirs could block siphon tubes or hoses from reaching bottom of fuel tank. This situation can be overcome with a few repeated attempts using different hose orientations.

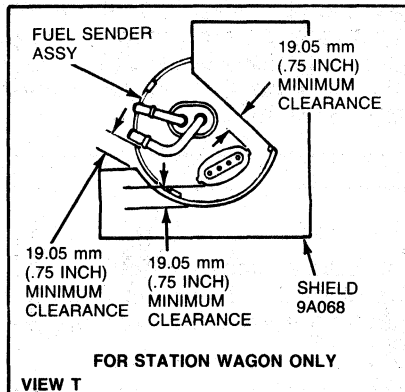
2. Place a safety support under tank and remove bolts or nuts from one end of fuel tank straps. The straps are hinged at one end. Remove bolts from unhinged end and swing straps out of the way. The fuel tank shield, if so equipped, should be left in place to prevent it from being misplaced or installed incorrectly.
3. Partially remove tank and disconnect fuel lines and electrical connector from fuel gauge sender/pump assembly, if required. Refer to Push Connect Fitting Removal.
4. Remove tank from vehicle.

#### Installation

1. Before proceeding, check following items:
  - a. Leak check sender unit.
  - b. Ensure fuel vapor separator valve is installed completely on tank top.
  - c. Make all required fuel line, fuel return line, vapor vent and electrical connections which will be inaccessible after tank is installed. Route lines through clip on tank.
2. Place fuel tank in its proper position in vehicle.
3. Bring fuel tank straps around tank and start attaching nut or bolt. Align tank with straps.
4. Check hoses and wiring mounted on tank top, to ensure they are correctly routed and will not be pinched between tank and body.
5. Tighten fuel tank strap attaching bolts to specification.

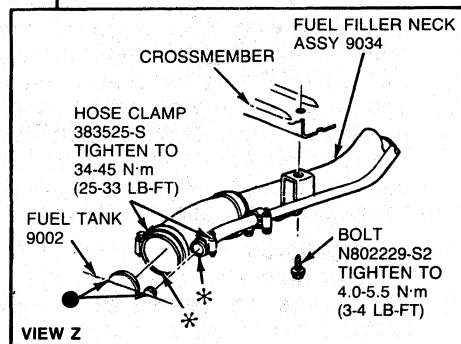
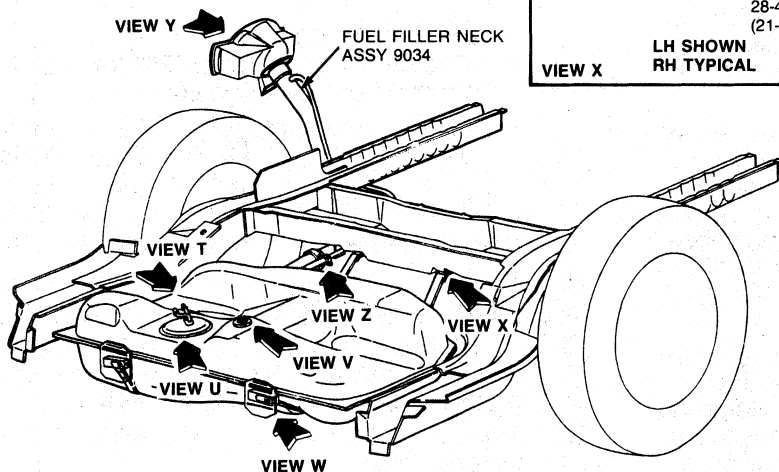
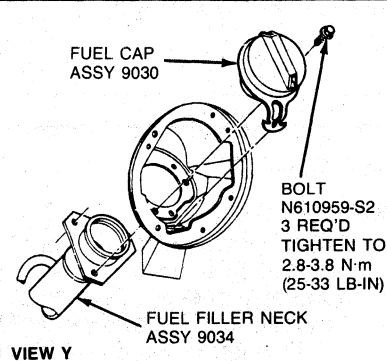
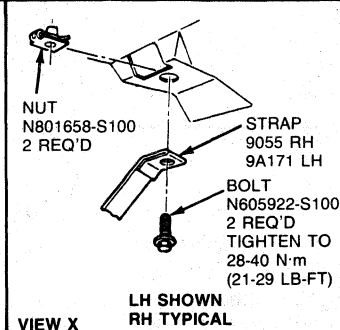
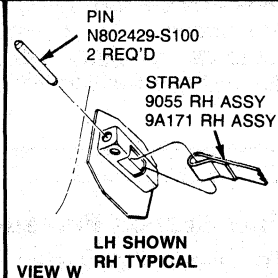
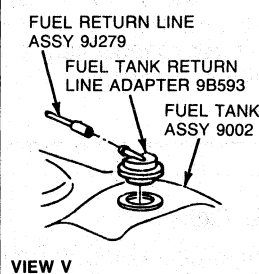
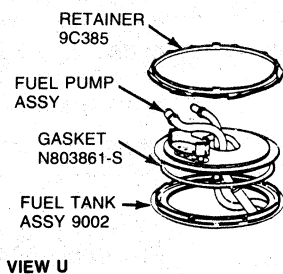
NOTE: For electric fuel pump installation (CFI and EFI engines), refer to Section 24-35.
6. Install fuel filler hoses which connect fuel tank to fuel filler pipe. Install hose clamps and tighten to specification.
7. Replace fuel drained from tank.
8. Check all connections for leaks.

## REMOVAL AND INSTALLATION (Continued)



\* SAE 10W-40 ENGINE OIL MAY BE USED ON 9002 AND OR 9034 AS AN ASSY AID. NO OTHER MATERIAL MAY BE USED.

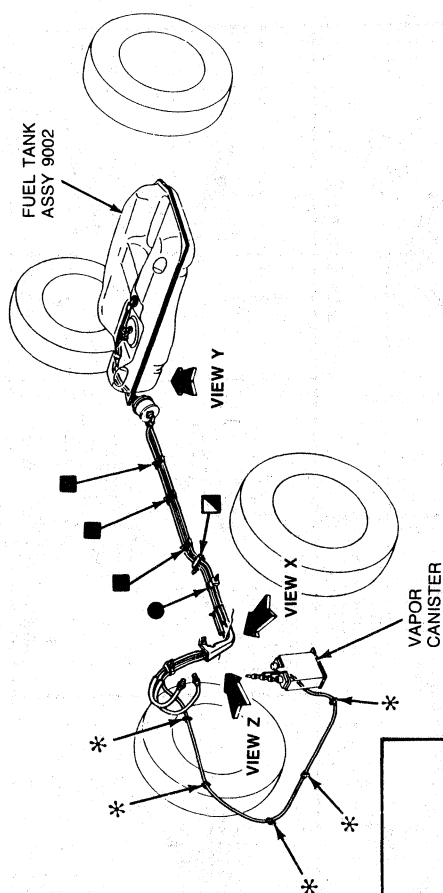
● INSTALL HOSES FLUSH TO TANK SURFACE. CLAMP MUST BE ON HOSE FLUSH TO 3.0mm (.1 INCH) FROM END OF HOSE.



V4551-B

## REMOVAL AND INSTALLATION (Continued)

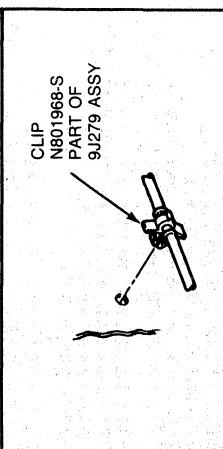
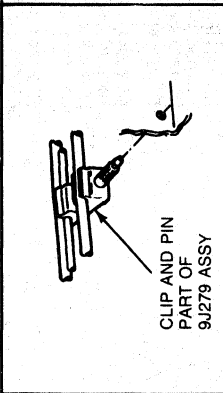
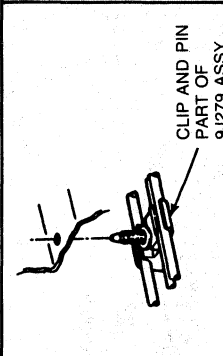
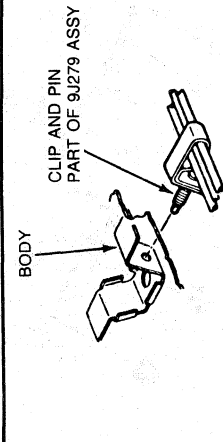
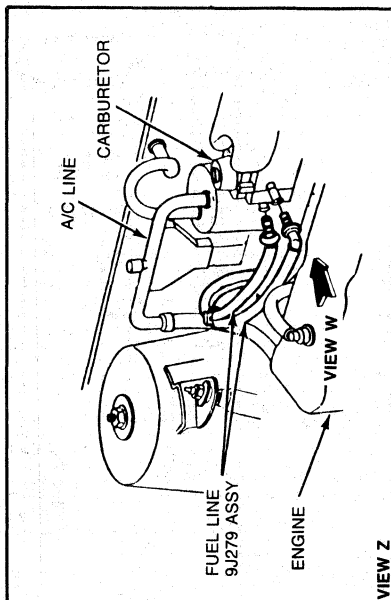
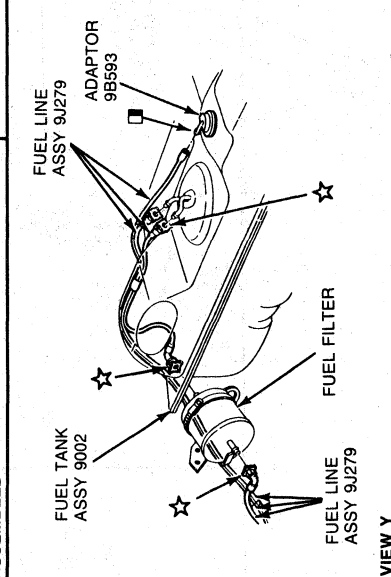
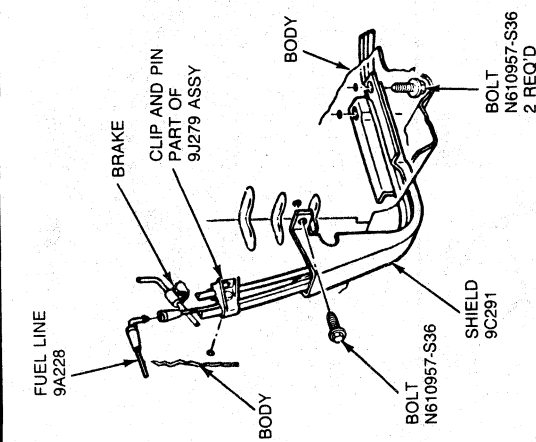
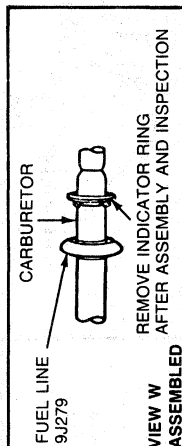
## 2.5L Engine



- INSTALL HOSE ON TUBE 15mm (.62 INCH)
- ☆ ALIGN PUSH CONNECTOR WITH METAL TUBE END AND INSTALL UNTIL A CLICK IS HEARD AND/OR FELT AND BEAD IS INSIDE OUTER LIP OF PUSH CONNECTOR. PULL BACK ON THE PUSH CONNECTOR APPROX. 44.5 N (10 LBS) FORCE.

- SAE-10W-40 ENGINE OIL OR ESE-M99B144-A LUBRICANT MUST BE USED ON 9B593 (SEPARATOR) AND/OR 9B076 (SEAL) AS AN ASSY AID. NO OTHER MATERIAL MAY BE USED.

ESE-M99B144-A LUBRICANT MAY BE USED AS AN ASSY AID FOR ASSY OF HOSES ON TUBES. NO OTHER MATERIAL MAY BE USED.



ONE PLACE MARKED

THREE PLACES MARKED ■

ONE PLACE MARKED ●

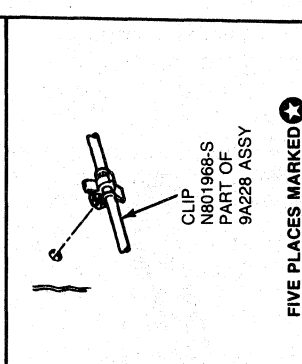
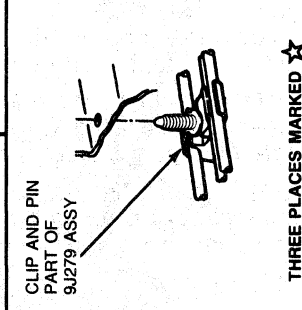
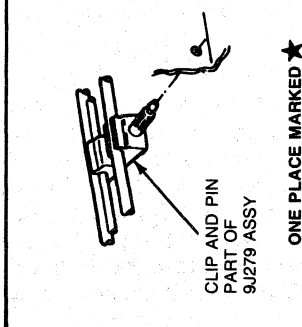
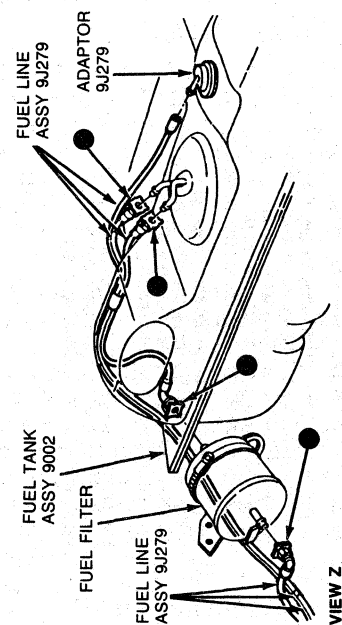
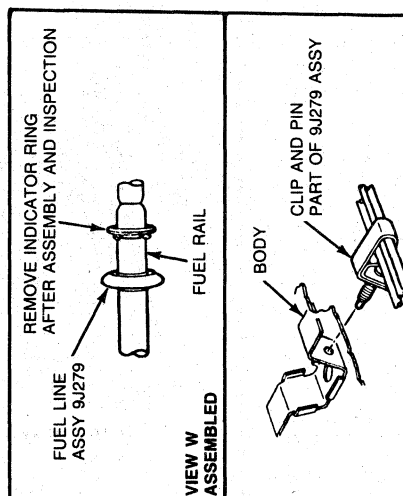
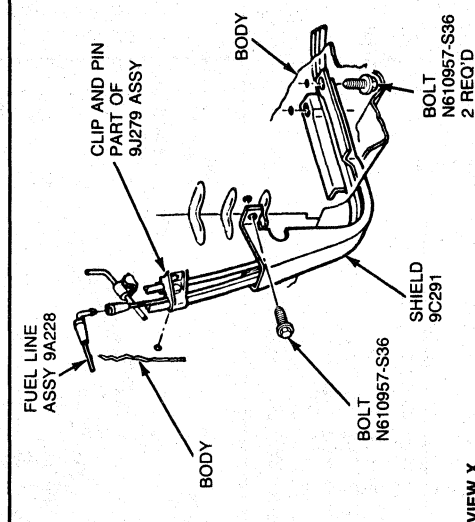
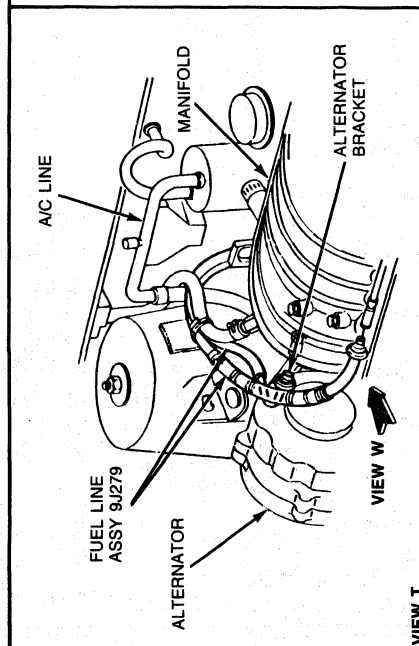
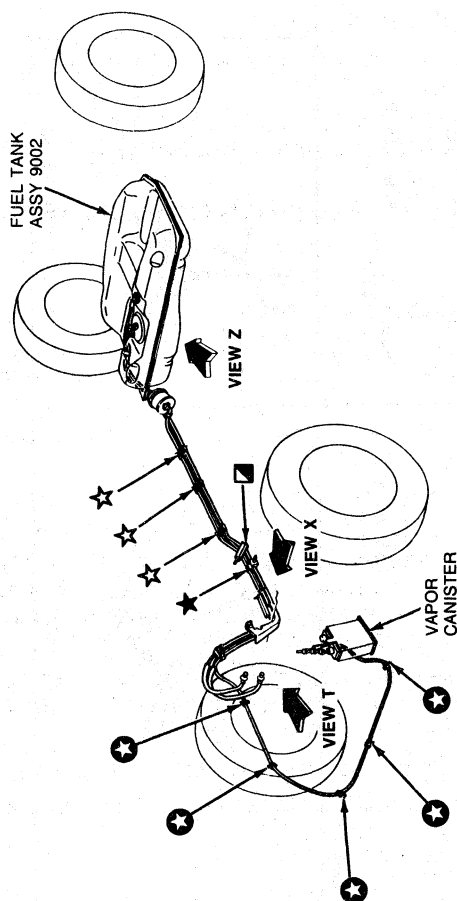
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V4552-B

## REMOVAL AND INSTALLATION (Continued)

### 3.0L Engine

- ★ INSTALL HOSE ON TUBE 15mm (.62 INCH)
- ALIGN PUSH CONNECTOR WITH METAL TUBE END AND INSTALL UNTIL A CLICK IS HEARD AND/OR FELT AND BEAD IS INSIDE OUTER LIP OF PUSH CONNECTOR. PULL BACK ON THE PUSH CONNECTOR APPROX. 44.5 N (10 LBS) FORCE
- ☆ SAE-10W-40 ENGINE OIL OR ESE-M98B144-A LUBRICANT MUST BE USED ON 98593 (SEPARATOR) AND/OR 98076 (SEAL) AS AN ASSEMBLY AID. NO OTHER MATERIAL MAY BE USED.
- ESE-M98B144-A LUBRICANT MAY BE USED AS AN ASSEMBLY AID FOR ASSEMBLY OF HOSES ON TUBES. NO OTHER MATERIAL MAY BE USED.



## REMOVAL AND INSTALLATION (Continued)

### Fuel Tank Straps

#### Removal

Straps may be removed, and/or replaced without removing the tank, if each strap is removed and installed one at a time and a support is provided under the tank.

NOTE: Straps may be removed or installed by following procedures under Fuel Tank Removal and Installation.

The hinged end of the strap attachment holds the strap in place after the fuel tank is removed. This hinged end uses a pin-type attachment through a loop in the end of the strap.

1. To remove strap, push strap up into bracket until pin lines up with large hole. There is a guide and stop inside bracket to assist in aligning strap for removal and installation of pin.
2. Push pin out of large hole in side of bracket by inserting a small drift pin or punch into small hole in opposite side of bracket.

NOTE: A magnetized screwdriver is helpful to draw pin out of large opening in bracket if pin does not line up properly.

#### Installation

1. Push strap into bracket opening.
2. Insert pin into loop in strap.
3. Pull strap down until pin is fully seated on bottom of bracket.

**CAUTION:** The pin must rest flat against bottom of bracket. If it does not, fuel tank could be damaged. Do not install tank. Attempt to position pin so that it will seat properly. If unsuccessful, remove pin and strap. Check for, and remove any obstruction that may be inside bracket. Check to ensure pin is correct length.

### Fuel Lines—Nylon

**WARNING: FUEL SUPPLY LINES ON ALL VEHICLES EQUIPPED WITH EFI OR CFI ENGINES WILL REMAIN PRESSURIZED FOR LONG PERIODS OF TIME AFTER ENGINE SHUTDOWN. THE PRESSURE MUST BE RELIEVED BEFORE SERVICING THE FUEL SYSTEM. REFER TO FUEL SYSTEM PRESSURE RELIEF.**

Nylon lines replace the conventional steel tubing. The individual tubes are clipped and taped together by the manufacturer and are supplied as an assembly. The nylon fuel tube assembly is secured to the body rails with clips and push-pins. The clips are located along the tube assembly by upsets on the fuel tube. In addition to locating the clips, these upsets prevent the tubes from sliding through the clips after they have been installed on the vehicle. The fuel supply and return lines are connected to the fuel pump and fuel filter using push-connects. Connections to the engine are made with spring lock connectors. Refer to Push Connect and Spring Lock Coupling Removal and Installation.

**CAUTION:** Ford approved nylon fuel tubing is made from material which has been tested and proven to be acceptable for use with commercially available fuels. It is also resistant to most environmental conditions. Avoid using alternate tubing materials. Use of non-approved tubing could pose a hazard in service.

**CAUTION:** Nylon fuel tube must not be repaired using hose and hose clamps. Push connect fittings cannot be repaired except to replace the retaining clips. Should the plastic tubes, push connect fittings or steel tube ends become damaged and leak, approved service parts must be used to service the fuel lines.

**CAUTION:** The nylon fuel lines can be damaged by torches, welding sparks, grinding and other operations which involve heat and high temperatures. If any repair or service operation will be used which involves heat and high temperatures, locate all fuel system components, especially the nylon fuel lines to be certain they will not be damaged. It is recommended that the nylon fuel tubes be removed from the vehicle if a torch or high heat producing equipment is to be used for service in the following areas:

1. Exhaust or suspension components in proximity to fuel tubes.
2. Floorpan under vehicle and inside the passenger compartment (RH side).
3. Rocker panel (RH side).
4. Underbody frames, rails and crossmembers (RH side).
5. Firewall or dash panel; under vehicle or inside the passenger compartment (lower RH side).
6. Front or rear wheel house/fender apron (RH side).

#### Removal

1. Drain fuel from fuel tank.
2. Lower fuel tank and disconnect push connect fittings from fuel pump mounted inside fuel tank.
3. Disconnect push connect fittings from fuel filter at RH side of fuel tank.
4. Remove three screws attaching fuel line shield to lower dash crossmember and remove shield.
5. Disconnect vapor tube from fuel line assembly at in-line connection in engine compartment along RH sidemember between shock tower and dash panel.
6. On vehicles with 3.0L engines, cut strap which retains fuel lines and vacuum hose in engine compartment.
7. Disconnect spring lock couplings from engine.
8. Cut push-pins off between each attaching clip and body.

#### Installation

1. Install fuel line assembly by pushing five or six pins into existing holes in underbody.

## REMOVAL AND INSTALLATION (Continued)

NOTE: New fuel lines come equipped with push-pins. If a fuel line is being reused, new push-pins must be installed on existing line. Any damaged clips must be replaced.

2. Install fuel line shield to lower dash crossmember and install three attaching screws.

NOTE: Lines must be routed between shield and lower dash.

3. Raise fuel tank up to underbody and connect fuel lines to fuel pump and vapor valve. Route lines through clip on top of tank. Connect electrical connector to fuel pump.
4. Install tank to underbody.
5. Connect fuel lines to fuel filter.
6. Connect vapor tube to fuel tube assembly in engine compartment.
7. Connect fuel line spring lock coupling to engine fuel rail or throttle body.

### CAUTION: Do not use any tools.

4. Grasp fitting and hose assembly and pull in an axial direction to remove fitting from steel tube.
5. When fitting is removed from tube end, inspect fitting and tube for any internal parts that may have been dislodged from fitting. Any loose internal parts should be immediately installed, using mating tube to insert parts.

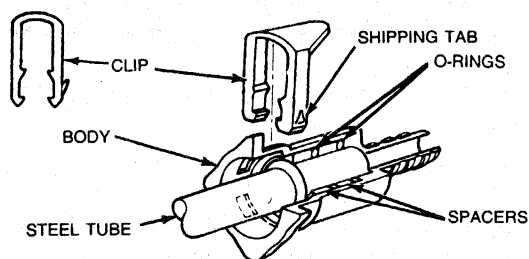
### Installation

1. Do not reuse original clip in fitting. A new clip must be used. To install new clip, insert clip into any two adjacent openings with triangular portion pointing away from fitting opening. Install clip to fully engage body (legs of "hairpin" clip locked on outside of body). Piloting with an index finger is necessary.
2. Before installing fitting on tube, wipe tube end with a clean cloth. Inspect inside of fitting to ensure it is free of dirt and/or obstructions.
3. To install fitting onto tube, align fitting and tube axially and push fitting onto tube end. When fitting is engaged, a definite click will be heard. Pull on fitting to ensure it is fully engaged.

### Push Connect Fittings

Push connect fittings are designed with a retaining clip. The fittings used with 9.5 and 7.9mm (3/8 and 5/16-inch) diameter tubing use a "hairpin" clip. Clips should be replaced whenever a connector is removed.

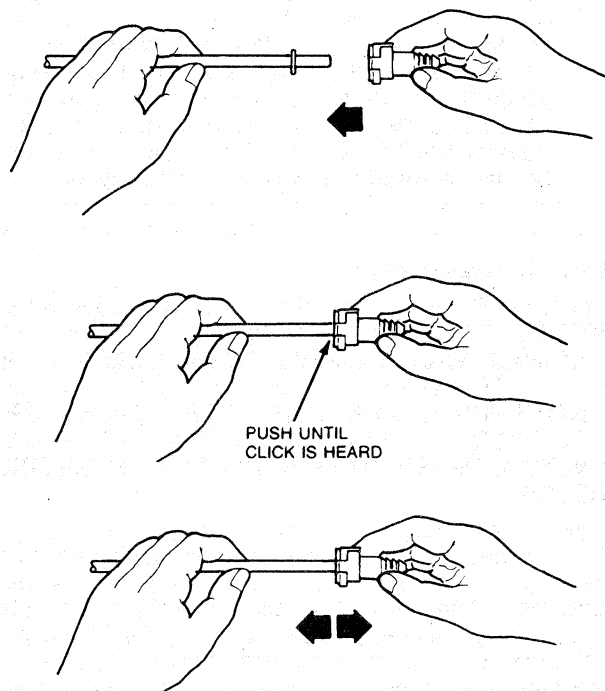
#### Hairpin Clip



V3587-D

#### Removal

1. Inspect internal portion of fitting for dirt accumulation. If more than a light coating of dust is present, clean fitting before disassembly.
2. Some adhesion between seals in fitting and tubing occurs with time. To separate, twist fitting on tube, then push and pull fitting until it moves freely on tube.
3. Remove "hairpin" type clip from fitting by first bending shipping tab downward so that it will clear body. Next (**using hands only**), spread two clip legs about 3.2mm (1/8 inch) each to disengage body and push legs into fitting. Complete removal is accomplished by lightly pulling from triangular end of clip and working it clear of tube and fitting.



V4141-A



**REMOVAL AND INSTALLATION (Continued)****Spring Lock Coupling**

The spring lock coupling is a fuel line coupling held together by a garter spring inside a circular cage. When the coupling is connected together, the flared end of the female fitting slips behind the garter spring inside the cage of the male fitting. The garter spring and cage then prevent the flared end of the female fitting from pulling out of the cage.

Two O-rings are used to seal between the two halves of the coupling. These O-rings are made of special material and **must** be replaced with an O-ring made of the same material. Use only the O-rings listed in the Spring Lock Coupling illustration.

A plastic indicator ring is used on spring lock couplings to indicate, during vehicle assembly, that

the coupling is connected. Once the coupling is connected, the indicator ring is no longer necessary but will remain captive by the coupling near the cage opening.

The indicator ring may also be used during service operations to indicate connection of the coupling. After the coupling has been cleaned and new O-ring installed and lubricated with clean engine oil ESE-M2C39-F or equivalent, insert the tabs of the indicator ring into the cage opening. Then, connect the coupling together by pushing with a slight twisting motion. When the coupling is connected, the indicator ring will snap out of the cage opening but will remain captured on the coupling by the refrigerant line.

**To Disconnect the Coupling**

1. Discharge fuel from system. Refer to Section 24-03 or Section 24-05. Then, fit Spring Lock Coupling Tool T81P-19623-G1 (3/8-inch), T81P-19623-G2 (1/2-inch) or equivalent to coupling.
2. Close tool and push into open side of cage to expand garter spring and release female fitting.  
**The garter spring may not release if the tool is cocked while pushing it into the cage opening.**
3. After garter spring is expanded, pull fittings apart.
4. Remove tool from disconnected coupling.

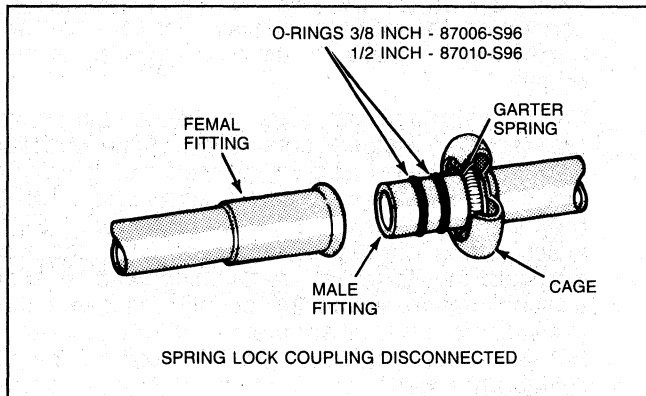
**To Connect the Coupling**

1. Ensure that garter spring is in cage of male fitting. If garter spring is missing, install a new spring by pushing it into cage opening. If garter spring is damaged, remove it from cage with a small wire hook (do not use a screwdriver) and install a new spring.
2. Clean all dirt or foreign material from both pieces of coupling.

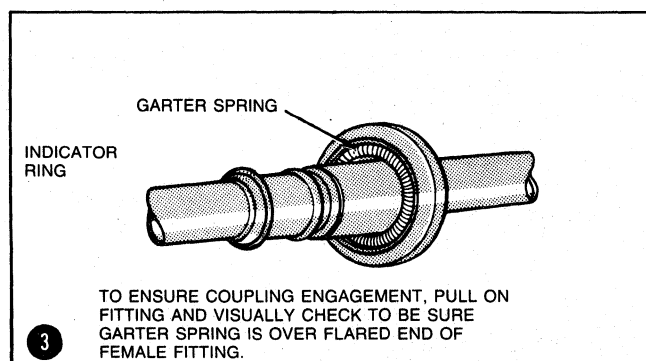
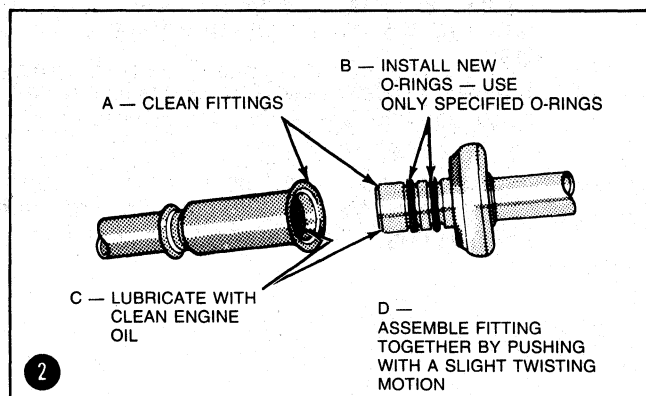
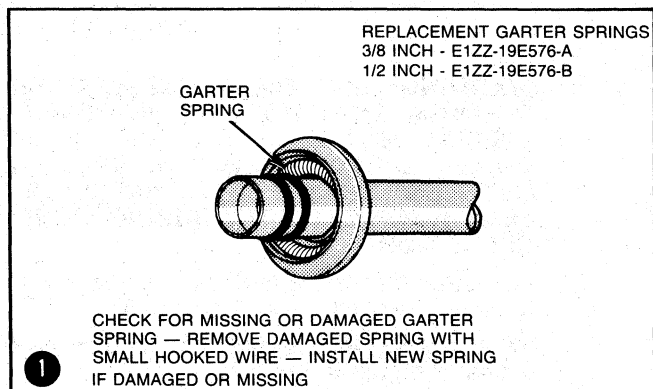
**WARNING: USE ONLY THE SPECIFIED O-RINGS AS THEY ARE MADE OF A SPECIAL MATERIAL. THE USE OF ANY O-RING OTHER THAN THE SPECIFIED O-RING MAY ALLOW THE CONNECTION TO LEAK INTERMITTENTLY DURING VEHICLE OPERATION.**

3. Lubricate male fitting and O-rings and inside of female fitting with clean engine oil.
4. Install plastic indicator ring into cage opening if indicator ring is to be used.
5. Fit female fitting to male fitting and push until garter spring snaps over flared end of female fitting.  
If plastic indicator ring is used, it will snap out of cage opening when coupling is connected to indicate engagement.
6. If indicator ring is not used, ensure coupling engagement by visually checking to verify garter spring is over flared end of female fitting.

## REMOVAL AND INSTALLATION (Continued)

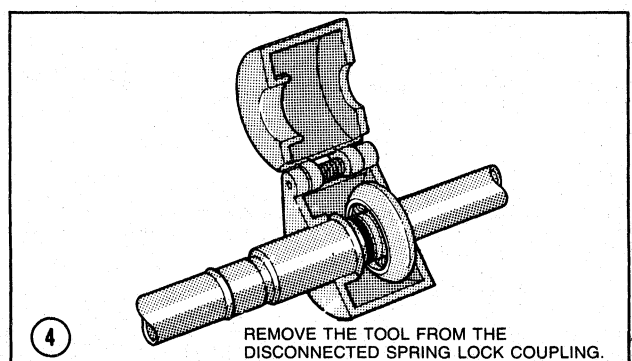
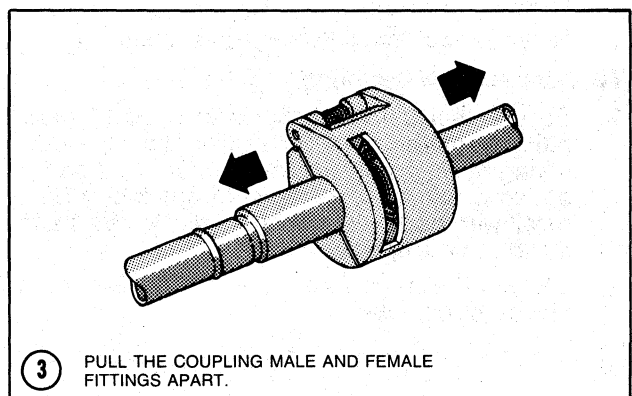
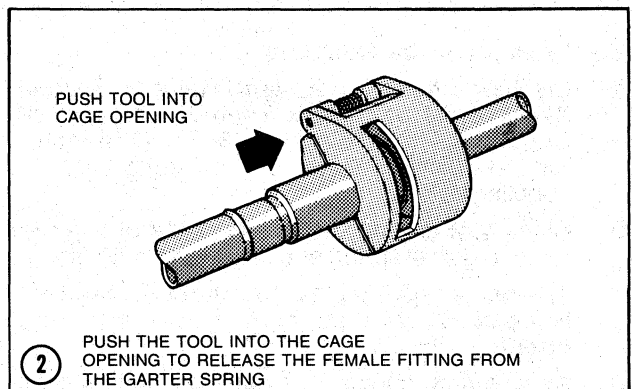
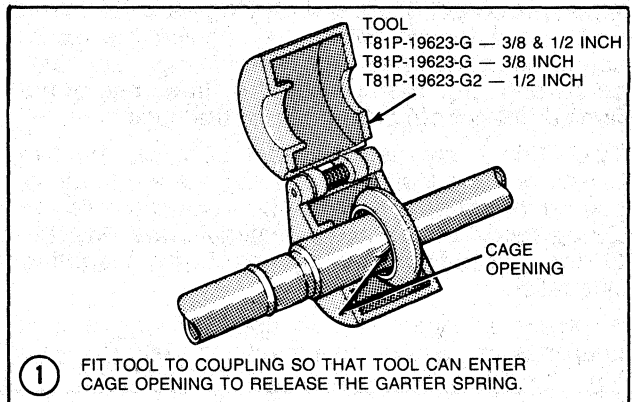


## TO CONNECT COUPLING



## TO DISCONNECT COUPLING

CAUTION-DISCHARGE SYSTEM BEFORE DISCONNECTING COUPLING



**MAJOR SERVICE OPERATIONS****Fuel Tanks**

Fuel tanks do not require special service procedures and may be steam-cleaned and/or serviced using standard procedures. After steaming, allow to thoroughly air dry. The vapor separator assembly should be replaced. Replace fuel tank strap bolts.

An electric fuel pump is located in the fuel tank. The pump is attached to the fuel tank, or as part of the sender unit. The fuel tank must be removed to service the fuel pump. Care should be taken during installation due to the hose and wire routing on the tank. Route all fuel lines and electrical harnesses properly. Check the fuel line connections for leaks.

**NOTE:** Remove the fuel pump prior to steaming the fuel tank.

For electric fuel pump service, refer to Section 24-35.

**WARNING: FUEL SUPPLY LINES ON VEHICLES EQUIPPED WITH FUEL INJECTED ENGINES WILL REMAIN PRESSURIZED FOR LONG PERIODS OF TIME AFTER ENGINE SHUTDOWN. THE PRESSURE MUST BE RELIEVED BEFORE SERVICING THE FUEL SYSTEM. REFER TO FUEL SYSTEM PRESSURE RELIEF.**

**Fuel Lines**

Vehicles equipped with nylon fuel tubes and push connect fittings have two types of service repairs that can be performed on the fuel lines; replacing nylon tubing (splicing nylon to nylon) and replacing push connector or spring lock fittings.

**Splicing Nylon to Nylon**

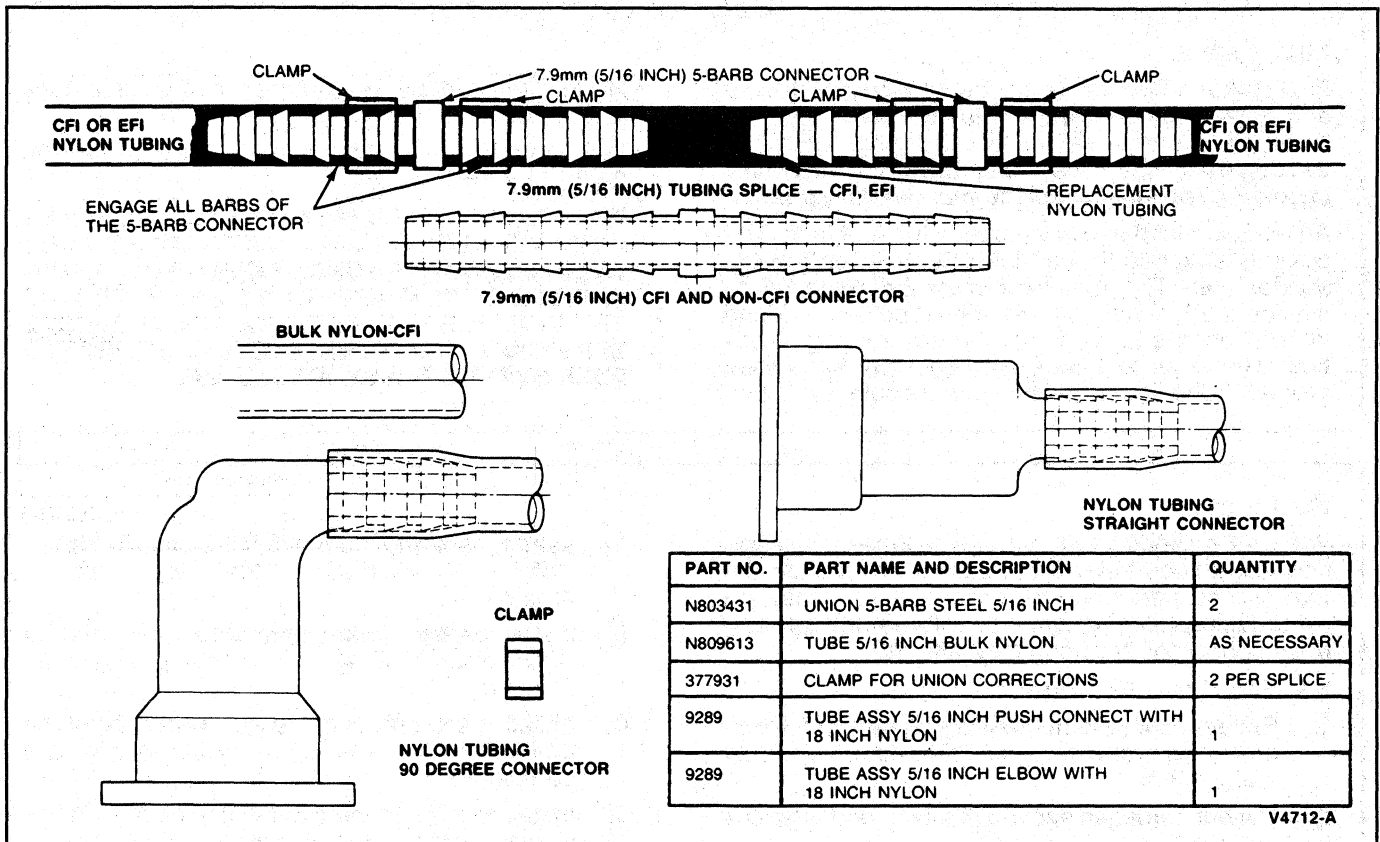
1. Relieve fuel system pressure as outlined. Read cautionary note prior to relieving pressurized fuel system.
2. Cut out damaged section of tubing and retain as a guide.
3. Cut a section of service tubing (type 11 or 12 nylon 7.9mm (5/16-inch) diameter) to same length as damaged section of tubing.
4. Select proper 7.9mm (5/16-inch) barbed connectors for completing splice. Two connectors are required for each splice.

**NOTE:** To make hand insertion of barbed connectors into nylon easier, tube end must be soaked in a cup of boiling water for one minute immediately before pushing barbs into nylon. The 7.9mm (5/16-inch) barbed connector is

used for splicing 7.9mm (5/16-inch) CFI tubing. Refer to the illustration under Step 11 of this procedure.

5. Install barbed connectors into each end of replacement tubing using boiling water as outlined.
6. Install clips onto any tubes which might be difficult to access once final splices are completed.
7. Install four keystone clamps (Part No. 377931) loosely onto original nylon tubing before beginning next step.
8. Complete splice of replacement nylon to original nylon tubing at both ends. (Use boiling water method mentioned previously to get required number of barbs engaged).
9. Tighten clamps in locations shown in illustration under Step 11 of this procedure.
10. Install any remaining clips which were removed for this service and check that tubes are secure in original clips.
11. Start engine and check for leaks.

## MAJOR SERVICE OPERATIONS (Continued)



## Damaged Push Connector Replacement

Refer to illustration under Splicing Nylon-to-Nylon, Step 11.

1. Relieve fuel system pressure as outlined. Read cautionary note prior to relieving pressurized fuel system.

NOTE: Damaged push connectors must be discarded and replaced with new push connectors. If only retaining clip is damaged, replace clip.

2. Disconnect damaged push connector. Be sure to bend shipping tab to side before removing retaining clip.
3. Select proper size replacement push connector and nylon tube assembly.
4. Cut out a section of original nylon tube to same length as nylon tube attached to new push connector.
5. Install proper barbed connector into replacement nylon assembly.

NOTE: To make hand insertion of barbed connectors into nylon easier, tube end must be soaked in a cup of boiling water for one minute immediately before pushing barbs into nylon. The 7.9mm (5/16-inch) barbed connector is used for splicing CFI tubing.

6. Install two keystone clamps (Part No. 377931) onto original nylon tubing before beginning next Step.
7. Complete splice by connecting barbed connector to original nylon.
8. Tighten clamps in locations shown in illustration under Step 11 of Splicing Nylon-to-Nylon.
9. Connect new connector assembly to steel tube end.
10. Check that underbody clips are properly securing fuel tubes.
11. Start engine and check for fuel leaks.

## SPECIFICATIONS

Vehicle	Model Usage	Approximate Fuel Tank Capacity		
		Liters	Imp.	U.S.
Taurus/Sable	Standard	60.6	13.3	16.0
	Extended Range	70.4	15.5	18.6

## SPECIFICATIONS (Continued)

## PUSH CONNECT RETAINERS — PART NUMBERS

Part Number	Component
N802241 (Black)	Hair Pin Clip① — 3/8 Inch Connector
N802239 (White)	Hair Pin Clip① — 5/16 Inch Connector
N802710-S190	Duck Bill Clip① — 1/4 Inch
N802441-S	Duck Bill Clip① — 1/2 Inch

① Replacement Required After Connector Removal

CV3589-C

## SPECIAL SERVICE TOOLS

Tool Number	Description
T74P-9275-A	Fuel Tank Sender Wrench
T82L-9500-AH	Push Connect Disassembly Tool
T80L-9974-A	Pressure Gauge Tool
T81P-19623-G	Spring Lock Coupling Tool 3/8", 1/2"
T81P-19623-G1	Spring Lock Coupling Tool 3/8"
T81P-19623-G2	Spring Lock Coupling Tool 1/2"

CV3085-D

## ROTUNDA EQUIPMENT

Number	Description
059-00008	Vacuum and Pressure Tester

CV5171-A

# SECTION 24-51 Fuel Filter

SUBJECT	PAGE	SUBJECT	PAGE
DESCRIPTION		SPECIAL SERVICE TOOLS	24-51-1
EFI Filter	24-51-1	VEHICLE APPLICATION	24-51-1
REMOVAL AND INSTALLATION			
Filter	24-51-1		

## VEHICLE APPLICATION

Taurus/Sable.

## DESCRIPTION

### EFI Filter

The fuel filter provides extremely fine filtration to protect the small metering orifices of the injector nozzles. The filter is a one-piece construction which cannot be cleaned. If the filter becomes clogged or restricted, it should be replaced. The filter is mounted on the underbody next to the RH front corner of the fuel tank.

## REMOVAL AND INSTALLATION

### Filter

#### Removal

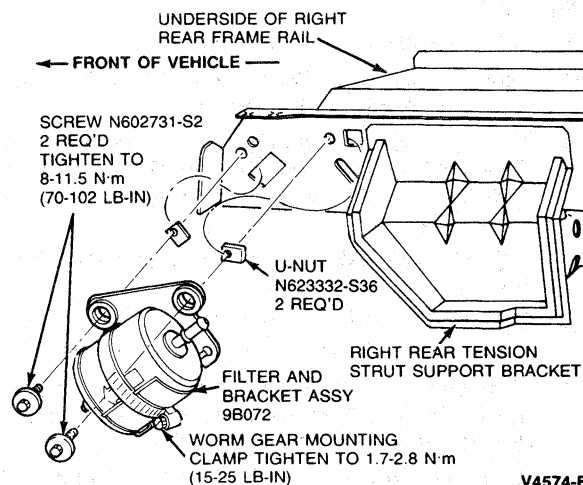
1. With engine off, depressurize fuel system using EFI Fuel Pressure Gauge T80L-9974-B or equivalent.

**WARNING: BECAUSE OF THE COMBUSTION CHARACTERISTICS OF GASOLINE, ALWAYS USE EXTREME CARE WHEN REMOVING AND INSTALLING ANY FUEL SYSTEM COMPONENT.**

2. Remove push connect fittings at both ends of the fuel filter as outlined in Section 24-50.

NOTE: The "flow" arrow direction should be positioned forward and downward to ensure proper flow of fuel through replacement filter.

3. Remove filter from bracket by loosening worm gear mounting clamp enough to allow filter to pass through.



V4574-B

### Installation

1. Install filter in bracket, ensuring proper direction of flow as noted earlier. Locate the fuel filter against tab at lower end of bracket.
2. Install push connect fittings at both ends of filter as outlined in Section 24-50.
3. Tighten worm gear mounting clamp to 1.7-2.8 N·m (15-25 lb-in).
4. Start engine and inspect for leaks.

## SPECIAL SERVICE TOOLS

Tool Number	Description
T80L-9974-B	EFI Fuel Pressure Gauge

CV3789-C

# SECTION 24-60 Throttle Linkage

SUBJECT	PAGE	SUBJECT	PAGE
REMOVAL AND INSTALLATION		SPECIFICATIONS .....	24-60-4
Accelerator Cable .....	24-60-1	VEHICLE APPLICATION .....	24-60-1
Accelerator Pedal Arm Assembly .....	24-60-1		

## VEHICLE APPLICATION

Taurus/Sable.

## REMOVAL AND INSTALLATION

### Accelerator Cable

#### Removal

1. Remove air duct assembly.
2. Using a suitable tool, remove cable snap-in nylon bushing from pedal arm.
3. Remove cable housing from dash panel by depressing two vertical snap-in tabs and pushing outward from inside passenger compartment.
4. On 2.5L engines, remove cable from retainer on rocker cover.
5. Remove speed control cable from accelerator cable, if so equipped. Refer to Section 37-05.
6. Disconnect cable at throttle body throttle lever by inserting a screwdriver between cable and throttle lever and giving a twist.
7. Remove screw attaching cable housing to engine mounting bracket. Remove cable from bracket slot.

#### Installation

1. Insert pedal end of cable, with cover in place, through dash panel and snap cable housing into dash panel. Ensure that cable housing retention snaps have engaged into dash panel.
2. Position cable housing in engine mounting bracket. Ensure cable isolation rests flat in bracket. Install attaching screw.
3. Connect cable to throttle body throttle lever.
4. Install speed control cable, if so equipped. Refer to Section 37-05.
5. On 2.5L engines, snap cable into retainer on rocker cover.
6. Remove cable protective cover and snap cable nylon bushing into pedal arm.
7. Ensure that body insulation is properly positioned and not in contact with moving member of accelerator cable.

### Mounting Bracket

#### Removal

1. Remove air duct assembly.
2. Disconnect cable at throttle body throttle lever by inserting a screwdriver between cable and throttle lever and giving a twist.
3. Remove screw attaching cable housing to bracket.
4. Remove speed control cable from bracket, if so equipped. Refer to Section 37-05.
5. Remove TV cable. Refer to Section 17-15 for AXOD or Section 17-25 for ATX.
6. Remove bolts securing mounting bracket to engine.

#### Installation

1. Position bracket on engine and install attaching bolts. Tighten bolts to 14-20 N·m (10-15 lb-ft).
2. Position cable housing in bracket. Ensure cable isolation rests flat in bracket. Install attaching screw.
3. Install speed control cable to bracket, if so equipped. Refer to Section 37-05.
4. Connect cable to throttle body lever.

### Accelerator Pedal Arm Assembly

#### Removal

1. Using a suitable tool, push the accelerator cable nylon bushing, from back side of arm, out of the accelerator pedal arm.
2. Remove the two nuts attaching the accelerator pedal assembly to the dash panel mounting studs.

## REMOVAL AND INSTALLATION (Continued)

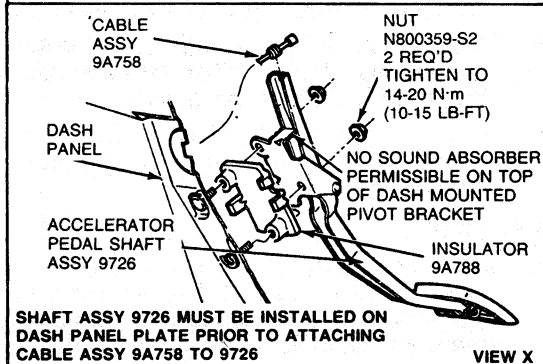
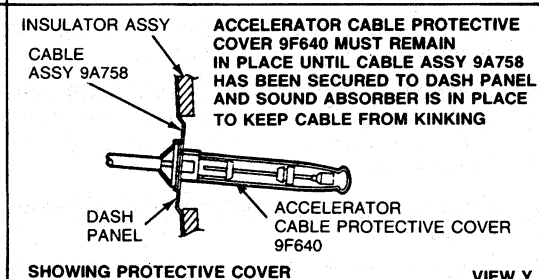
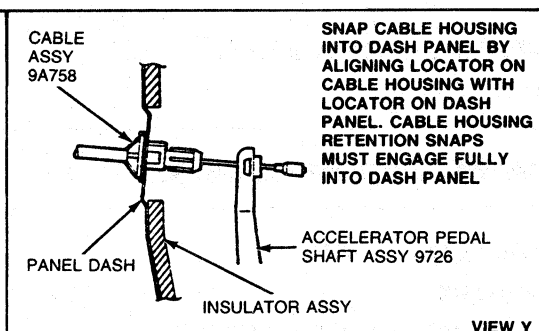
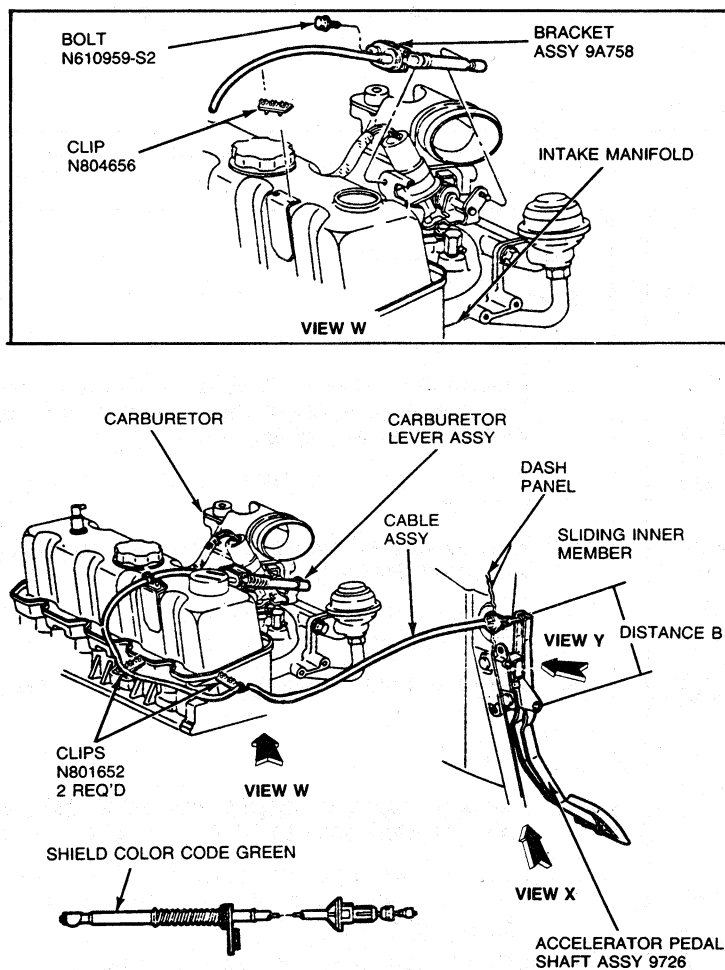
## Installation

1. Position pedal arm assembly on the two dash panel mounting studs. Install the two attaching nuts. Tighten attaching nuts to 14.0-20.0 N·m (10-15 lb-ft).
2. Install accelerator cable nylon bushing into accelerator pedal arm. Ensure bushing is properly seated in arm.
3. Check pedal for free operation.

2. Install accelerator cable nylon bushing into accelerator pedal arm. Ensure bushing is properly seated in arm.

3. Check pedal for free operation.

## 2.5L Engine

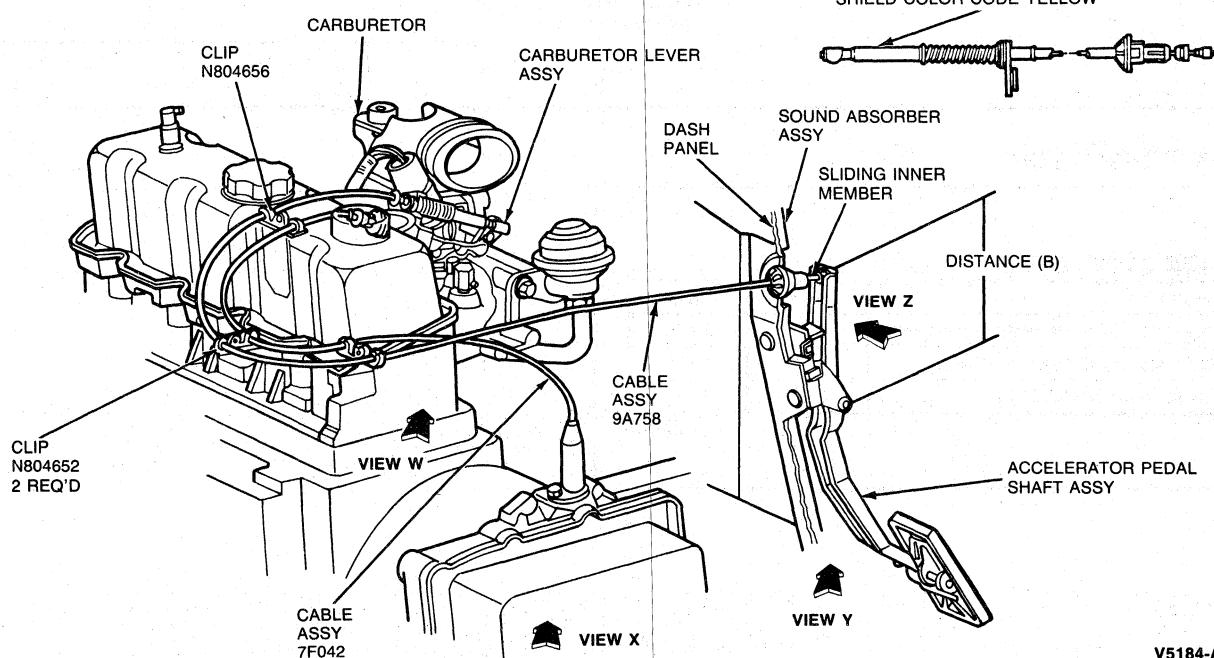
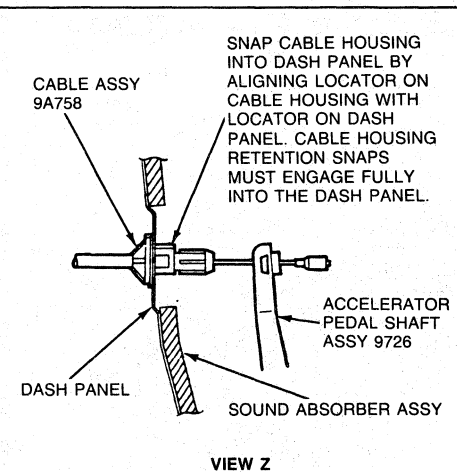
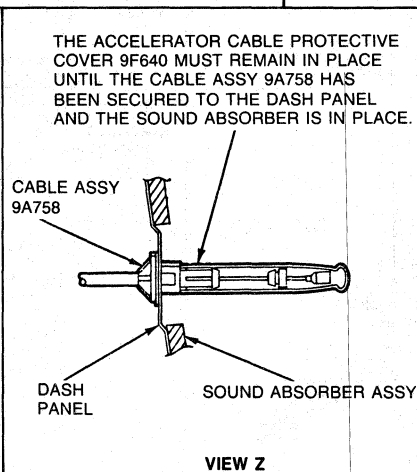
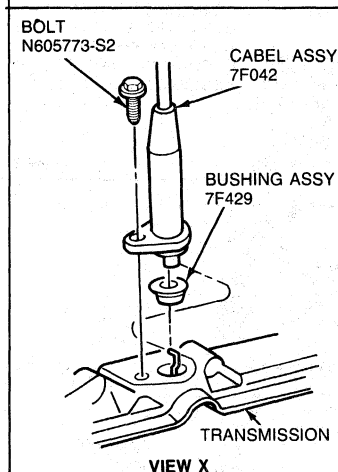
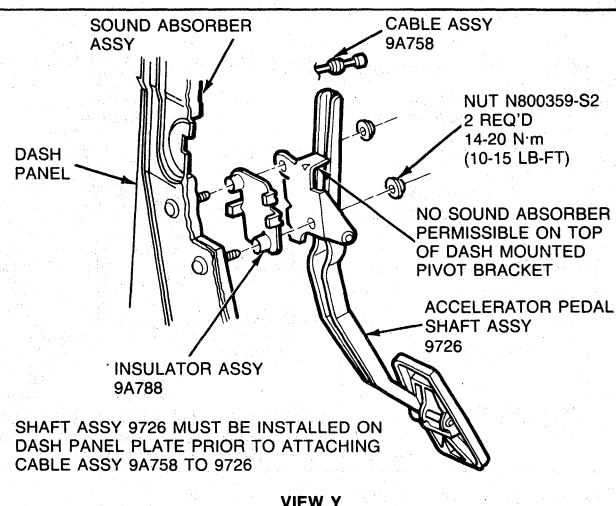
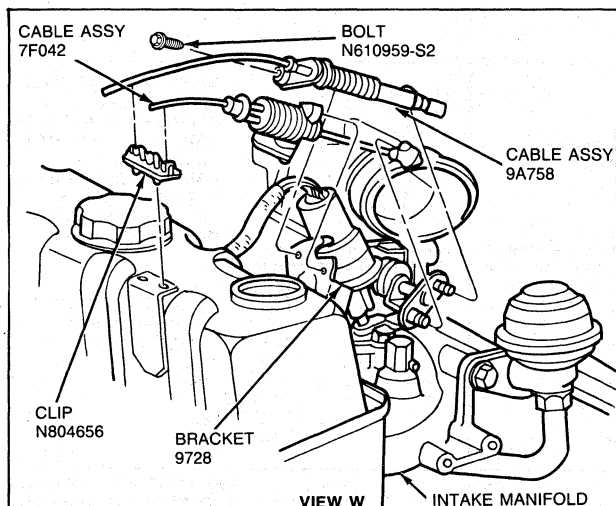
**MTX**

**V4554-B**



## REMOVAL AND INSTALLATION (Continued)

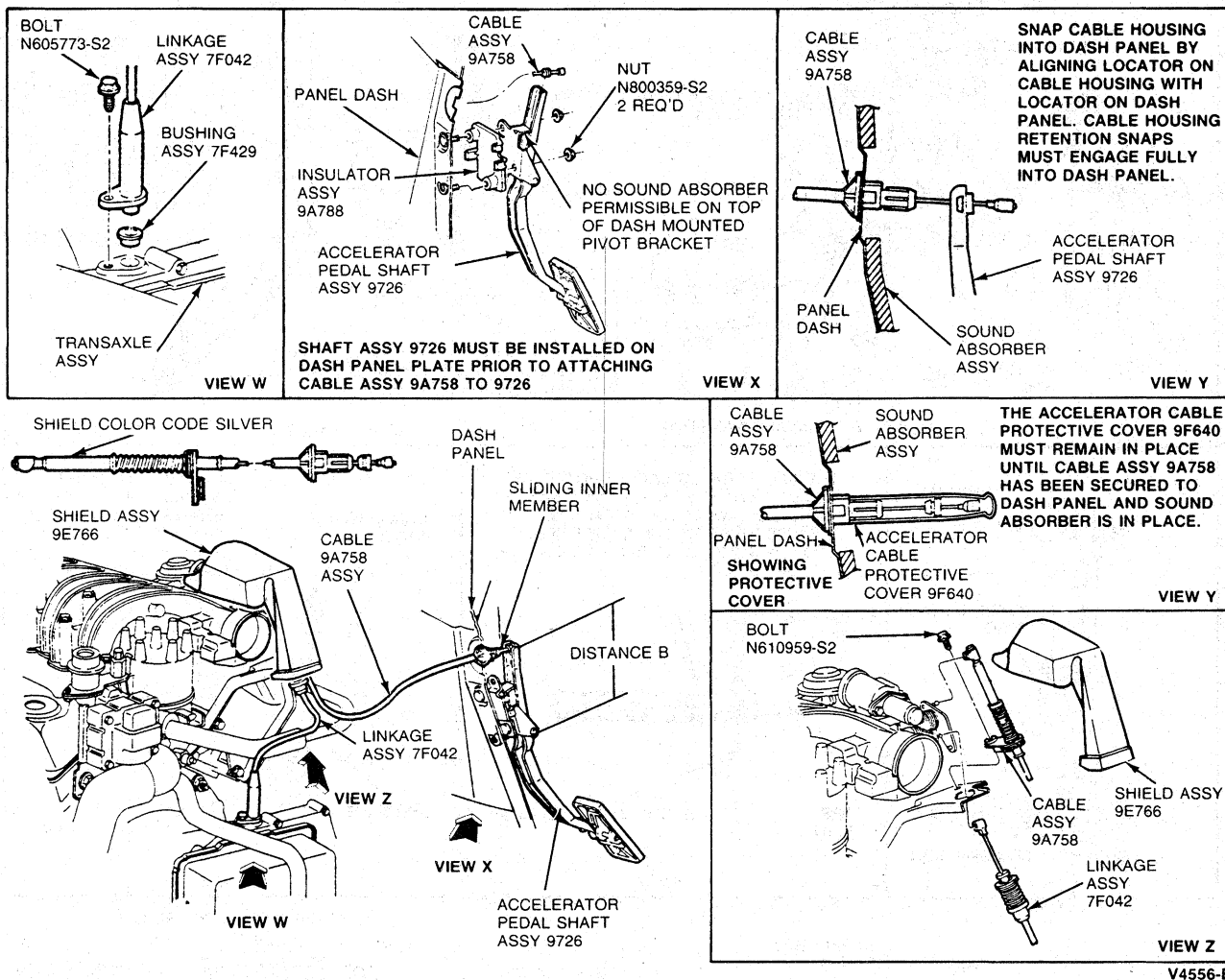
## AXOD



## REMOVAL AND INSTALLATION (Continued)

## 3.0L Engine

## AXOD



## SPECIFICATIONS

## TORQUE SPECIFICATIONS

Description	N-m	Lb-Ft
Accelerator Cable Mounting Bracket Bolts	14-20	10-15
Accelerator Pedal Attachment Nuts	14-20	10-15
Throttle Valve Bracket Bolts	14-20	10-15

CV4563-A

# GROUP 26EXHAUST SYSTEM (5000)

## SECTION 26-10 Exhaust System—Single, 2.5L and 3.0L Engines

SUBJECT	PAGE	SUBJECT	PAGE
<b>DESCRIPTION AND OPERATION</b>		<b>GENERAL INFORMATION</b> .....	26-10-1
Exhaust Shield Service and/or Replacement .....	26-10-2	<b>REMOVAL AND INSTALLATION</b>	
TWC .....	26-10-2	2.5L HSC Engine .....	26-10-4
TWC/COC .....	26-10-2	3.0L EFI Engine .....	26-10-3
		<b>VEHICLE APPLICATION</b> .....	26-10-1

### VEHICLE APPLICATION

Taurus/Sable.

### GENERAL INFORMATION

This Section covers the general exhaust system, adjustments and service procedures. Always refer to the Master Parts catalog for parts usage and interchangeability before replacing a component part of the exhaust system.

The exhaust system must be free of leaks, binding, grounding and excessive vibrations. These conditions are usually caused by loose, broken or misaligned clamps, shields, brackets or pipes. If any of these conditions exist, check the exhaust system components and alignment. Adjust or replace, as necessary, to maintain the specified clearances (refer to the illustrations in this Section). Brackets, clamps and insulators should be replaced if they are damaged or badly corroded. Do not attempt to service these parts.

Inspect the inlet pipe(s), outlet pipe(s), catalytic converters and muffler for cracked joints, broken welds, and corrosion damage that would result in a leaking exhaust system. Inspect the clamps, brackets, and insulators for cracks and stripped or badly corroded bolt threads.

When pipe clamp(s) is loosened and/or removed to replace a pipe, muffler or resonator, replace the clamp(s).

### DESCRIPTION AND OPERATION

**WARNING: THE NORMAL OPERATING TEMPERATURE OF THE EXHAUST SYSTEM IS VERY HIGH. NEVER WORK AROUND OR ATTEMPT TO SERVICE ANY PART OF THE EXHAUST SYSTEM UNTIL IT HAS COOLED. USE SPECIAL CARE WHEN WORKING AROUND THE CATALYTIC CONVERTER. THESE UNITS HEAT TO A HIGH TEMPERATURE AFTER ONLY A SHORT PERIOD OF ENGINE OPERATION.**

All engines are equipped with a single muffler, single catalytic converter and interconnecting pipes. For the 3.0L EFI engine, a single brick under engine oil pan converter uses a three-way catalyst (TWC) only. For the 2.5L HSC engine, MTX and ATX, a dual brick underbody converter uses both a Three-Way Catalyst (TWC) and a Conventional Oxidation Catalyst (COC).

**DESCRIPTION AND OPERATION (Continued)**

The 2.5L HSC engine with the AXOD transmission uses a dual brick underbody converter with a three-way catalyst only.

**TWC****3.0L EFI Engine**

This converter contains one ceramic honeycomb coated with a rhodium/platinum catalyst designed to control oxides of nitrogen ( $\text{NO}_x$ ), unburned hydrocarbons (HC) and carbon monoxide (CO). This is therefore called a "three-way catalyst" (TWC).

The TWC converter operates on the exhaust gases as they arrive from the engine.

The six-cylinder 3.0L EFI engine uses a single-pipe type exhaust system. The production exhaust system differs from the service replacement system in the number of basic pieces used.

The factory installed exhaust system uses a one-piece converter system. The converter assembly is a bolt-on catalyst installed between the exhaust manifolds and resonator. A spring-loaded ball joint is used between the converter and resonator assembly. A slip joint is used between the resonator and muffler. The muffler is secured with a U-bolt. The exhaust system is usually serviced in four pieces. The rear section of the muffler inlet pipe (intermediate muffler inlet) is furnished separate from the muffler. For exact service replacement parts information, refer to the Master Parts catalog.

**WARNING: THE NORMAL OPERATING TEMPERATURE OF THE EXHAUST SYSTEM IS VERY HIGH. NEVER ATTEMPT TO SERVICE ANY PART OF THE SYSTEM UNTIL IT HAS COOLED. BE ESPECIALLY CAREFUL WHEN WORKING AROUND THE CATALYTIC CONVERTER. THE TEMPERATURE OF THE CONVERTER RISES TO A HIGH LEVEL AFTER ONLY A FEW MINUTES OF ENGINE OPERATION.**

**TWC/COC****2.5L HSC Engine****ATX/MTX Transaxles**

This converter contains two separate ceramic honeycombs coated with different catalytic material. The front catalyst is coated with a rhodium/platinum catalyst designed to control oxides of nitrogen ( $\text{NO}_x$ ), unburned hydrocarbons (HC) and carbon monoxide (CO). This is therefore called a "three-way catalyst" (TWC). The rear catalyst is coated with platinum/palladium catalyst and is called a Conventional Oxidation Catalyst (COC).

The TWC converter operates on the exhaust gases as they arrive from the engine. As the gases flow from the TWC to the COC converter, they mix with air from the dual pulse air valve and are injected into the mixing chamber between the two ceramic honeycombs. This air is required for optimum operating condition for the oxidation of HC and CO in the COC converter.

**AXOD Transmission**

This converter contains two separate ceramic honeycombs with the same catalytic converter material. Both bricks are coated with platinum/rhodium and work as a three-way catalyst. This converter does not have a downstream air injection system.

The four-cylinder 2.5L HSC engine uses a single-pipe type exhaust system. The production exhaust system differs from the service replacement system in the number of basic pieces used.

The factory-installed exhaust system uses a one-piece converter system. The converter assembly is a bolt-on catalyst installed between the inlet pipe and the muffler. A slip joint is used between the converter and muffler on underbody converter systems and the muffler is secured with a U-bolt. The exhaust system is usually serviced in four pieces. The rear section of the muffler inlet pipe (intermediate muffler inlet) is furnished separate from the muffler. For exact service replacement parts information, refer to the Master Parts catalog.

**WARNING: THE NORMAL OPERATING TEMPERATURE OF THE EXHAUST SYSTEM IS VERY HIGH. NEVER ATTEMPT TO SERVICE ANY PART OF THE SYSTEM UNTIL IT HAS COOLED. BE ESPECIALLY CAREFUL WHEN WORKING AROUND THE CATALYTIC CONVERTER. THE TEMPERATURE OF THE CONVERTER RISES TO A HIGH LEVEL AFTER ONLY A FEW MINUTES OF ENGINE OPERATION.**

**Exhaust Shield Service and/or Replacement**

Exhaust shields, consisting of formed metal sheets, attach to the exhaust system or the catalytic converter using various methods. Exhaust shields are not subject to service other than replacing missing or damaged attaching parts such as clamps or screws, and removing debris that may collect in the shield area. If an exhaust shield is damaged or shows evidence of deterioration, it must be replaced rather than serviced.

The catalyst welded shields are to be replaced with bolt-on service shields.

Removal and installation procedures are, in most cases, a matter of removing the shield attachments and shield. Installation is the reverse process, using new parts. The illustrations indicate the types and proper positioning of exhaust shields and clamps.

## REMOVAL AND INSTALLATION

Typical factory-installed exhaust systems are shown in the illustrations.

### 3.0L EFI Engine

#### Resonator Assembly

##### Removal

1. Raise vehicle.
2. Remove front resonator flange fasteners at flex joint and discard flex joint gasket. Loosen rear U-bolt connection.
3. Separate resonator inlet and outlet connections.

4. Remove resonator.

##### Installation

1. Loosely install resonator to muffler.
2. Install new flex joint gasket.
3. Install resonator and muffler assembly to converter outlet flex joint.
4. Align exhaust system to specification. Tighten all nuts and bolts, starting at front of system, to specification.
5. Check system for leaks and lower vehicle.

#### Muffler Assembly

##### Removal

1. Raise vehicle.
2. Remove U-bolt assembly and rubber insulators from hanger brackets and remove muffler assembly. Slide muffler assembly rearward to disconnect it from resonator.
3. Replace any damaged parts.

##### Installation

1. Position muffler assembly and slide it onto resonator outlet pipe. Check to ensure slot in muffler and tab on resonator are fully engaged.
2. Install rubber insulators on hanger assemblies and install and tighten U-bolt to specification.
3. Check system for leaks and lower vehicle.

#### EXHAUST SYSTEM APPLICATIONS

Vehicle	Model		Number of Converters	49S	Can.	Cal.	Alt.
	Sedan	Station Wagon					
Taurus/Sable	X	X	1	X	X	X	X

**NOTE:** The information shown above represents what was intended prior to certification. However, the actual applications certified may be different than that shown.

CU2073-A

#### Catalytic Converter—Under Engine Oil Pan

##### Removal

1. Raise vehicle.
2. Remove front and rear catalytic converter flange fasteners, and bolt and spring attachment at transmission.
3. Separate catalytic converter inlet and outlet connections.
4. Remove converter.

##### Installation

1. Loosely install converter to resonator.
2. Install converter and resonator assembly to manifold connection.
3. Install bolt and spring to converter and transmission.
4. Align exhaust system to specification. Starting at front of system, tighten all nuts and bolts to specification.
5. Check system for leaks and lower vehicle.

**REMOVAL AND INSTALLATION (Continued)****2.5L HSC Engine****Inlet Pipe****Removal**

1. Raise vehicle.
2. Remove front and rear inlet pipe flange and steady rest bracket fasteners. Discard flex joint gasket at rear of inlet pipe.
3. Separate inlet pipe manifold and converter connections.
4. Remove inlet pipe.

**Installation**

1. Loosely install inlet pipe to manifold connection.
2. Secure steady rest bracket to oil pan connection.
3. Install new flex joint gasket.
4. Install inlet pipe to converter.
5. Align exhaust system to specification. Starting at front of system, tighten all nuts and bolts to specification.
6. Check system for leaks and lower vehicle.

**Muffler Assembly****Removal**

1. Raise vehicle.
2. Remove U-bolt assembly and rubber insulators from hanger brackets and remove muffler assembly. Slide muffler assembly rearward to disconnect it from catalytic converter.
3. Replace any damaged parts.

**Installation**

1. Position muffler assembly and slide it onto converter outlet pipe. Check to ensure slot in muffler and tab on converter are fully engaged.
2. Install rubber insulators on hanger assemblies. Install and tighten U-bolt to specification.
3. Check system for leaks and lower vehicle.

**EXHAUST SYSTEM APPLICATIONS**

Vehicle	Sedan	Station Wagon	Number of Converters	49S	Can.	Cal.	Alt.
Taurus/Sable	X	X	1	X	X	X	X

**NOTE:** The information shown above represents what was intended prior to certification. However, the actual applications certified may be different than that shown.

CU2074-A

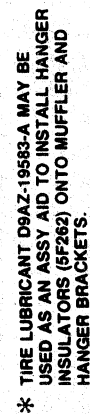
**Catalytic Converter—Underbody****Removal**

1. Raise vehicle.
2. Remove front catalytic converter flange fasteners at flex joint and discard flex joint gasket. Remove rear U-bolt connection.
3. Separate catalytic converter inlet and outlet flange connections.
4. Remove converter.

**Installation**

1. Install converter to muffler.
2. Install new flex joint gasket.
3. Install converter and muffler assembly to inlet pipe/flex joint.
4. Align exhaust system to specification. Starting at front of system, tighten all nuts and bolts to specification.
5. Check system for leaks and lower vehicle.

### 3.0L EFI



U2072-B





# COOLING SYSTEM

# GROUP 27

(8000)

SECTION TITLE	PAGE	SECTION TITLE	PAGE
COOLING SYSTEM—SERVICE .....	27-01-1	FAN, ELECTRO—DRIVE COOLING .....	27-10-1
DRIVE BELTS, ACCESSORY—SERVICE .....	27-02-1	RADIATORS—ALUMINUM CORE .....	27-03-1

## SECTION 27-01 Cooling System—Service

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DESCRIPTION		SERVICE ADJUSTMENT AND CHECKS (Cont'd.)	
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DIAGNOSIS AND TESTING		Coolant Drain Procedure .....	27-01-5
Cooling System Pressure Test .....	27-01-3	Coolant Level Maintenance .....	27-01-5
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PRINCIPLE OF OPERATION .....	27-01-2	Coolant System Flush Procedure .....	27-01-5
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Radiator Hose .....	27-01-10	Cooling System Hoses and Clamps	
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SERVICE ADJUSTMENT AND CHECKS		SPECIFICATIONS .....	27-01-11
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### VEHICLE APPLICATION

Taurus/Sable.

### DESCRIPTION

"Walter C. Avrea, the owner of patents 3, 601, 181 and RE 27, 965, has granted Ford Motor Company rights with respect to cooling systems covered by these patents."

The cooling system includes a radiator, circulating pump, and a cooling fan which is activated by the integrated relay control module. Also included in the cooling system is a separate coolant recovery reservoir which is located beside the radiator and aids in maintaining the correct volume of coolant.

The water pump is of a conventional design and is driven by the accessory drive belt.

A thermostat is in a water outlet connection housing at one end of the engine. The thermostat ensures rapid engine warm-up by restricting coolant flow at lower operating temperatures. It also assists in keeping the engine operating temperature within predetermined limits.

## DESCRIPTION (Continued)

The coolant normally contains a 50/50 mix of water and permanent coolant/antifreeze fluid such as Ford Cooling System Fluid E2FZ-19549-A (ESE-M97B44-A) or equivalent. **The addition of more water than recommended will raise the freezing protection temperature and weaken the corrosion inhibitors.** Refer to Specifications for the cooling system capacity for all vehicles.

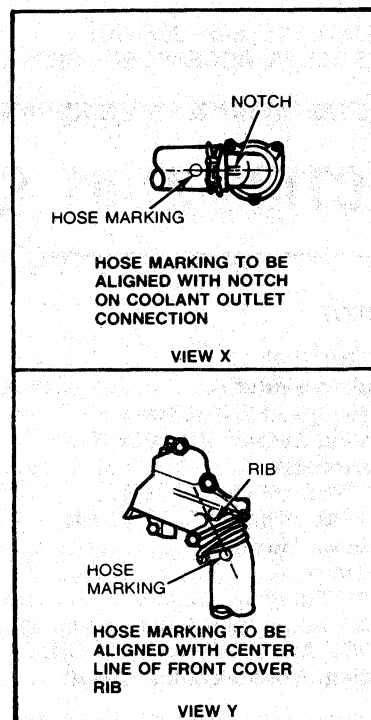
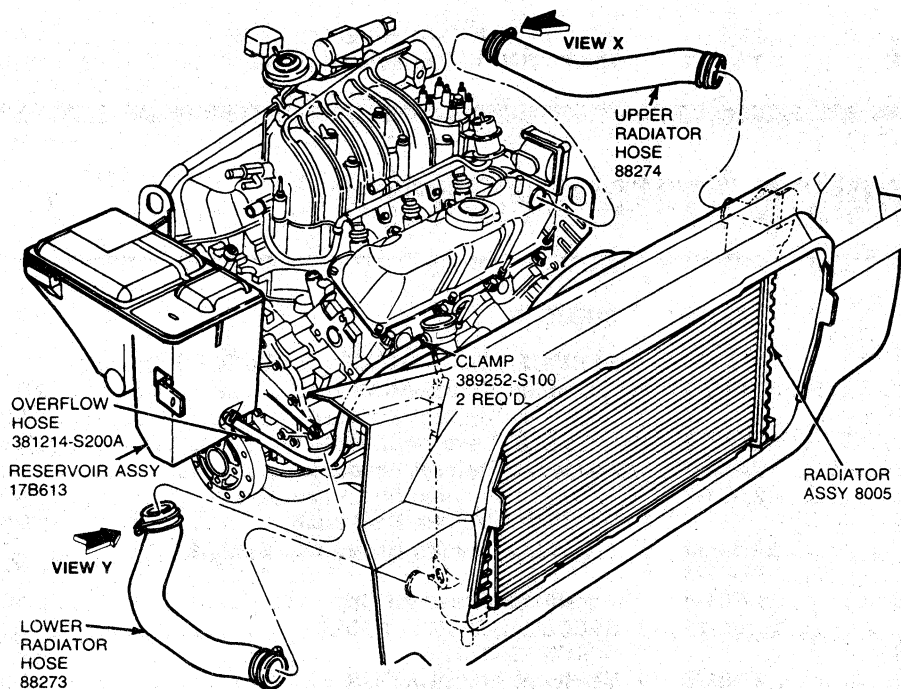
NOTE: The system must be maintained with the correct concentration and type of antifreeze to prevent corrosion damage.

## Cooling System

## 3.0L Engine

The electric radiator cooling fan motor is mounted within a shroud behind the radiator. The integrated relay control module actuates the fan when the coolant reaches a specified temperature, and/or when the engine reaches a specified speed, and/or when the air conditioning clutch is activated, if so equipped.

**WARNING: THE ENGINE ELECTRIC COOLING FAN MAY COME ON AT ANY TIME WITHOUT WARNING, EVEN IF THE ENGINE IS NOT RUNNING.**



Q2309-A

## PRINCIPLE OF OPERATION

When the coolant is cold, the thermostat is in the closed position and the coolant flow is restricted to the cylinder block, head, intake manifold and heater. As the temperature increases, the thermostat opens, allowing a portion of the coolant to pass into the radiator. The coolant flows through the radiator tubes and is cooled by air passing over the cooling fins assisted by the cooling fan. Coolant is then circulated from the radiator outlet tank through the water pump and into the cylinder block to complete the circuit.

The coolant expands as the temperature and pressure rise in the system. When the limiting system working pressure is reached, the pressure relief valve in the radiator filler cap is lifted from its seat and allows coolant to flow through the radiator filler neck and the overflow hose into the coolant

recovery reservoir. The radiator filler cap has a rubber seal on the underside to prevent leakage.

When the system temperature and pressure drop, the coolant contracts in volume and the pressure in the radiator is reduced. The coolant in the reservoir bottle will then flow back into the radiator through the vacuum relief valve in the radiator filler cap.

The integrated relay control module activates the cooling fan motor when the coolant reaches a specified temperature, and/or when the engine reaches a specified temperature. On vehicles equipped with air conditioning, the cooling fan motor is activated whenever the air conditioning clutch is engaged.

Refer to Section 27-10 for electro-drive cooling fan service procedures.

## DIAGNOSIS AND TESTING

### Thermostat

When investigating a problem of overheating or insufficient heater/defroster performance, the following tests should be performed:

1. Check and service any leaks:
  - Radiator cap.
  - Heater hoses.
  - Radiator hoses.
  - Vent plug on water outlet connection (2.5L engine only).
  - Water outlet connection gasket.
  - Head gasket.
  - Water pump gasket.
2. Check cold engine coolant level in radiator.
  - a. If level is below radiator filler neck, fill to filler neck with an approved coolant. Add coolant to recovery bottle to the FULL COLD mark.

NOTE: On 2.5L engines, remove vent plug on water outlet connection before filling radiator. After filling radiator, and before starting engine, securely install vent plug.

  - b. If the cold coolant level in the radiator is sufficient, run the vehicle for 10 minutes with the radiator cap off and check for coolant circulation through the heater and radiator. If the coolant drops below the radiator filler neck, add coolant to the filler neck. Repeat the above procedure until all the air is purged from the cooling system.

When this procedure has been completed, feel the heater inlet and outlet hoses and the underside of the upper radiator hose. The thermostat should be removed only if these hoses are cold or if no coolant circulation is observed through the radiator after 10 minutes of operation.

### Cooling System Pressure Test

1. Open hood and place fender covers.
2. When engine is cool, cautiously remove radiator cap. Disconnect battery. Fit correct adapter to Rotunda Pressure Tester 021-00012 or equivalent and clip in position onto radiator filler neck.

**WARNING: NEVER REMOVE THE RADIATOR CAP (OR VENT PLUG ON 2.5L ENGINES) UNDER ANY CONDITIONS WHILE THE ENGINE IS OPERATING. FAILURE TO FOLLOW THESE INSTRUCTIONS COULD RESULT IN PERSONAL INJURY AND/OR DAMAGE TO THE COOLING SYSTEM OR ENGINE. TO AVOID HAVING SCALDING HOT COOLANT OR STEAM BLOW OUT OF THE RADIATOR, USE EXTREME CARE WHEN REMOVING THE CAP (OR VENT PLUG ON 2.5L ENGINES) FROM A HOT RADIATOR.**

**WAIT UNTIL THE ENGINE HAS COOLED, THEN WRAP A THICK CLOTH AROUND THE RADIATOR CAP AND TURN IT SLOWLY TO THE FIRST STOP. STEP BACK WHILE THE PRESSURE IS RELEASED FROM THE COOLING SYSTEM. WHEN YOU ARE SURE ALL THE PRESSURE HAS BEEN RELEASED, PRESS DOWN ON THE CAP (STILL WITH A CLOTH), TURN AND REMOVE.**

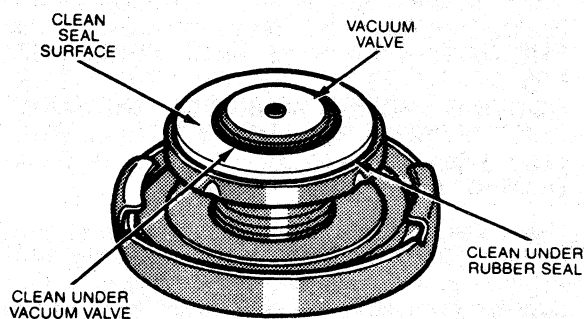
3. Pump up cooling system to a maximum of 110 kPa (16 psi) and hold for two minutes. If pressure drops within this time, inspect for leaks and service as required.
4. Pressure test radiator cap.
5. Check condition of secondary seal on radiator cap seals.
6. Check coolant level in radiator and in reservoir bottle. Fill as required with recommended coolant, install radiator cap, and connect battery cables.
7. Remove fender covers and close hood.

## SERVICE ADJUSTMENT AND CHECKS

### Radiator Pressure Cap

#### Cleaning and Inspection

1. Remove radiator cap from radiator filler neck.
2. Inspect areas under vacuum valve and rubber seal for rust or dirt particles.
3. Using warm tap water, clean the seal surface, raise vacuum valve and rubber seal and thoroughly flush away trapped, loose rust or dirt particles.

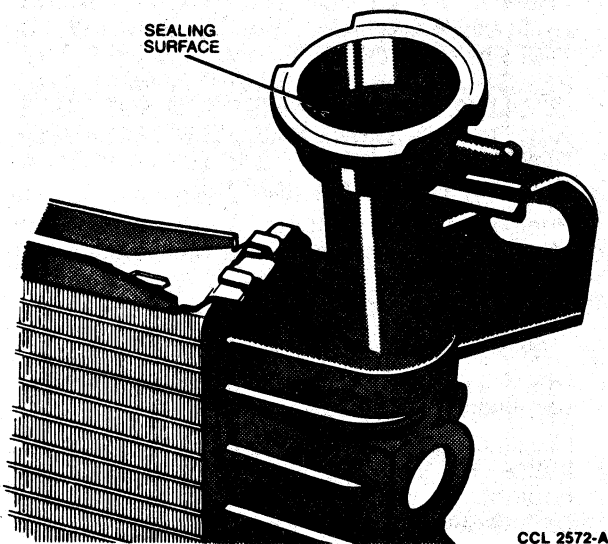


CCL 2571-A

4. Inspect and remove any imbedded rust or dirt particles on sealing surfaces of rubber seal.
5. Inspect radiator filler neck opening for rust or dirt particles on sealing surface at bottom of filler neck opening. Use a clean cloth and wipe sealing surface to remove any rust or dirt particles.

NOTE: If paint is observed on filler neck sealing surface, remove it using paint thinner.

## SERVICE ADJUSTMENT AND CHECKS (Continued)



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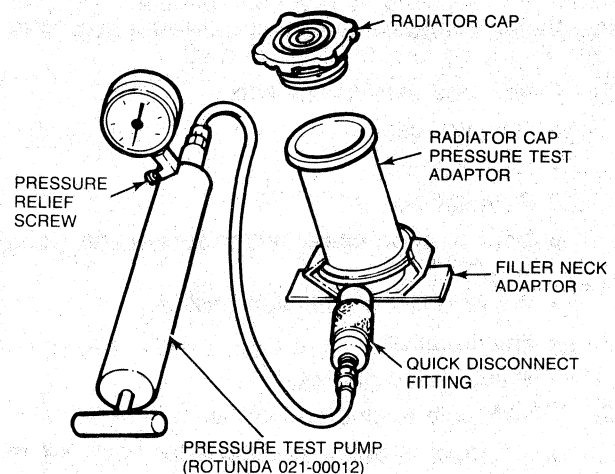
**Pressure Check**

1. Remove radiator cap from radiator filler neck.

**WARNING: NEVER REMOVE THE RADIATOR CAP (OR VENT PLUG ON 2.5L ENGINES) UNDER ANY CONDITIONS WHILE THE ENGINE IS OPERATING. FAILURE TO FOLLOW THESE INSTRUCTIONS COULD RESULT IN DAMAGE TO THE COOLING SYSTEM OR ENGINE AND/OR PERSONAL INJURY. TO AVOID HAVING SCALDING HOT COOLANT OR STEAM BLOW OUT OF THE RADIATOR, USE EXTREME CARE WHEN REMOVING THE CAP (OR VENT PLUG ON 2.5L ENGINES) FROM A HOT RADIATOR. WAIT UNTIL THE ENGINE HAS COOLED, THEN WRAP A THICK CLOTH AROUND THE RADIATOR CAP AND TURN IT SLOWLY TO THE FIRST STOP. STEP BACK WHILE THE PRESSURE IS RELEASED FROM THE COOLING SYSTEM. WHEN YOU ARE SURE ALL THE PRESSURE HAS BEEN RELEASED, PRESS DOWN ON THE CAP (STILL WITH A CLOTH), TURN AND REMOVE.**

2. Use water to clean cap in area of rubber seal and vacuum relief valve. Immerse radiator cap in water and install radiator cap pressure test adaptor from Rotunda Pressure Tester 021-00012 or equivalent.
3. Immerse filler neck seal in water and install in filler neck adapter. Then, install filler neck adapter with seal on open end of radiator cap pressure test adapter.

NOTE: The filler neck seal is reversible so it may be used on either end of radiator cap pressure test adapter.



CCL 1146-C

4. Connect female quick disconnect fitting of pressure test pump to male quick disconnect fitting of filler neck adapter.
5. SLOWLY depress plunger of pressure test pump until pressure gauge reading stops increasing and note highest pressure reading obtained.  
  
NOTE: If plunger of pump is depressed too fast, an erroneous pressure reading will result.
6. Release pressure by turning pressure relief screw counterclockwise. Then, tighten pressure relief screw and repeat Step 5 (at least twice) to ensure pressure test reading is repeatable within acceptable gauge reading limits of radiator cap and is not erratic. Refer to Specifications.
7. If pressure test gauge readings are not within acceptable gauge reading limits, replace radiator cap.

**Cooling System Hoses and Clamps Check**

1. Inspect cooling system hoses and clamped hose connections for leaks and/or excessive deterioration. Service or replace as required.
2. Inspect radiator core and tanks for leaks. Service or replace as required.
3. Inspect cooling system hose routing to ensure sufficient clearance to engine compartment components. Reposition hoses if required.
4. Check radiator supports and brackets for firm radiator assembly retention. Correct as required. The radiator is installed with rubber isolation mounts.

**SERVICE ADJUSTMENT AND CHECKS (Continued)****Coolant Level Maintenance**

Check coolant level in the coolant recovery reservoir at least once a month.

With cold engine, the level must be maintained at or above the FULL COLD mark. At normal engine operating temperature, the coolant level should be at the FULL HOT mark. If coolant level in the reservoir is below specified levels, a 50/50 mixture of Cooling System Fluid E2FZ-19549-A (ESE-M97B44-A) (in Canada, Motorcraft CXC-8-B coolant) or equivalent and water should be added to the reservoir to the specified levels.

If the reservoir is low, add the specified 50/50 coolant mixture to the recovery reservoir. Check the coolant level again after one or two occasions of vehicle use.

4. Idle engine for 3 to 5 minutes.
5. Turn engine off and drain water by opening draincock.
6. Repeat Steps 1 through 5 as many times as necessary until nearly clear water is drained from radiator.
7. Allow remaining water to drain, then close draincock.
8. Disconnect overflow hose from radiator filler neck connection.
9. Remove coolant recovery reservoir from fender apron and empty fluid. Flush reservoir with clean water, drain and install reservoir and overflow hose and clamp to radiator filler neck.

**Coolant Condition Check**

Remove radiator cap and check coolant for dirty or rusty appearance.

If coolant is not dirty or rusty in appearance, check level and concentration as outlined in the following procedures.

If coolant is dirty and/or rusty in appearance, proceed to the cooling system drain, flush and refill procedures.

**Cooling System Backflush****Radiator Removed**

1. Backflush radiator. Ensure radiator cap is in position. Turn radiator upside down. Position a high-pressure water hose in bottom hose location and backflush.

**CAUTION: Radiator internal pressure must not exceed 138 kPa (20 psi).**

2. Remove thermostat housing and thermostat. Refer to Thermostat Removal.
3. Backflush engine. Position high-pressure hose into engine through thermostat location and backflush engine.

**Coolant Concentration Check****(Not Required when Coolant Is Replaced)**

Check coolant concentration for recommended protection level. If concentration is low, partially drain the system and add 100 percent coolant meeting specification ESE-M97B44-A, such as Ford Cooling System Fluid E2FZ-19549-A or equivalent to obtain the recommended protection level.

**Coolant Refill Procedure**

With the entire cooling system drained, the following procedure should be used to ensure a complete fill.

1. Install block drain plug, if removed, and close draincock. With engine off, add 50 percent of total coolant system capacity with specified coolant concentrate to radiator. Refer to Specifications for refill capacities. Then, add water until it reaches the radiator filler neck seat.

**CAUTION: Less than 30 percent, approximately 2 liters (2.1 quarts) coolant concentrate (-16°C (4°F) freezing point) may cause engine corrosion and overheating.**

NOTE: On 2.5L engines, remove vent plug on water connection outlet.

**CAUTION: The vent plug must be removed before radiator fill or the engine may not fill completely. Do not turn plastic cap under vent plug or the gasket may be damaged. Do not try to add coolant through vent plug hole. Install vent plug after filling radiator and before starting engine.**

**Coolant Drain Procedure**

With the engine off and sufficiently cool, place heater temperature control at the maximum heat position, remove radiator cap, open draincock and allow coolant to drain. A 9.5mm (3/8-inch) hose should be attached to the draincock to direct coolant into a suitable container.

**Coolant System Flush Procedure****Radiator Installed**

1. Drain cooling system as outlined.
  2. Install block drain plug, if removed, and close radiator draincock.
  3. Fill system with water at radiator filler neck.
- NOTE: On 2.5L engines, remove vent plug on water outlet connection before filling radiator. After filling radiator and before starting engine, securely install vent plug.

**SERVICE ADJUSTMENT AND CHECKS (Continued)**

2. Install radiator cap to first notch to keep spillage to a minimum.
3. Start and idle engine until upper radiator hose is warm. (This indicates thermostat is open and coolant is flowing through entire system).
4. Remove cap carefully and top off radiator with water.
5. Install cap on radiator securely.
6. Fill coolant recovery reservoir to FULL COLD mark with specified coolant concentrate, then add water to FULL HOT mark. This will ensure a proper mixture in coolant recovery bottle.
7. Check for leaks at draincock, block plug and vent plug on 2.5L engines.

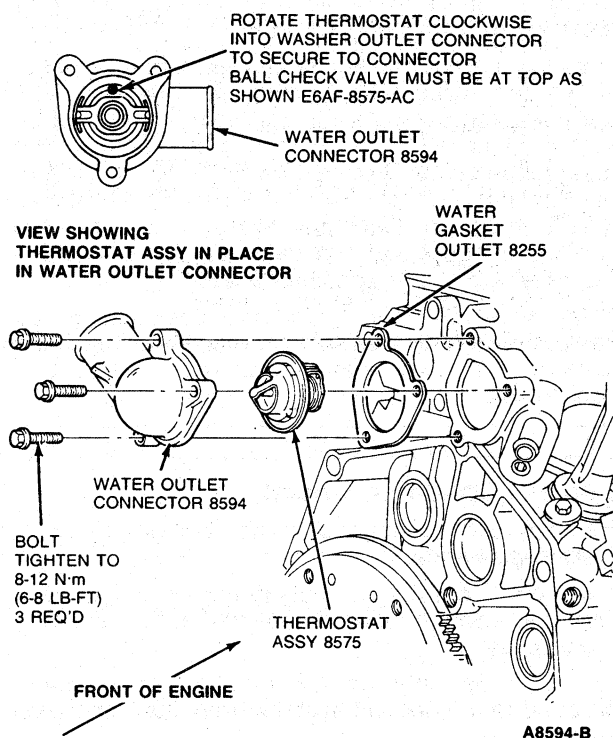
**REMOVAL AND INSTALLATION****Thermostat****3.0L Engine****Removal**

1. Open hood and place fender covers.
2. Disconnect battery cables.
3. Position drain tray below radiator.
4. Remove radiator cap. Attach 9.5mm (0.4-inch) hose to drain tube and open draincock. Drain radiator to a corresponding level below water outlet connection. Close draincock.
5. Loosen top hose clamp at radiator, remove water outlet connection retaining bolts, lift clear of engine and remove thermostat by rotating counterclockwise in water outlet connection until thermostat becomes free to remove.

**CAUTION: Do not pry housing off.**

**Installation**

1. Clean water outlet connection pocket and cylinder head mating faces.
2. Place thermostat in position, fully inserted and rotate clockwise in water outlet connection to secure. Position water outlet connection to intake manifold with a new gasket and secure bolts. Tighten to specification. Position top hose to radiator and tighten clamps. Close draincock.
3. Refill cooling system with specified antifreeze solution. Refer to Coolant Refill procedure.
4. Connect battery cables.
5. Start engine and check for leaks.
6. Check coolant level as required.
7. Remove fender covers and close hood.

**2.5L Engine****Removal**

1. Open hood and place fender covers.
2. Disconnect battery cables.
3. Position drain tray below radiator.
4. Remove radiator cap. Attach 9.5mm (0.4-inch) hose to drain tube and open draincock. Drain radiator to a corresponding level below water outlet connection. Close draincock.
5. Remove vent plug from water outlet connection.
6. Loosen top hose clamp at radiator, remove water outlet connection retaining bolts, lift clear of engine and remove thermostat by pulling it out of water outlet connection.

**CAUTION: Do not pry housing off.**

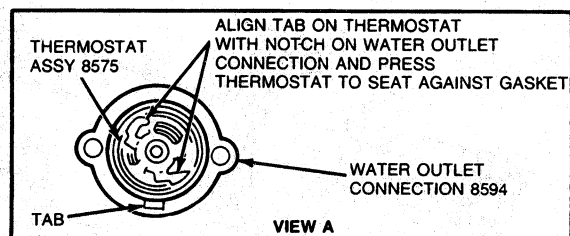
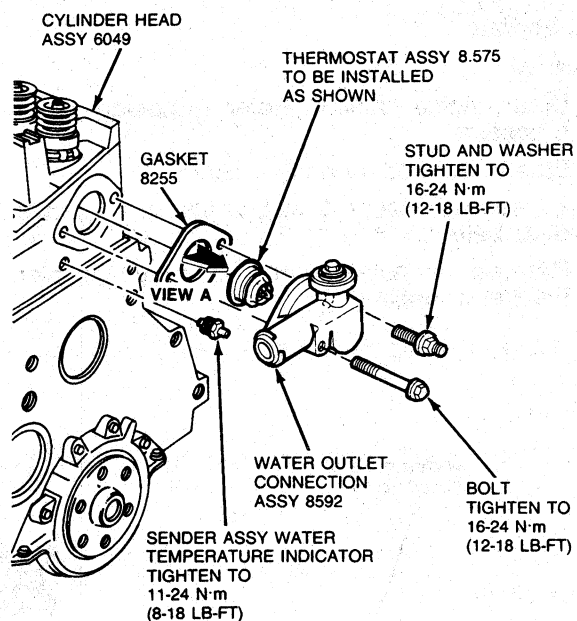
**Installation**

1. Ensure that water outlet connection and cylinder head mating faces are clean and free from gasket material. Ensure water outlet connection pocket and air vent passage are clean and free from rust. Clean vent plug and gasket.



## REMOVAL AND INSTALLATION (Continued)

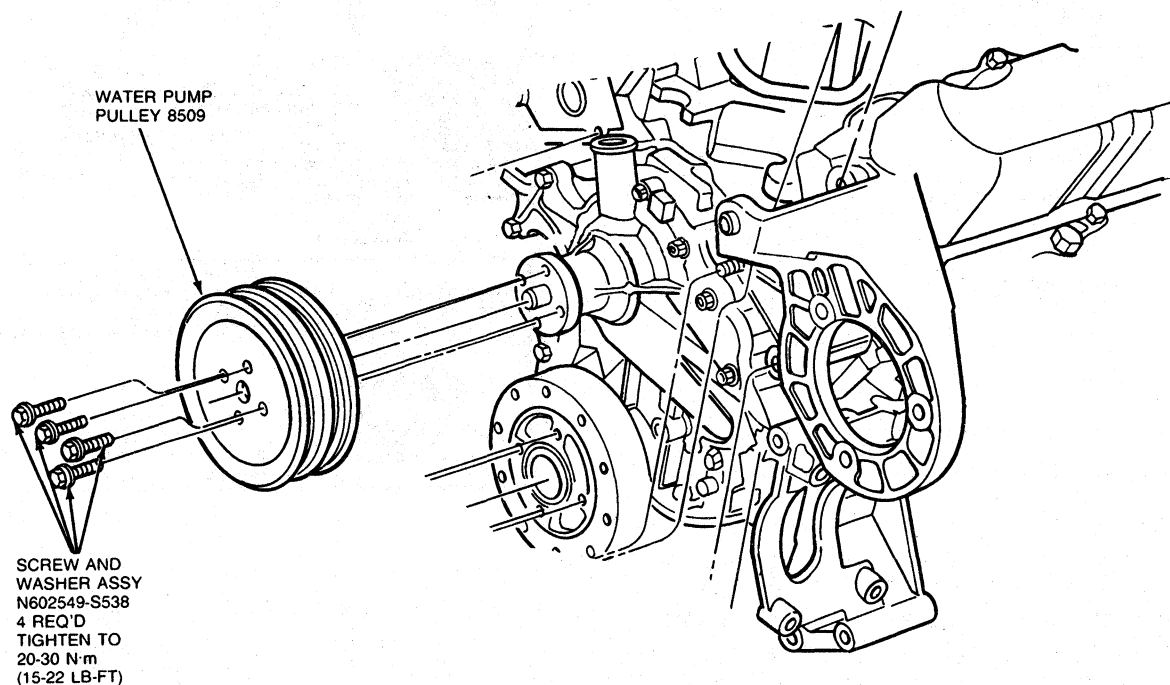
2. Place thermostat in position, fully inserted to compress gasket and press into water outlet connection to secure. Position water outlet connection to intake manifold with a new gasket and secure bolts. Tighten to specification. Position top hose to radiator and tighten clamps. Close draincock.
3. Refill cooling system with specified antifreeze solution. Refer to Coolant Refill procedure.
4. Connect battery cables.
5. Start engine and check for leaks.
6. Check coolant level as required.
7. Remove fender covers and close hood.



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**REMOVAL AND INSTALLATION (Continued)****Water Pump****3.0L Engine****Removal**

1. Drain engine coolant. Refer to coolant drain procedure.
2. Disconnect battery ground cable.
3. Loosen accessory drive belt idle and remove drive belts.
4. Remove two nuts and one bolt attaching idler bracket to engine.
5. Disconnect heater hose at water pump.
6. Remove four pulley-to-pump hub bolts. The pulley will remain loose on hub due to insufficient clearance between inner fender and pump, restricting removal from vehicle.

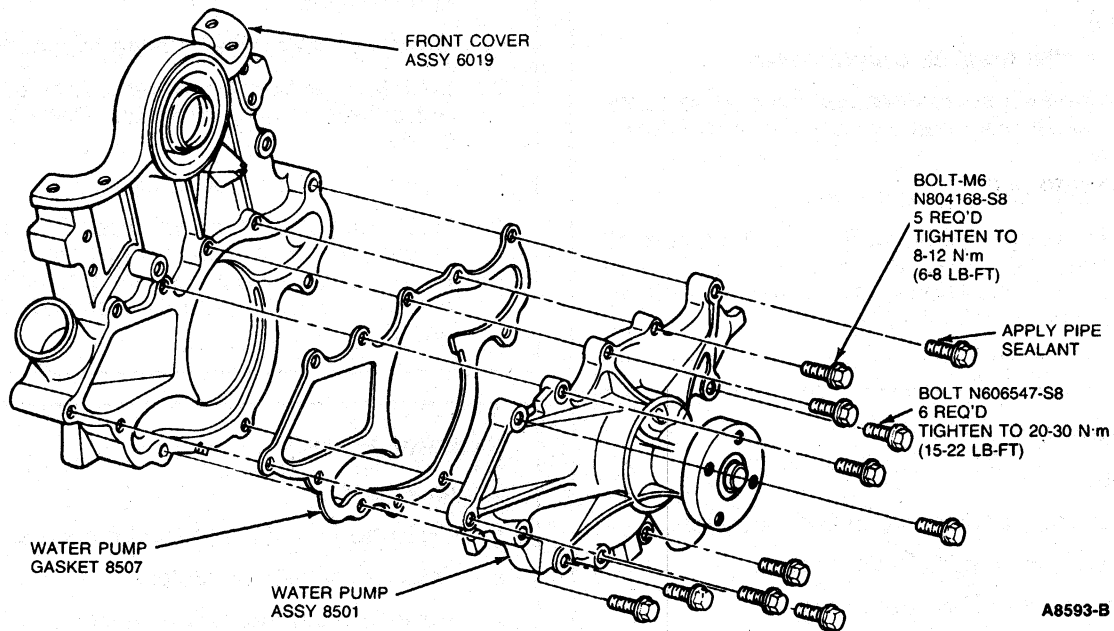


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## REMOVAL AND INSTALLATION (Continued)

7. Remove 11 water pump-to-engine attaching bolts.
8. Lift water pump and pulley out of vehicle.

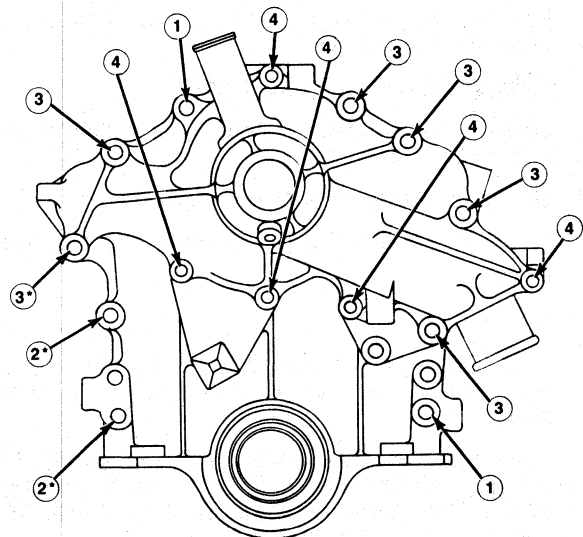


## Installation

NOTE: Lightly oil all bolt and stud threads before installation except those specifying special sealant.

1. Clean both gasket mating surfaces on water pump and engine front cover.
2. Position gasket on water pump sealing surface using Contact Adhesive D7AZ-19B508-A or equivalent.
3. With pulley positioned on water pump hub, position water pump on front cover and install attaching bolts.

**CAUTION:** Two lengths of bolts are used. Install bolts as shown.



NUMBER	PART NUMBER	SIZE	QTY	N·m	LB-FT
1	N605909-SB	M8 x 1.25 x 42.0	2	20-30	15-22
2	N804113-S8	M8 x 1.25 x 43.5 (LARGE HEX)	2	20-30	15-22
3	N606547-S8	M8 x 1.25 x 70.0	6	20-30	15-22
4	N804168-S8	M6 x 1.0 x 25.0	5	8-12	6-8

NOTE: APPLY PIPE SEALANT D6AZ-19558-A TO THE THREADS OF THESE BOLTS

A8818-B

**REMOVAL AND INSTALLATION (Continued)**

4. Tighten attaching bolts to 8-12 N·m (6-8 lb-ft).
5. Install pulley-to-pump hub bolts. Tighten to 20-30 N·m (15-22 lb-ft).
6. Connect coolant bypass/heater hose to water pump.
7. Install idler bracket to front cover.
8. Position accessory drive belt over pump pulley and adjust drive belt tension. Refer to Section 27-02.
9. Connect battery ground cable.
10. Replace engine coolant. Refer to Coolant Refill procedures. Operate engine until normal operation temperature is reached. Check for leaks and check coolant level.

5. Install water pump belt on pulley and adjust tension to specification. Refer to Section 27-02.
6. Install new O-ring for water pump inlet and install water pump inlet. Tighten bolts to specification.
7. Connect lower radiator hose to radiator.
8. Install drive belt on water pump pulley and adjust tension to specification. Refer to Section 27-02.
9. Connect battery ground cable.
10. Refill cooling system with specified antifreeze solution. Refer to Coolant Refill procedure. Run engine until normal operating temperature is reached. Check coolant level and check for leaks.

**2.5L Engine****Removal**

1. Open hood and secure in open position.
2. Put protection aprons on fenders.
3. Disconnect battery ground cable.
4. Remove radiator cap.
5. Raise vehicle on a hoist. Refer to Pre-Delivery manual, Section 50-04.
6. Position drain pan under lower radiator hose.
7. Loosen clamp from lower radiator hose and drain engine coolant.
8. Remove water pump inlet tube.
9. Loosen belt tensioner and remove belt from water pump pulley.
10. Disconnect heater hose at water pump.
11. Remove three water pump bolts and remove pump.

**Installation**

1. Ensure mating surface of cylinder block and water pump are clean and free of gasket material.
2. Place water pump assembly and new gasket to cylinder block. Apply Perfect Seal Sealing Compound B5A-19554-A or equivalent, to water pump gasket before installing.
3. Install three water pump attaching bolts. Tighten to 20-30 N·m (15-22 lb-ft).
4. Connect heater hose to water pump.

**Radiator Hose****Replacement**

1. Open hood and place fender covers.
2. Disconnect battery cables.
3. Position drain tray below radiator.
4. Remove radiator cap, attach a 9.5mm (0.4-inch) ID hose to draincock and drain radiator.
5. Position a drain tray under lower radiator hose. Loosen lower radiator hose clamps. Disconnect hose from water pump or inlet tube, and allow to drain.
6. Loosen clamps, disconnect top hose at radiator and thermostat housing and remove hose.
7. Position top hose to radiator and thermostat housing. Tighten clamps.
8. Position bottom hose to engine-mounted water pump or inlet tube and radiator. Secure clamps and close draincock.
9. Fill cooling system with specified cooling system concentrate and water solution. Refer to Coolant Refill procedure.
10. Connect battery cables.
11. Start engine. Check for leaks.
12. Check coolant level as required, only when engine is cool.
13. Remove fender covers and close hood.

**REMOVAL AND INSTALLATION (Continued)****Water Pump Inlet Tube Assembly****2.5L Engine****Removal**

1. Open and secure hood.
2. Install protective fender covers.
3. Disconnect battery ground cable.
4. Remove radiator cap.
5. Raise vehicle.
6. Position drain pan below radiator under lower radiator hose.
7. Loosen clamp, disconnect lower radiator hose from radiator, and drain engine coolant.
8. Remove one nut attaching water pump inlet tube clamp to engine mount and remove one bolt securing inlet tube clamp to oil pan.
9. Carefully remove water pump inlet tube assembly.
10. Remove O-ring from water pump.

**Installation**

1. Clean surfaces of inlet tube and water pump where new O-ring gasket is to be installed. Install new O-ring in water pump. Carefully insert inlet tube with new O-ring into water pump, and secure clamp with one bolt to oil pan and with one nut to engine mount stud. Tighten to specification.
2. Install lower radiator hose to radiator.
3. Lower vehicle.
4. Connect battery ground cable.
5. Replace engine coolant. Refer to Coolant Refill procedure. Ensure vent plug on water outlet connection is open during refill. Operate engine until normal operating temperature is reached. Check for leaks and check coolant level.

**SPECIFICATIONS****TORQUE SPECIFICATIONS — 3.0L ENGINE**

Description	N·m	Lb·Ft
Water Outlet Connection Bolts	8-12	6-9
Water Pump Attaching Bolts (M6)	8-12	6-8
Water Pump Attaching Bolts (M8)	20-30	15-22
Clamps	2.3-3.4	20-30 lb-in

**CQ2310-A****TORQUE SPECIFICATIONS — 2.5L ENGINE**

Description	N·m	Lb·Ft
Water Pump Attaching Bolts	20-30	15-22.5
Water Outlet Connection Bolts	16-24	12-18
Vent Plug — In Water Connection	10-15	7.5-11.3
Hose Clamps	2.3-3.4	20-30 (Lb-in)
Water Pump Inlet Tube Clamp to Oil Pan	8-11.5	6-8.5
Water Pump Inlet Tube Clamp Nut to Engine Block	70-95	52-70

**CQ2311-A**

Vehicle	Engine	Trans.	Cooling System	Capacity	
				Liters	Quarts
Taurus/Sable	2.5L	MTX	ALL	7.9	8.3
	3.0L Sedan	ALL	ALL	10.4	11.0
	3.0L Wagon	ALL	A/C	11.2	11.8

Listed Capacities include heater and coolant reservoir filled to add mark.

Service refill recommendations are 50/50 mixture of water and coolant. Use coolant meeting Ford specification E2E-M97B44-A, such as Ford Cooling System Fluid E2FZ-19549-A.

All figures shown are actual, but may vary  $\pm$  15 percent due to system variations.**CQ2312-A**

Specified Cap Pressure PSI	Lower Limit PSI (Must Maintain)	Upper Limit PSI (Must Relieve)
16	13	18

**CQ2049-B****SPECIAL SERVICE TOOLS**

Tool Number	Description
T81P-10300-AH	Alternator Tensioning Tool
T81P-6254-A	Belt Tension Torque Wrench Adapter
Rotunda 021-00012	Pressure Tester
Rotunda 021-00028	Belt Tension Gauge
Rotunda 021-00046	Optical Battery/Coolant Tester

**CQ1619-F**

# SECTION 27-02 Drive Belts, Accessory—Service

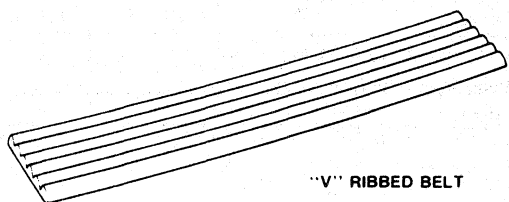
SUBJECT	PAGE	SUBJECT	PAGE
ADJUSTMENTS		REMOVAL AND INSTALLATION (Cont'd.)	
2.5L Engine .....	27-02-2	3.0L Engine .....	27-02-2
3.0L Engine .....	27-02-1	SPECIAL SERVICE TOOLS .....	27-02-3
DESCRIPTION .....	27-02-1	SPECIFICATIONS .....	27-02-3
REMOVAL AND INSTALLATION		VEHICLE APPLICATION .....	27-02-1
2.5L Engine .....	27-02-2		

## VEHICLE APPLICATION

Taurus/Sable.

## DESCRIPTION

Taurus/Sable vehicles are equipped with V-ribbed belts. To ensure maximum life, replacement belts should be of the same type as originally installed. These belts must be properly adjusted at all times. Loose belt(s) will result in slippage which may cause a noise complaint or improper accessory operation (alternator won't charge, etc). Over-tightened belts will place a severe load on accessory bearings and cause premature failure.



"V" RIBBED BELT

Q2258-A

## ADJUSTMENTS

To ensure proper tension, follow these procedures. Refer to the applicable adjustment illustration and belt tension specification chart.

NOTE: Use Rotunda Belt Tension Gauge 021-00028 or equivalent on 3.0L engine equipped vehicles only.

### 3.0L Engine

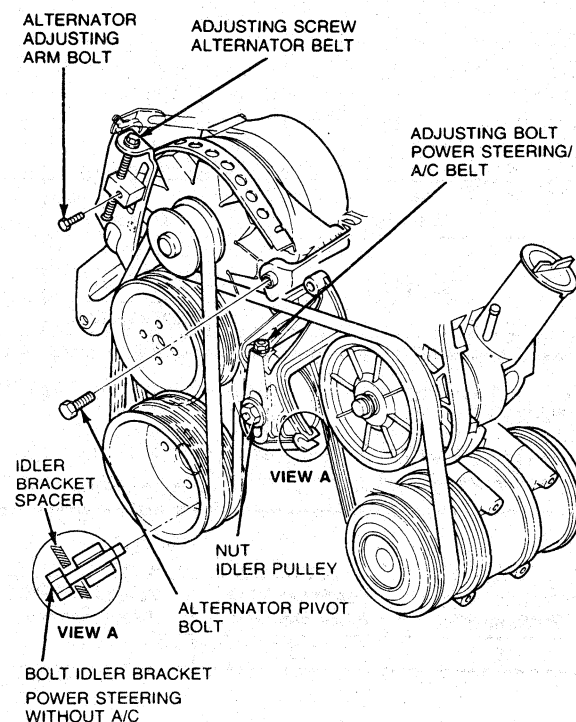
#### Alternator Belt

1. Loosen alternator adjusting arm bolt and alternator pivot bolt and turn adjusting screw until belt is adjusted to specification.
2. Tighten alternator pivot bolt and adjusting bolt to specification and check belt tension.

### Power Steering, A/C Belt

1. Loosen idler pulley nut and turn adjusting screw until belt is adjusted to specification.  
NOTE: Turning wrench to right tightens belt and turning wrench to left loosens belt.
2. Tighten idler pulley nut to specification and check belt tension.

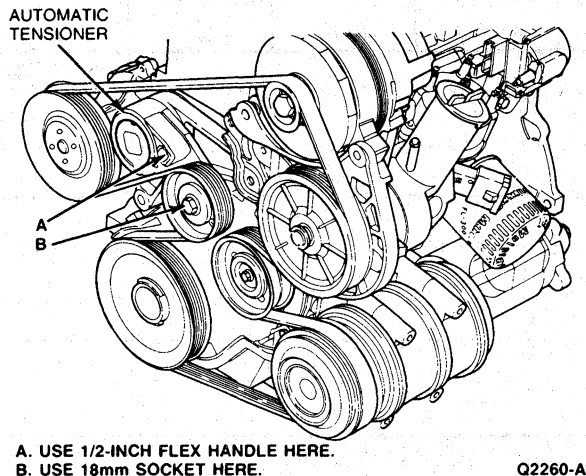
The alternator, power steering, air conditioning drive belt should be checked for proper tension after both belts are adjusted and the component attaching belts are properly tightened.



Q2259-A

**ADJUSTMENTS (Continued)****2.5L Engine**

Belt tension is maintained by an automatic tensioner and does not require adjustment.

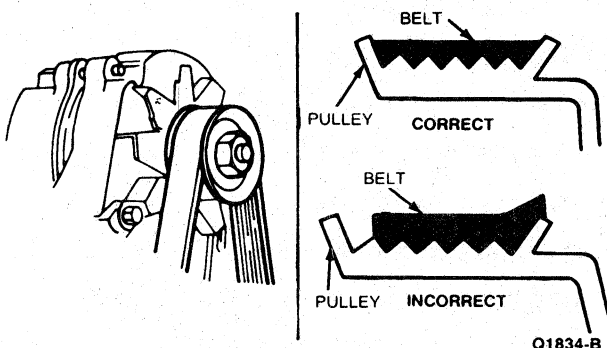
**REMOVAL AND INSTALLATION**

Conditions requiring belt replacement are excessive wear, severe glazing or frayed cords. Replace any belt exhibiting any of these conditions.

NOTE: Minor cracks in the back of the belt are considered acceptable as long as no large pieces are missing.

NOTE: Refer to the illustrations under Adjustments while performing the following Removal and Installation procedures.

NOTE: When installing belts on pulley, ensure that all V-grooves make proper contact with pulleys.

**3.0L Engine****Alternator Belt****Removal**

1. Loosen adjusting arm and pivot bolts.
2. Turn alternator belt adjusting screw counterclockwise until old belt can be removed.
3. Remove belt.

**Installation**

1. Install new belt over pulleys. Ensure that all V-grooves make proper contact with pulleys.
2. Adjust belt tension as outlined.

**Power Steering, A/C Belt****Removal**

1. Remove alternator belt as outlined.
2. Loosen nut on tensioner pulley.
3. Turn belt adjusting screw on tensioner counterclockwise until belt can be removed.
4. Remove belt.

**Installation**

1. Position belt over pulleys and belt tensioner. Ensure that all V-grooves make proper contact with pulleys.
2. Install alternator belt as outlined.
3. Adjust belt tension for both belts as outlined.

**2.5L Engine****Removal**

Insert a 1/2-inch flex handle in square hole in tensioner and rotate tensioner counterclockwise and remove belt from pulleys.

NOTE: As an alternate method, an 18mm socket can be placed over nut on tensioner pulley and rotated counterclockwise to remove belt.

**WARNING: USE CAUTION WHEN REMOVING OR INSTALLING BELTS TO ENSURE THAT TOOL DOES NOT SLIP.**

**Installation**

1. Install belt over all pulleys except alternator pulley.
2. Rotate tensioner as described under Removal and install belt over alternator pulley. Ensure that all V-grooves make proper contact with pulleys.

## SPECIFICATIONS

## BELT TENSION SPECIFICATIONS

Engine	Belt Type	New Installation		Used Belt Reset		Allowable Minimum	
		N	Lbs	N	Lbs	N	Lbs
3.0L Engine①	Alternator	533-711	120-160	356-445	80-100	267	60
	Power Steering — Air Conditioning	667-845	150-190	623-712	140-160	400	90

① 2.5L Engine has automatic tensioner.

CQ2261-B

## TORQUE SPECIFICATIONS

Engine	Description	N·m	Lb·Ft
3.0L Engine	Alternator Pivot Bolt	61-75.5	45-57
	Alternator Adjusting Bolt	30-43	22-32
	Slider Idler Pulley	70-95	52-70
2.5L Engine	None	—	—

CQ2262-A

## SPECIAL SERVICE TOOLS

## ROTUNDA EQUIPMENT

Model Number	Description
021-00028	Belt Tension Gauge Tool

CQ2263-A

# SECTION 27-03 Radiators—Aluminum Core

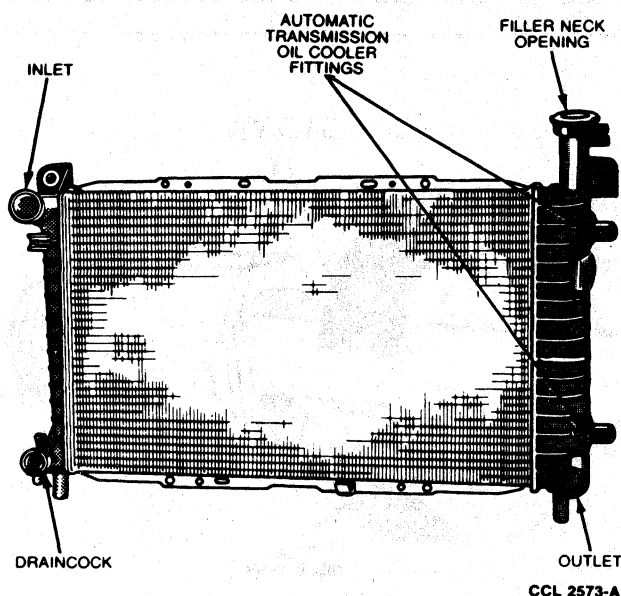
SUBJECT	PAGE	SUBJECT	PAGE
CLEANING .....	27-03-7	SERVICE PROCEDURES	
DESCRIPTION .....	27-03-1	Radiator Core .....	27-03-8
REMOVAL AND INSTALLATION		SPECIAL SERVICE TOOLS AND	
Coolant Recovery Bottle .....	27-03-3	EQUIPMENT .....	27-03-9
Draincock Replacement .....	27-03-6	SPECIFICATIONS .....	27-03-9
Oil Cooler Transfer or Replacement .....	27-03-6	TESTING	
Radiator .....	27-03-2	Leak Testing .....	27-03-7
Radiator Tank .....	27-03-3	VEHICLE APPLICATION .....	27-03-1

## VEHICLE APPLICATION

Taurus/Sable.

## DESCRIPTION

The radiator is a vacuum brazed aluminum fin and tube type design arranged for cross flow of the engine coolant. Nylon end tanks on each end of the core allow uniform distribution of engine coolant to the radiator tubes. The nylon end tanks are attached to the aluminum core by bending tabs on the core header over the foot (edge) of the nylon tank. A rubber O-ring gasket is placed between the nylon tank and the radiator core header to achieve a seal between the tank and the radiator core header. The nylon tanks are a moulded one-piece design with mounting brackets a part of each tank.



**WARNING: NEVER REMOVE THE RADIATOR CAP UNDER ANY CONDITIONS WHILE THE ENGINE IS OPERATING. FAILURE TO FOLLOW THESE INSTRUCTIONS COULD RESULT IN DAMAGE TO THE COOLING SYSTEM OR ENGINE AND/OR PERSONAL INJURY.**

**TO AVOID HAVING SCALDING HOT COOLANT OR STEAM BLOW OUT OF THE RADIATOR, USE EXTREME CARE WHEN REMOVING THE CAP FROM A HOT RADIATOR. WAIT UNTIL THE ENGINE HAS COOLED; THEN, WRAP A THICK CLOTH AROUND THE RADIATOR CAP AND TURN IT SLOWLY TO THE FIRST STOP. STEP BACK WHILE THE PRESSURE IS RELEASED FROM THE COOLING SYSTEM. WHEN YOU ARE SURE ALL THE PRESSURE HAS BEEN RELEASED, PRESS DOWN ON CAP (STILL WITH A CLOTH), TURN AND REMOVE IT.**

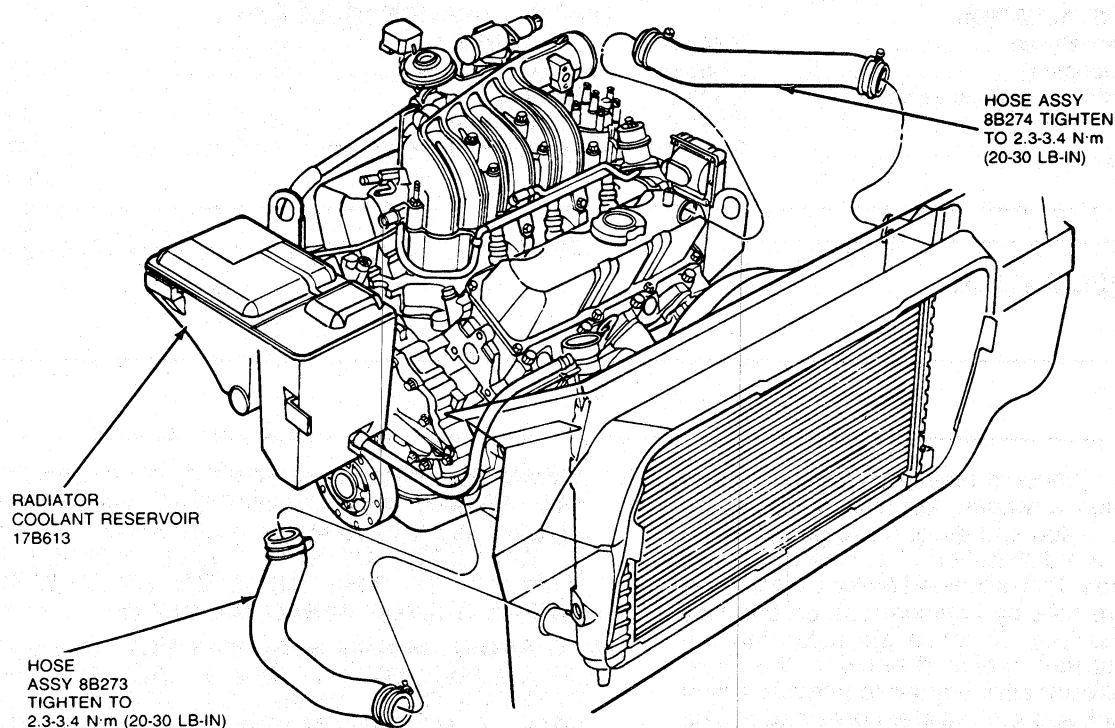
**WARNING: THE ENGINE ELECTRIC COOLING FAN MAY COME ON AT ANYTIME WITHOUT WARNING EVEN IF THE ENGINE IS NOT RUNNING.**

## REMOVAL AND INSTALLATION

## Radiator

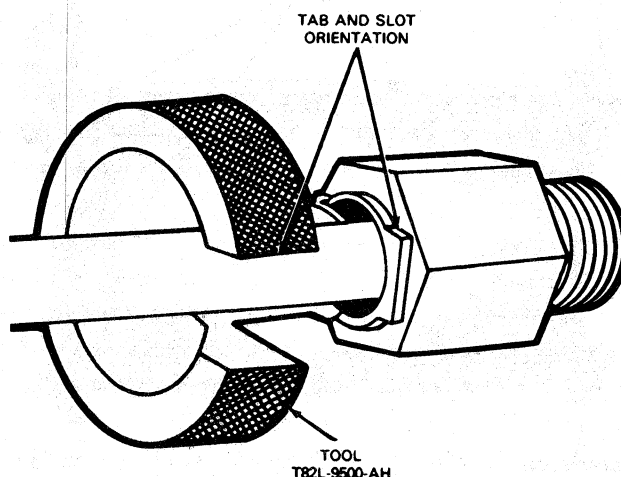
## Removal

1. Drain cooling system by removing radiator cap and opening draincock located at lower rear corner of radiator inlet tank.
2. Remove rubber overflow tube from coolant recovery bottle and detach it from radiator.



Q2269-A

3. Remove two shroud upper attaching screws and lift shroud out of lower retaining clips.
4. Loosen upper and lower hose clamps at radiator and remove hoses from radiator connectors.
5. Disconnect two automatic transmission oil cooling lines from radiator fittings with Cooler Line Disconnect Tool T82L-9500-AH, if so equipped.
6. Remove two radiator upper attaching screws.
7. Tilt radiator back (rearward) approximately 25mm (1 inch) and lift directly upward, clear of radiator support and cooling fan.
8. If either hose is to be replaced, loosen clamp at engine end and slip hose off connections with a twisting motion.
9. Lift shroud off fan and remove from vehicle.
10. Remove radiator lower support rubber pads.

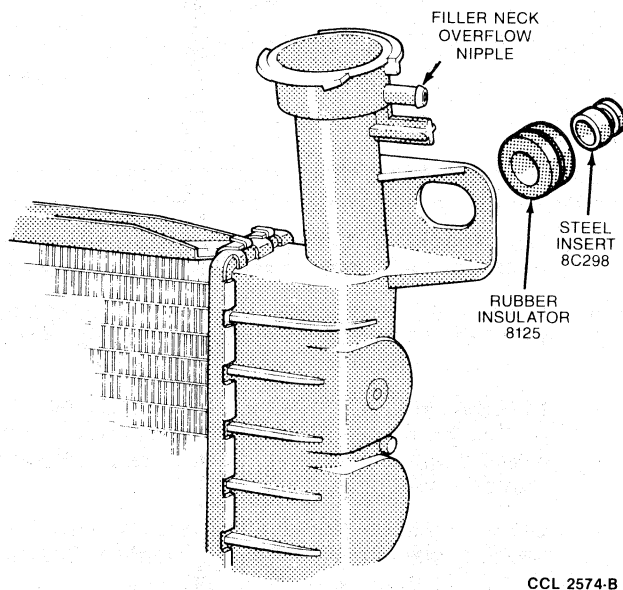


CCL 2274-A



**REMOVAL AND INSTALLATION (Continued)****Installation**

1. Position radiator lower support rubber pads to lower support.
2. Position shroud on fan until radiator is installed.
3. If either hose has been replaced, position hose on engine with index arrow in line with mark on fitting at engine. Tighten clamp to 2.3-3.4 N·m (20-30 lb-in). Refer to illustration under Removal, Step 2.
4. Position radiator into engine compartment and to radiator support, being careful to clear fan. Insert the molded pins at bottom of each tank through slotted holes in lower support rubber pads.
5. Inspect radiator nylon tank upper mounting bushings for damage. Replace if damaged.



6. Ensure plastic pads on bottom of radiator tanks are resting on rubber pads. Install two upper attaching bolts to attach radiator to radiator support. Tighten to 17-27 N·m (13-20 lb-ft).
7. Attach radiator upper and lower hoses to radiator. Position hose on radiator connector so that index arrow on hose is in line with mark on connector. Refer to illustration under Removal, Step 2. Tighten clamps to 2.3-3.4 N·m (20-30 lb-in).
8. Position shroud on lower retainer clips and attach top of shroud to radiator with two screw and washer assemblies. Tighten to 5.5-8 N·m (4-6 lb-ft).
9. Attach rubber overflow tube to radiator filler neck overflow nipple and coolant recovery bottle.

10. Install new 50/50 mixture of water and antifreeze. Refer to Section 27-01, Cooling System Service and operate engine for 15 minutes. Check coolant level and bring it to within 38mm (1-1/2 inches) of radiator filler neck. Add two Cooling System Protector Pellets C9AZ-19558-A or equivalent.

**Coolant Recovery Bottle****Removal**

1. Drain radiator until coolant is out of recovery bottle. Disconnect overflow line at recovery bottle. Refer to illustration under Radiator Removal, Step 2.
2. Remove overflow tube from recovery bottle. Remove recovery bottle attachments and remove recovery bottle.

**Installation**

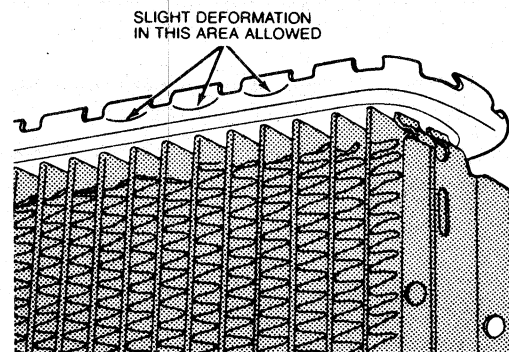
1. Position recovery bottle in vehicle and install attaching screws. Tighten to 5.5-8 N·m (4-6 lb-ft).
2. Connect overflow tube to recovery bottle.
3. Fill and bleed cooling system. Refer to Section 27-01. Check for coolant leaks and proper coolant level after engine reaches normal operating temperature.

**Radiator Tank****Removal**

The radiator tank is moulded glass-filled nylon and is attached to the core header by bending the header tabs over the foot (edge) of the tank.

When removing a nylon tank, a screwdriver or one of the various special tools available can be used to open the header tabs. Some of these tools, including a screwdriver, may cause a small section of the header side to bend with the tabs as they are opened. This slight deformation is permissible, provided the tabs are opened only enough for tank removal. The header sides will usually return to the normal position when the tabs are recrimped during tank installation.

Procedures given are for tank removal using a screwdriver or a Borroughs Tool BT-8260. Follow the manufacturer's instructions for other radiator tab opening and closing tools.



## REMOVAL AND INSTALLATION (Continued)

## With Screwdriver

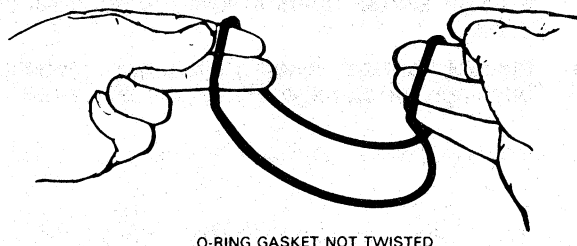
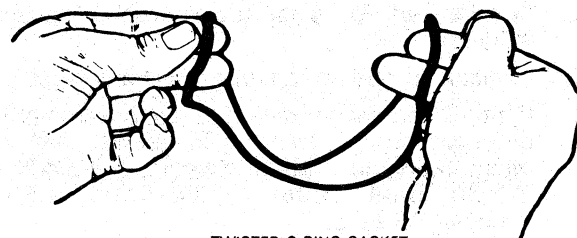
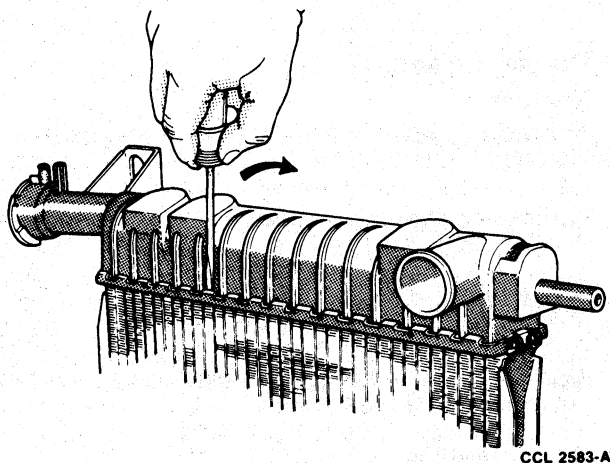
1. Insert end of medium tip screwdriver between end of header tab and tank. Press screwdriver blade against tank to bend (pry) tab away from tank foot (edge). Repeat procedure for each tab.

NOTE: Bend (open) the tabs only enough for tank removal.

2. Lift tank from core header when all of header tabs are bent away from tank foot (edge).
3. Remove O-ring gasket from header.

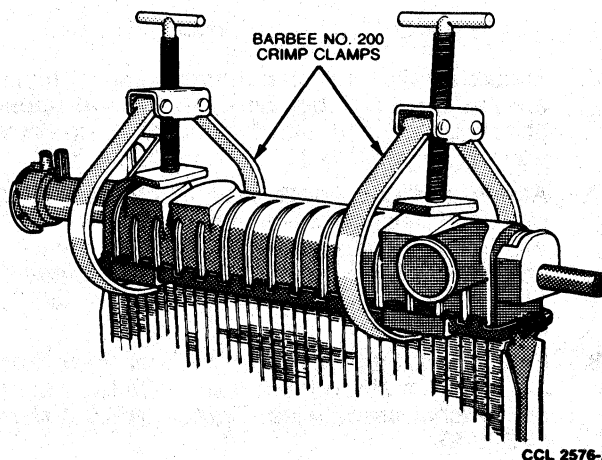
## With BT-8260

1. Insert end of Borroughs Tool BT-8260 between end of header tab and tank. Then, push tool handle down toward core to bend tab away from radiator tank. **Do not open the tabs more than is necessary for tank removal.**
2. Repeat Step 1 for each header tab. Then, lift tank from header.
3. Remove O-ring gasket from header.



CCL 2286-A

3. Dip new O-ring gasket in glycol or silicone or equivalent and place gasket in header groove.
4. If outlet tank is being replaced and is equipped with an oil cooler, transfer oil cooler from replaced tank to new tank as outlined.
5. Position tank to header using care not to scratch tank sealing surfaces with header tabs. Ensure top and bottom of tank is positioned properly with other tank.
6. Clamp tank in position on header with two header clamps as shown. Tighten header clamps to compress O-ring gasket.



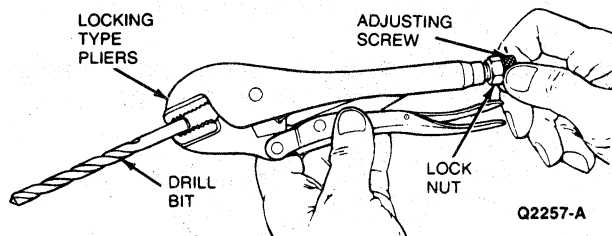
## Installation

NOTE: If any header tabs are missing from an aluminum core, the core should be replaced.

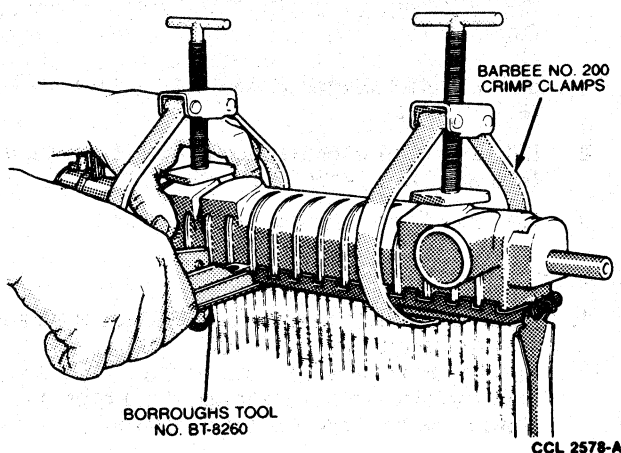
1. Inspect seal surface of radiator core header to ensure it is clean and free of foreign material or damage.
2. Check new O-ring gasket to ensure it is not twisted.

## REMOVAL AND INSTALLATION (Continued)

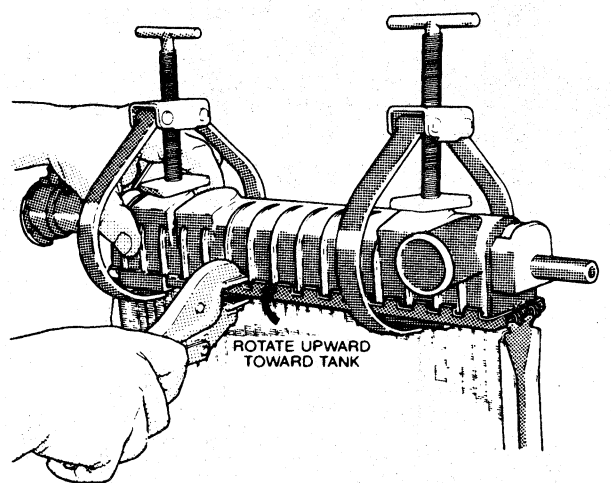
7. If locking type pliers are used to squeeze header tabs against tank, install a hex nut on pliers adjusting screw.
8. With jaws of locking type pliers closed and locked, turn adjusting screw to position jaws against shank of a 10.94mm (7/16-inch) drill bit. Tighten hex nut on adjusting screw against handle to lock adjustment in place.



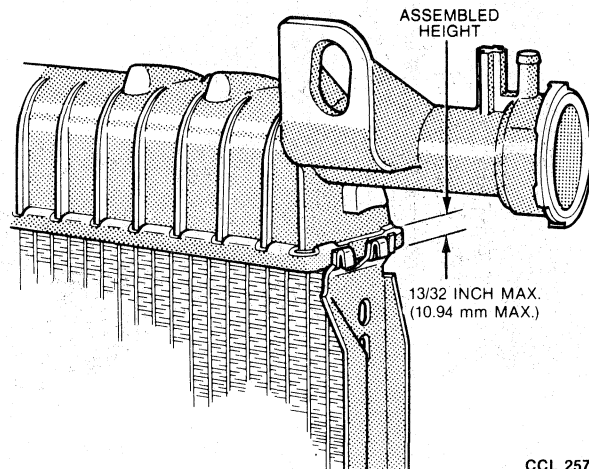
10. If a special crimping tool is used such as the one shown, follow the manufacturer's instructions.



9. Squeeze header tabs down against lip of tank base with locking type pliers while rotating pliers toward tank.



However, it is important that assembled height of crimp be 10.94mm (7/16-inch) when measured from bottom of header to top of tab.



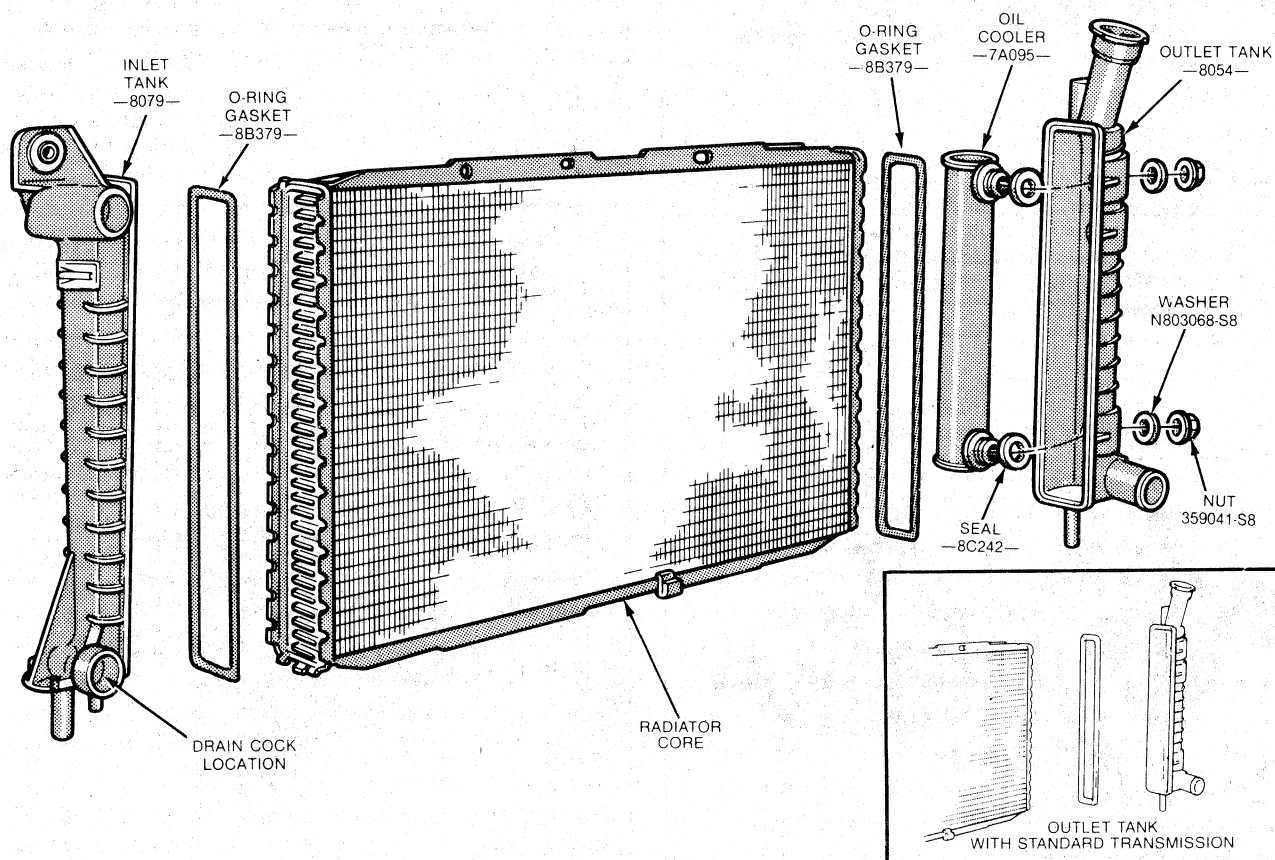
11. Remove header clamps from radiator and squeeze header tab(s) down that were behind clamps.
12. Leak test radiator at 145 kPa (21 psi). Most minor leaks at tank seal can be corrected by again squeezing header tabs down against tank lip in area of indicated leak.

**REMOVAL AND INSTALLATION (Continued)****Oil Cooler Transfer or Replacement****Removal**

1. Remove outlet tank from radiator following procedure given for Radiator Tank Removal.
2. Remove retaining nuts and washers from oil cooler inlet and outlet connections. Lift oil cooler from radiator outlet tank.
3. Remove rubber gaskets from oil cooler inlet and outlet connections if oil cooler is to be reused.

**Installation**

1. Remove outlet tank from radiator following procedure for Radiator Tank Removal.
2. Position oil cooler to radiator outlet tank and insert inlet and outlet connections through holes in outlet tank.
3. Install flatwasher and nut on each oil cooler connections to retain oil cooler in radiator outlet tank.
4. Tighten oil cooler retaining nuts to 6.6-8 N·m (9-11 lb-ft).
5. Install outlet tank on radiator core header following procedure for Radiator Tank Installation.



CCL 2582-B

**Draincock Replacement**

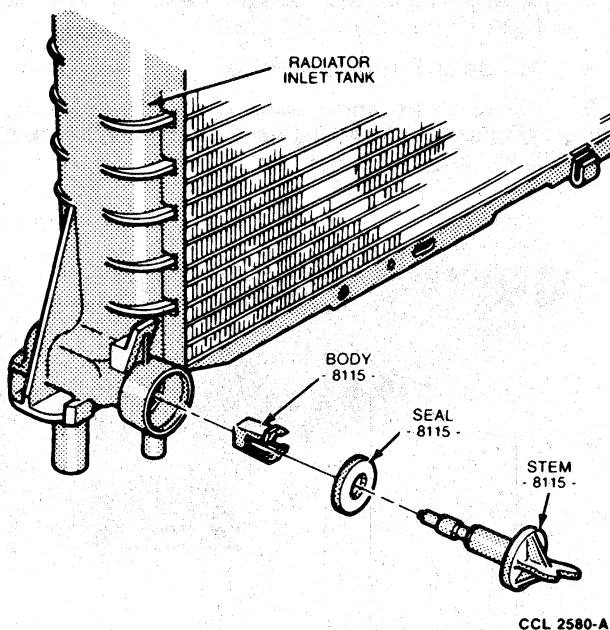
The draincock is located near the bottom of the inlet tank and can be replaced without removing the tank from the radiator. However, the radiator should be

removed from the vehicle for access to the draincock.

## REMOVAL AND INSTALLATION (Continued)

## Removal

1. Turn draincock stem counterclockwise to unscrew stem. When stem is unscrewed to end of threads, pull stem from radiator tank and draincock body.



## Installation

1. Insert draincock body into draincock opening of radiator inlet tank. Push body into opening until it locks into place. Refer to illustration under Removal, Step 2.
2. Position draincock stem into draincock body opening and push to engage stem tabs with draincock body.
3. Tighten draincock stem by turning clockwise until tight.

## CLEANING

## External

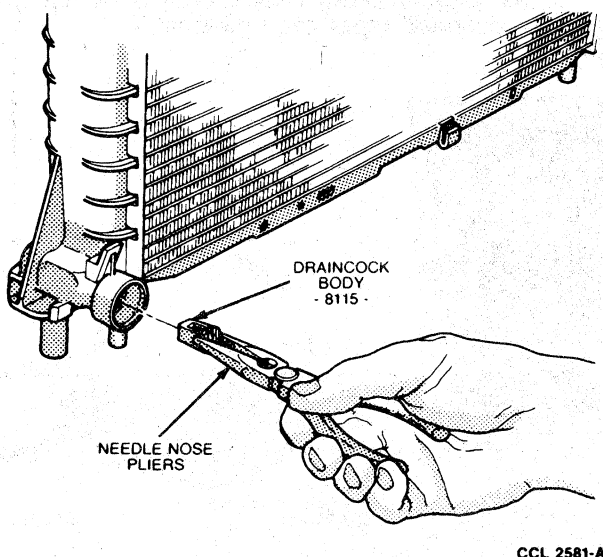
The aluminum core can be cleaned externally with a soft bristle brush, warm water and a mild household liquid detergent. Rinse with clear water.

If the radiator is equipped with an oil cooler, install steel or brass plugs in the oil cooler fittings before cleaning and keep them installed during the entire service operation.

## Internal

**NOTE:** Do not use caustic cleaning solutions or copper/brass radiator cleaning agents on aluminum radiators. Internal cleaning of the aluminum tubes can be accomplished with sonic cleaning equipment or by removing one end of the tank to gain access to the tubes. Clean the tubes with a mild household liquid detergent. Rinse the core with clean water when completed. Do not use a metal brush to clean an aluminum core. Use only horsehair, bristle or nylon brushes.

2. Remove draincock body from radiator tank by squeezing sides together with a pair of needle-nose pliers. Pull body from inlet tank.



## TESTING

## Leak Testing

Clean the radiator before leak testing to prevent contaminating the test tank. Leak test the radiator in **clean** water with 138 kPa (20 psi) air pressure. **Do not** leak test an aluminum radiator in the same water that copper/brass radiators are tested in. Flux and caustic cleaners may be present in the tank and they will attack aluminum. A separate clean test tank is necessary for aluminum radiators. If conditions do not allow a separate tank for aluminum radiator leak testing, thoroughly clean the test tank each time before testing an aluminum radiator in the tank.

When a tank is removed to service a tube to header leak, the core can be leak tested by clamping the tank (with an O-ring gasket in place) to the core and leak testing with air under water. When service is completed, install the tank. Refer to Radiator Tank Installation.

Always install plugs in the oil cooler fittings before leak testing or cleaning any radiator equipped with an oil cooler.

## SERVICE PROCEDURES

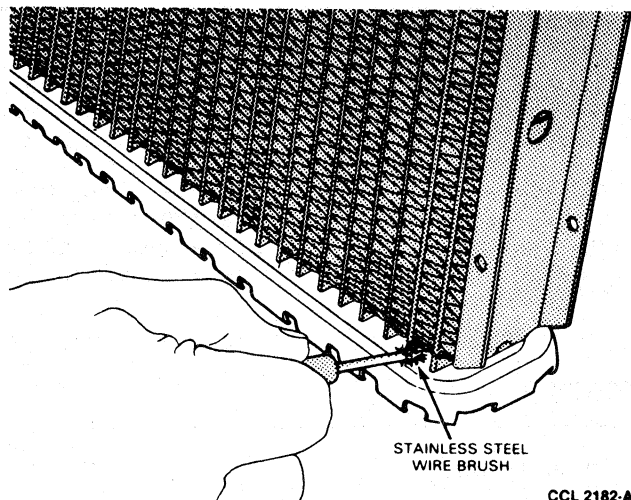
### Radiator Core

The only approved repair method for the aluminum radiator core is using a two-component epoxy material. The materials and supplies necessary to repair the aluminum core are:

- EPOXI-PATCH KIT No. 6C Aluminum. Hysol Division of the Dexter Corporation, Olean, New York 14760.
- Sandpaper and/or emery paper: 80 or 100 grit.
- Stainless steel wire brush No. 23151 or equivalent. The Milwaukee Brush Manufacturing Co., Menomonee Falls, Wisconsin 53051.
- 375 watt heat lamp.
- Mixing card and spatulas.

### Repair

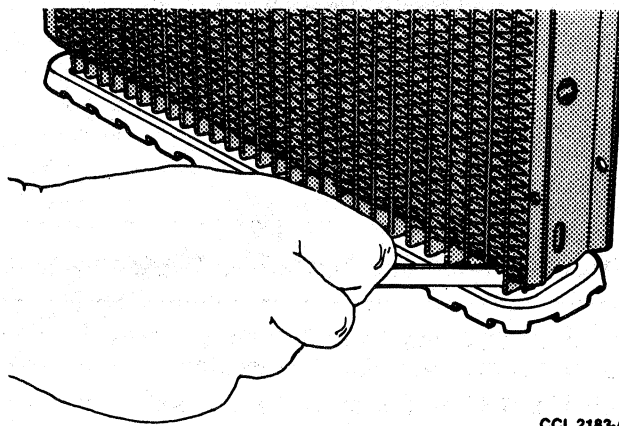
1. Thoroughly clean area around leak with a stainless steel wire brush.



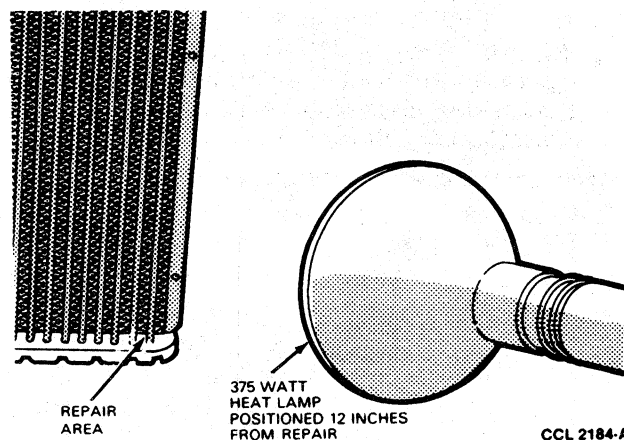
2. Squeeze a bead (length-enough to repair the leak) of repair material Part A (resin) on a clean, dry, disposable flat mixing surface. Use uniform pressure to obtain an even bead.

NOTE: Observe all cautions and warnings printed on the repair material containers.

3. Squeeze an equal length bead of hardener (Part B) parallel to the Part A bead.
4. Mix parts A and B together.
5. If it is necessary to have epoxy flow to obtain satisfactory results, warm core around leak with a 375 watt heat lamp. Apply repair material to leak.



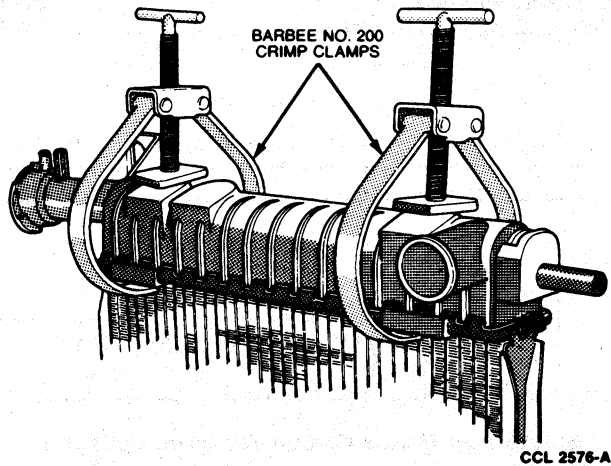
6. Position 375 watt heat lamp 305mm (12-inches) from repair area and allow to cure for 2 hours. Do not position head lamp closer to repair area than 305mm (12-inches). Do not use a heat gun or overheat repair area material.





**SERVICE PROCEDURES (Continued)**

7. Leak test the repair by clamping tank to header with No. 200 Crimp Clamps or equivalent. After a successful leak test, install radiator tank following the procedure for Radiator Tank Installation.

**SPECIAL SERVICE TOOLS AND EQUIPMENT**

- No. 200 Crimp Clamp. The Barbee Company, P.O. Box 323, Louisville, Kentucky 40201.
- No. 23151 Stainless Steel Wire Brush. The Milwaukee Brush Manufacturing Co., P.O. Box 830, Menomonee Falls, Wisconsin 53051.
- Heat Lamp and Socket, 375 watt.
- Sandpaper or Emery Paper: 80 or 100 grit.
- Methylene Chloride Solvent.
- Mixing Card.
- Spatulas, Wood.
- Epoxi-Patch Kit No. 6C Aluminum. Hysol Division of the Dexter Corporation, Olean, New York 14760.
- O.T.C. Line Disconnect Tool T82L-9500-AH.
- Tool BT-8260 and 8260-A Radiator Tank Remover and Replacer. Borroughs Tool and Equipment Corporation, 2429 North Burdick St., Kalamazoo, Michigan 49007.

**SPECIFICATIONS**

Description	
Radiator Pressure Test	138 kPa (20 psi)
Radiator Cap Pressure	16 Lbs. $\pm$ 2 Lbs.

**TORQUE SPECIFICATIONS**

Component	N-m	Lb-Ft
Radiator Attaching Bolts	7-9.5	5-7
Shroud Attaching Bolts	3.9-5.1	35-45 (lb-in)
Oil Cooler Nuts	12-15	9-11
Hose Clamps	2.25-3.38	4-6
Radiator Upper Support Attaching Bolts	17-27	13-20
Radiator Shroud to Radiator	5.5-8	4-6
Recovery Bottle Attaching Screws	5.5-8	4-6

CQ2255-B

**TANK TO HEADER CRIMP ASSEMBLED HEIGHT**

Aluminum Core	10.94mm (7/16 inch) Maximum
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CQ2256-B

# SECTION 27-10 Fan, Electro—Drive Cooling

SUBJECT	PAGE	SUBJECT	PAGE
DESCRIPTION AND OPERATION .....	27-10-1	SPECIFICATIONS .....	27-10-3
DIAGNOSIS .....	27-10-2	VEHICLE APPLICATION .....	27-10-1
REMOVAL AND INSTALLATION			
Fan, Motor and Integrated Relay Control			
Assembly .....	27-10-2		

## VEHICLE APPLICATION

Taurus/Sable.

## DESCRIPTION AND OPERATION

The electro-drive cooling fan system consists of a two-speed fan on all 2.5L and 3.0L engines with ATX or, a one-speed motor on 2.5L engines with MTX, and an electric motor attached to a fan shroud located behind the radiator. The electro-drive cooling fan is wired to operate only when the ignition switch is in the RUN position thereby preventing cooling fan operation after the ignition switch is turned to the OFF position.

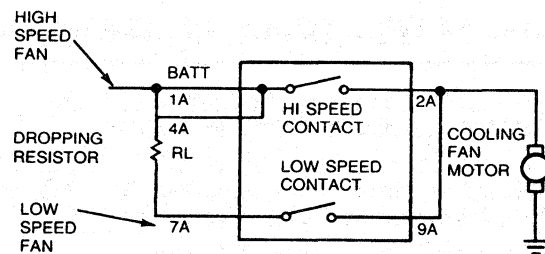
**WARNING: DISCONNECT THE COOLING FAN PRIOR TO PERFORMING ANY UNDERHOOD SERVICE SINCE THE FAN COULD CYCLE IF THE IGNITION SWITCH IS LEFT IN THE ON POSITION EVEN THOUGH THE ENGINE IS NOT RUNNING.**

The cooling fan is controlled during vehicle operation by the integrated relay control assembly and EEC-IV module, which will energize the cooling fan under the following conditions:

- Cooling fan is turned on at low speed if:
  - a. Engine temperature is higher than normal (on at 102°C (215°F), off at 99°C (210°F)).
  - b. A/C is on and vehicle speed does not provide enough natural airflow (on at 77 km/h (48 mph), off at 69 km/h (43 mph)).

Low speed cooling fan motor operation is achieved by using a dropping resistor in series with the motor.

## Cooling Fan Motor Circuit Diagram with the motor.



PORTION OF CIRCUITRY:  
INTEGRATED RELAY CONTROL ASSEMBLY Q2379-A

- Cooling fan is turned on at high speed (except 2.5L MTX) if:
  - a. Engine temperature is higher than desirable and fan has been operating at low speed (on at 110°C (230°F), off at 107°C (224°F)).
- Cooling fan will turn off (providing engine coolant temperature is not too high) if:
  - a. Driver demand is high (WOT mode).
  - b. A/C clutch is not cycling rapidly.

Several different controllers are available depending on application. Proper operation of the system cannot be obtained unless the correct controller is used.



**DESCRIPTION AND OPERATION (Continued)**

The A/C heater system contains a function control and temperature selector assembly (on the instrument panel), a blower housing and evaporator assembly and ductwork (behind the instrument panel), and compressor and condenser (in the engine compartment).

The function control lever controls system vacuum and electrical operation. Vacuum motors operate doors to direct airflow. The electrical switches attached to the function control lever connect power to the blower motor, the clutch cycling pressure switch, and the integrated relay control assembly.

When there is low refrigerant suction pressure, the clutch cycling pressure switch cuts off power to the A/C clutch field coil.

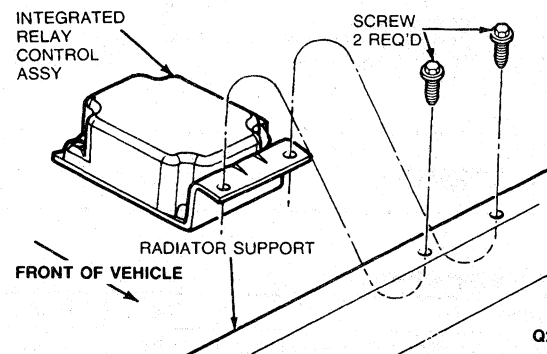
The wide-open throttle (WOT) A/C cutout switch is used on some applications. During hard acceleration, the WOT A/C cutout switch signals the integrated relay control assembly to cut off power to the A/C clutch field coil. This keeps the engine from being overloaded. For the same reason, the stoplamp switch signals the integrated relay control assembly to cut off power to the A/C clutch field coil for 1.5-5.0 seconds after the power brakes are applied.

**DIAGNOSIS**

Refer to the Engine/Emission Diagnosis\* manual for diagnosis of the integrated relay control assembly.

**REMOVAL AND INSTALLATION****Fan, Motor and Integrated Relay Control Assembly****Removal and Installation**

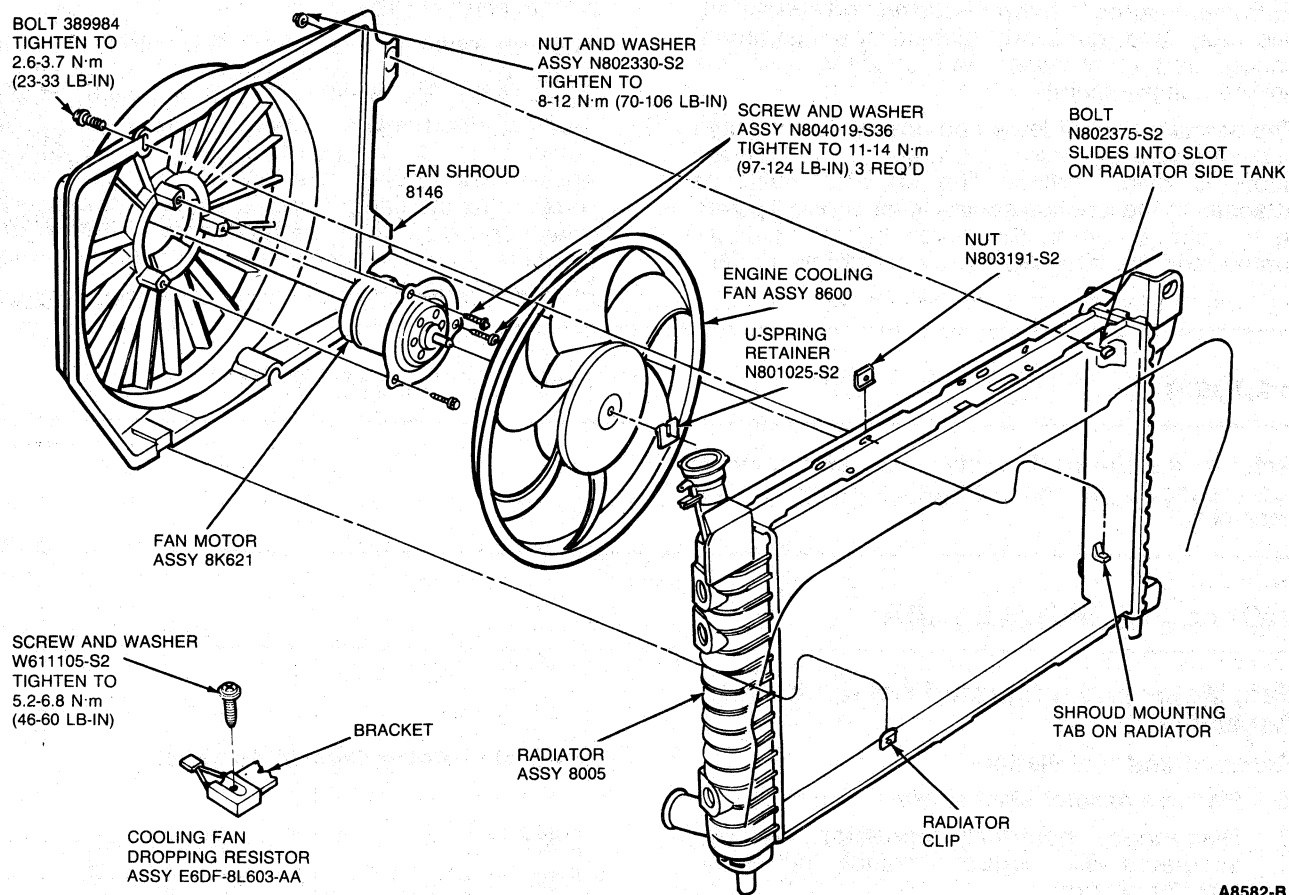
1. Remove radiator sight shield.
2. Disconnect electrical connector. Remove integrated relay control assembly located on radiator support.
3. Disconnect electric fan connector.
4. Unbolt fan/shroud assembly from radiator.
5. Rotate fan/shroud assembly and remove past radiator.
6. Remove fan U-spring retainer from motor shaft and remove fan.
7. Unbolt fan motor from shroud.
8. To install, reverse Steps 1 through 7.

**Integrated Relay Control Assembly**

\*Can be purchased as a separate item.

## REMOVAL AND INSTALLATION (Continued)

## Fan and Motor



A8582-B

## SPECIFICATIONS

## TORQUE SPECIFICATIONS

Description	N·m	Lb-In
Fan Motor to Fan Shroud Retaining Screws	11-14	97-104
Fan Shroud to Radiator — Bolt	2.6-3.7	23-33
Fan Shroud to Radiator — Nut	3.9-5.1	35.45
Resistor to Mounting Bracket — Screw and Washer	5.2-6.8	46-60

CQ2307-B

# GROUP 28STARTING SYSTEM (11000)

## SECTION 28-02 Starter—Positive Engagement

SUBJECT	PAGE	SUBJECT	PAGE
DESCRIPTION .....	28-02-1	SPECIAL SERVICE TOOLS .....	28-02-9
DISASSEMBLY AND ASSEMBLY		SPECIFICATIONS .....	28-02-9
Armature Replacement .....	28-02-9	TESTING	
Starter .....	28-02-6	Bench Tests .....	28-02-4
Assembly .....	28-02-8	Jump Starting .....	28-02-2
Cleaning and Inspection .....	28-02-7	On Vehicle Testing .....	28-02-3
Disassembly .....	28-02-6	Road Service .....	28-02-2
Starter Drive Replacement .....	28-02-8	VEHICLE APPLICATION .....	28-02-1
REMOVAL AND INSTALLATION			
Starter Motor .....	28-02-5		

### VEHICLE APPLICATION

Taurus/Sable.

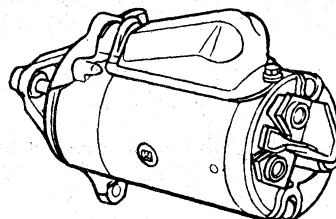
### DESCRIPTION

The function of the starting system is to crank the engine at a speed fast enough to permit the engine to start. Heavy cables, connectors and switches are used in the starting system because of the large current required by the starter while it is cranking the engine. The amount of resistance in the starting circuit must be kept to an absolute minimum to provide maximum current for starter operation. A discharged or damaged battery, loose or corroded connections, or partially broken cables will result in slower than normal cranking speeds, and may even prevent the starter from cranking the engine.

In case of starting system trouble, the operator may have discharged the battery before calling for assistance. A road service procedure is presented to aid the service technician in such cases of starting trouble. Follow diagnosis procedures in the Engine/Emissions Diagnosis\* manual, in order to

locate the cause of the starting difficulty. Road service is not a part of the diagnosis procedures.

The starting system includes the starter motor with an integral positive-engagement drive, the battery, a remote control starter switch (part of the ignition switch), the neutral start switch (automatic transaxle), the starter relay, and heavy circuit wiring.



J2913-A

\*Can be purchased as a separate item.

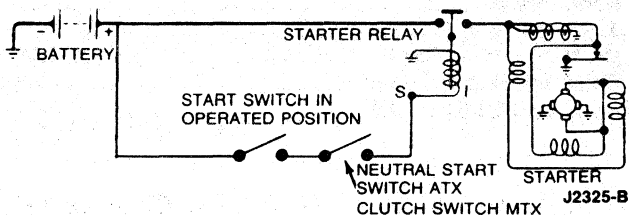
**DESCRIPTION (Continued)**

Turning the ignition key to the START position actuates the starter relay, through the starter control circuit. The starter relay then connects the battery to the starter.

Vehicles equipped with a manual transaxle have a clutch switch in the starter circuit which prevents operation of the starter unless the clutch pedal is depressed.

Vehicles equipped with an automatic transaxle have a neutral start switch in the starter control circuit, which prevents operation of the starter unless the selector lever is not in NEUTRAL or PARK.

When the starter is not in use, one of the field coils is connected directly to the ground through a set of contacts. When the starter is first connected to the battery, a large current flows through the grounded field coil, actuating a movable pole shoe. The pole shoe is attached to the starter drive plunger lever and thus, the drive is forced into engagement with the flywheel ring gear.



When the movable pole shoe is fully seated, it opens the field coil grounding contacts and the starter is then in normal operation. A holding coil is used to maintain the movable pole shoe in the fully seated position during the time that the starter is turning the engine.

**WARNING: HYDROGEN AND OXYGEN GASES ARE PRODUCED DURING NORMAL BATTERY OPERATION. THIS GAS MIXTURE CAN EXPLODE IF FLAMES, SPARKS OR LIGHTED TOBACCO ARE BROUGHT NEAR THE BATTERY. WHEN CHARGING OR USING A BATTERY IN AN ENCLOSED SPACE, ALWAYS PROVIDE VENTILATION AND SHIELD YOUR EYES.**

**WARNING: KEEP OUT OF REACH OF CHILDREN. BATTERIES CONTAIN SULFURIC ACID. AVOID CONTACT WITH SKIN, EYES OR CLOTHING. ALSO, SHIELD YOUR EYES WHEN WORKING NEAR THE BATTERY TO PROTECT AGAINST POSSIBLE SPLASHING OF THE ACID SOLUTION. IN CASE OF ACID CONTACT WITH SKIN, EYES OR CLOTHING, FLUSH IMMEDIATELY WITH WATER FOR A MINIMUM OF FIFTEEN MINUTES. IF ACID IS SWALLOWED, DRINK LARGE QUANTITIES OF MILK OR WATER, FOLLOWED BY MILK OF MAGNESIA, A BEATEN EGG, OR VEGETABLE OIL. CALL A PHYSICIAN IMMEDIATELY.**

**WARNING: DO NOT DISCONNECT THE BATTERY OF THE VEHICLE TO BE STARTED. DISCONNECTING THE BATTERY COULD DAMAGE THE VEHICLE'S ELECTRONIC SYSTEM.**

**Negative Grounded Battery**

**WARNING: TO AVOID ANY POSSIBILITY OF INJURY, USE PARTICULAR CARE WHEN CONNECTING A BOOSTER BATTERY TO A DISCHARGED BATTERY.**

**CAUTION: 12-volt starting motors can be damaged beyond repair if connected to a 24-volt power supply (two 12-volt batteries in series, or a 24-volt motor-generator set), even when cranking loads are relatively light. Extensive starting motor damage is more likely if the starter is connected to a 24-volt supply while being subjected to prolonged heavy cranking loads such as attempting to start an engine in subzero temperatures.**

1. Position vehicles so jumper cables will reach, being careful that vehicles **do not touch**.
2. Turn on heater blower motor (set control on DEFROST for vehicles equipped with automatic temperature control) of vehicle to be started. Turn off all other switches and lamps.

**TESTING****Road Service**

On road service calls, connect a 12-volt booster battery to the system for cases of a starter that will not crank the engine or a starter that cranks the engine very slowly.

**Jump Starting**

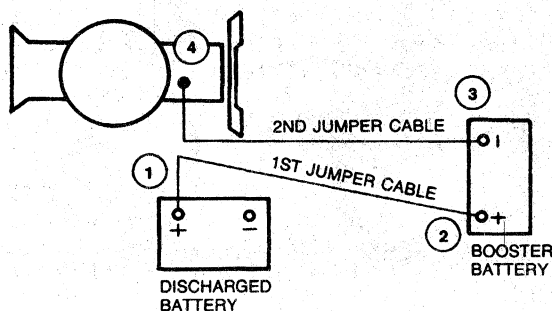
To avoid damage to the vehicle and battery or the possibility of personal harm, follow these instructions and precautions:

**TESTING (Continued)**

## 3. Make jumper cable connections.

- Connect one end of the first jumper cable to the positive (+) terminal of the discharged battery and the other end to the positive (+) terminal of the booster battery.
- Connect one end of the second jumper cable to the negative (-) terminal of the booster battery. Connect the other end to an engine bolthead or good metallic contact spot on the engine of the vehicle to be started, **not to the negative (-) battery terminal**.

**MAKE CONNECTION IN NUMERICAL ORDER (DISCONNECT IN REVERSE ORDER 4, 3, 2, 1).**



**MAKE SURE VEHICLES DO NOT TOUCH**

J2319-B

**WARNING: DO NOT ATTACH THE OTHER END TO THE NEGATIVE (-) BATTERY TERMINAL, BECAUSE A SPARK COULD OCCUR AND CAUSE EXPLOSION OF GASES NORMALLY PRESENT AROUND THE BATTERY. REFER TO WARNING AT THE BEGINNING OF THE JUMP STARTING PROCEDURE.**

- Ensure the jumper cables are not in the way of moving engine parts.
  - Start the engine of the vehicle with the good battery. Run the engine at a moderate speed.
  - Start the engine of the vehicle with the discharged battery. Follow starting instructions in the Owner Guide.
  - Leave all switches off except the heater blower motor. Reduce engine speed to idle on both vehicles to prevent possible damage to the vehicle electrical system.
4. Remove cables in exact **reverse** sequence. Begin by removing cable from engine of vehicle that had discharged battery.

If the starter does not turn the engine over, even with the booster battery attached, refer to On Vehicle Testing.

**On Vehicle Testing**

Place the transaxle in **NEUTRAL** or **PARK**. Disconnect vacuum line to Thermactor bypass valve before performing any cranking tests. After tests, run engine three minutes before connecting vacuum line.

**Starter Cranks Slowly**

- **Battery:** Use jumper cables per instructions. If this corrects the problem, check the condition of the battery. Recharge or replace the battery if necessary. Clean the battery posts and cable lugs making sure to tighten the connections.
- **Cables:** If the above does not correct the problem, clean and tighten the connections at the starter relay and battery ground on the engine. Eyelet terminals should not be easily rotated by hand. Also check for a short to ground.

If the above does not correct the problem, replace the starter.

**Starter Does Not Crank But Starter Relay Operates (Clicks)**

- **Cables:** Clean and tighten connections at the starter and the relay. Ensure the wire strands are secure in the eyelets.

If the above does not correct the problem, replace the starter.

**Starter Does Not Crank And Relay Chatters Or Does Not Click**

- **Battery:** Use jumper cables. Check battery as previously mentioned.
- Remove push-on connector from the relay (red w/blue stripe wire). Ensure the connection is clean and secure and that the relay bracket is grounded. If the connections are good, check the operation of the relay with a jumper wire. Place the transaxle in **PARK** or **NEUTRAL**. Remove the push-on connector from the relay. Using a jumper wire, jump from the now exposed terminal on the starter relay to the main terminal (battery side or battery positive post). If this corrects the problem, check the **IGNITION** switch, **NEUTRAL** switch and wiring in the starting circuit for open or loose connections.

If a jumper wire across the relay does not correct the problem, replace the relay.

**Starter Spins (Humming Noise) But Does Not Crank Engine**

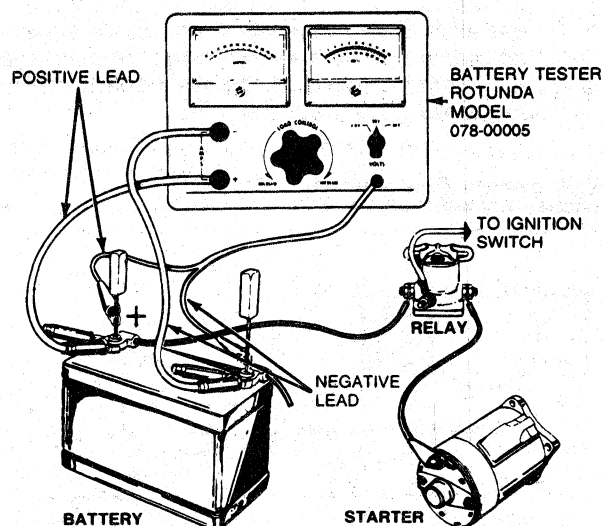
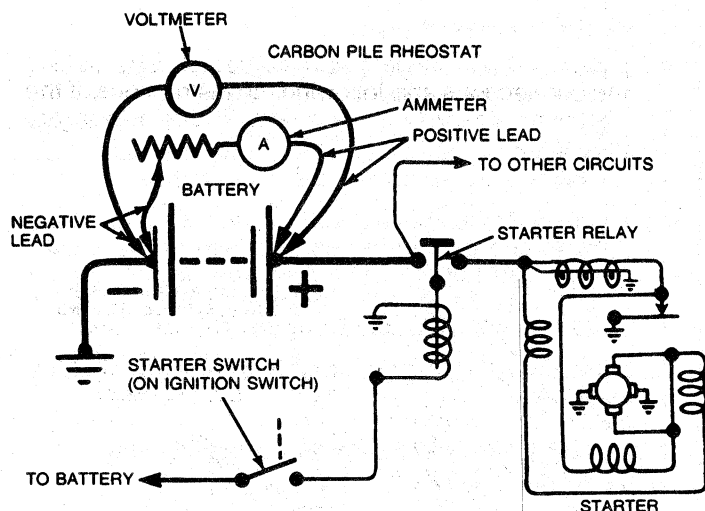
**Starter:** Remove and check the armature shaft for corrosion. Clean or replace. If no corrosion is found, service starter or replace slipping drive assembly.

**TESTING (Continued)****Starter Load Test**

Conduct this test if the starter cranks slowly and it is desired to compare current to specifications.

Connect the Rotunda Battery Tester 078-00005 or equivalent. Verify that no current is flowing through

the ammeter and heavy-duty carbon pile rheostat portion of the circuit (rheostat at maximum counterclockwise position).



J2254-F

Place transaxle in NEUTRAL or PARK. Crank the engine with the ignition off, and determine the exact reading on the voltmeter. This test is accomplished by disconnecting the push-on connector S at starter relay and by connecting a remote-control STARTER switch from the positive battery terminal to the S terminal of the starter relay.

Stop cranking engine, and reduce resistance of carbon pile until voltmeter indicates the same reading as that obtained while the starter cranked the engine. The ammeter will indicate the starter current draw under load. Normal load starter current draw is 150-250 amps.

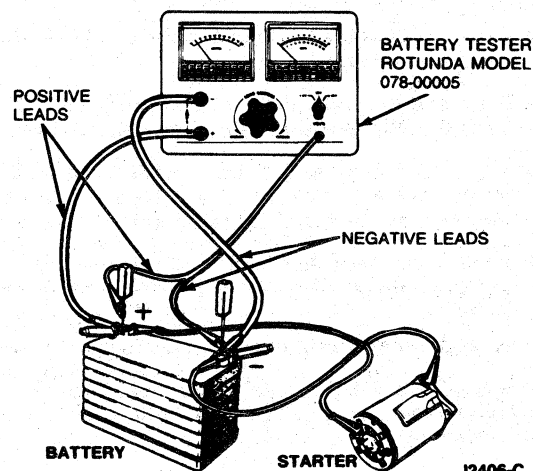
**Bench Tests****Starter No-Load Test**

The starter no-load test will uncover such conditions as open or shorted windings, rubbing armature, and bent armature shaft. The starter can be tested, at no-load, on the test bench only.

Make the test connections with the Rotunda Battery Tester 078-00005 or equivalent cables connected to the starter, large enough to carry high current—the same as in the vehicle. The starter will run at no-load. Verify that no current is flowing through the ammeter (rheostat at maximum counterclockwise position). Determine the exact reading on the voltmeter.

Disconnect the starter from the battery, and reduce the resistance of the rheostat until the voltmeter indicates the same reading as that obtained while the starter was running. The ammeter will indicate the starter no-load current draw. Starter no-load current draw is 80 amps.

If current exceeds specification, check for rubbing armature, bent shaft, binding bearings, or shorts in armature, fields or brush assembly.



J2406-C

**TESTING (Continued)****Armature Open Circuit Test**

An open circuit armature may sometimes be detected by examining the commutator for evidence of burning. A burn spot on the commutator is caused

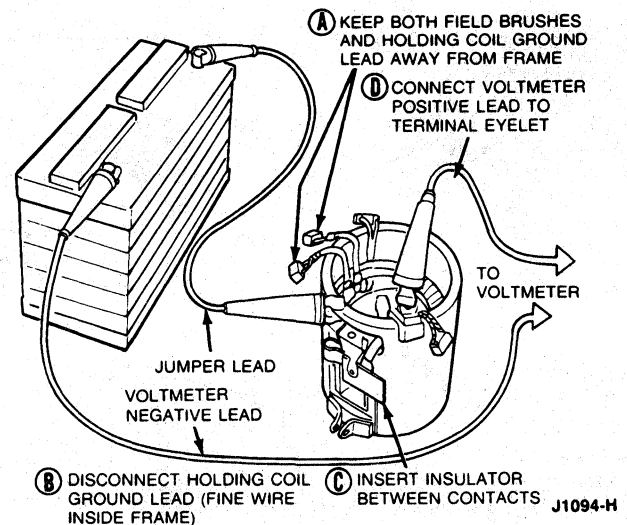
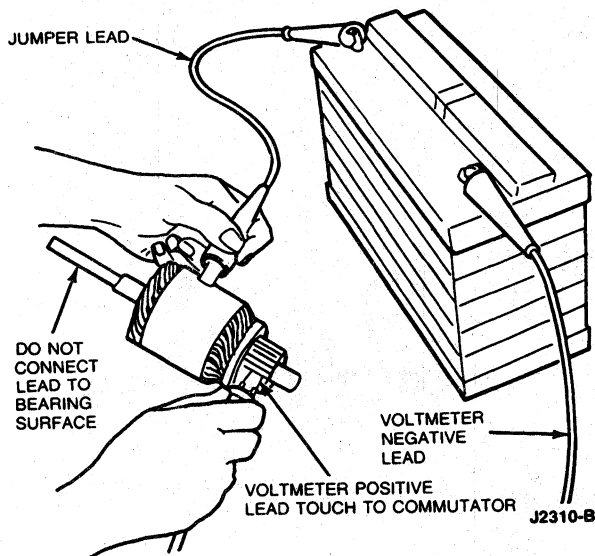
by an arc formed every time the commutator segment, connected to the open circuit winding, passes under a brush.

**Armature and Field Grounded Circuit Test**

This test will determine if the winding insulation has failed, permitting a conductor to touch the frame or armature core.

To determine if the armature windings are grounded, make the connections. If the voltmeter indicates any voltage, the windings are grounded.

Grounded field windings can be detected by making the connections and following the instructions. If the voltmeter indicates any voltage, the windings are grounded.

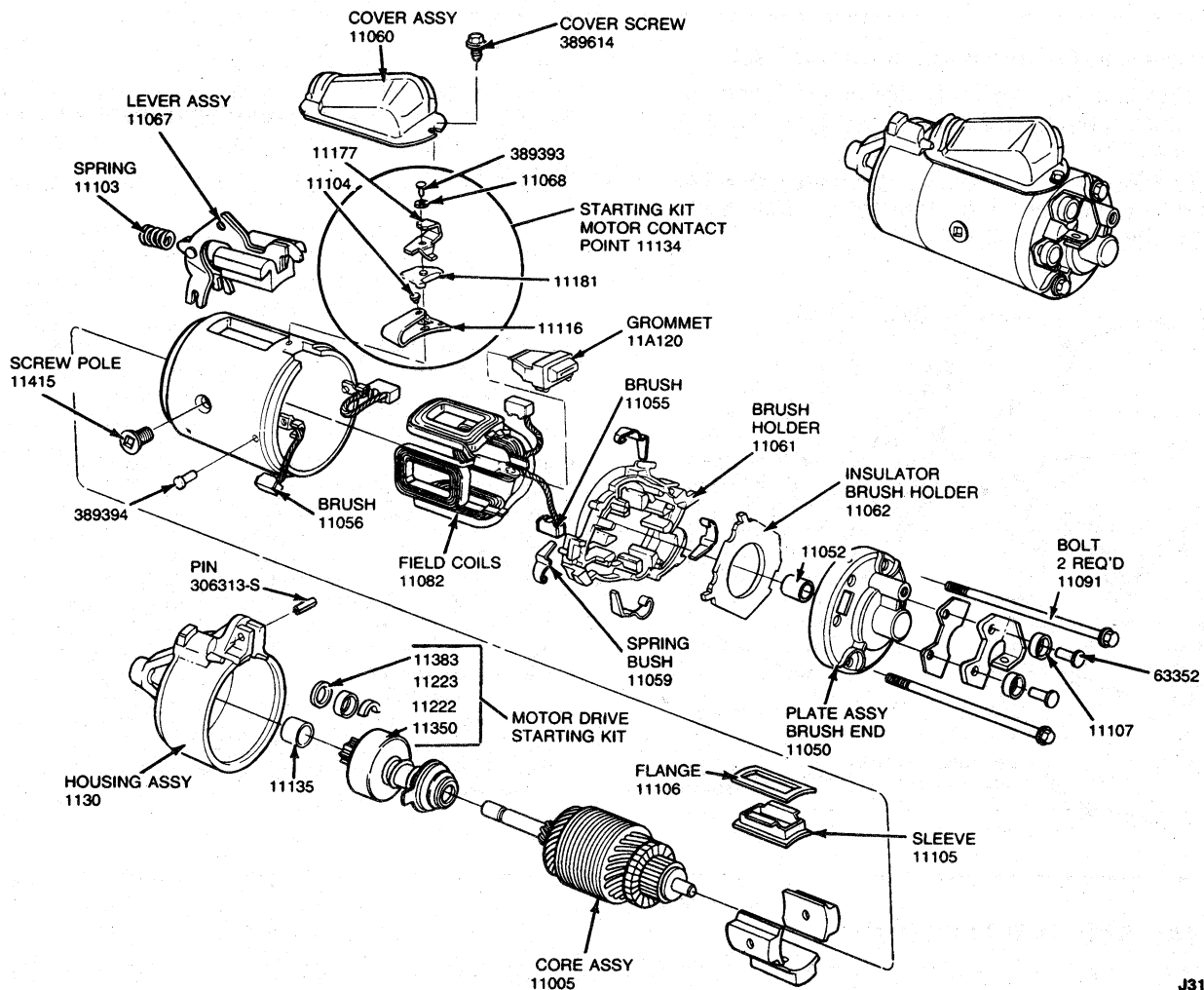
**REMOVAL AND INSTALLATION****Starter Motor****Removal and Installation**

1. Disconnect negative battery cable and cable connection at starter.
2. Remove cable support and ground cable connection from upper starter stud bolt.
3. Remove starter brace from cylinder block and starter.
4. On 2.5L engines, remove three starter-to-bell housing bolts. On 3.0L engines, remove two starter-to-bell housing bolts.
5. Remove starter between sub-frame and radiator (automatic transmission). Remove starter between sub-frame and engine (manual transmission).
6. To install, reverse Steps 1 through 5. Refer to Specifications during installation.

## DISASSEMBLY AND ASSEMBLY

**Starter**

Use the following procedure when it is necessary to overhaul the starter. Refer to the illustration for a disassembled view of the starter.



J3118-A

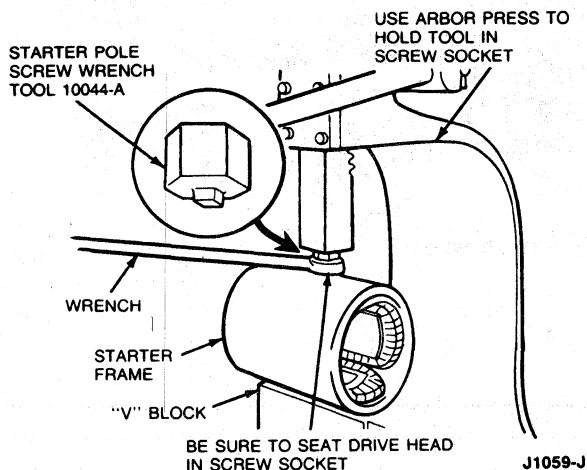
**Disassembly**

1. Remove cover screw, cover and through bolts.
2. Remove pivot pin retaining starter gear plunger lever. Remove lever, starter drive end housing armature and drive plunger return spring.
3. Remove stop ring retainer and thrust washer from armature shaft. Remove stop ring from groove in armature shaft and discard. Remove starter drive gear assembly.
4. Remove brush end plate and insulator assembly.
5. Remove brushes from plastic brush holder and lift out brush holder. Note location of brush holder with respect to end terminal.
6. Remove two copper rivets retaining ground brushes to frame.
7. Bend up edges of sleeve which is inserted in rectangular hole in frame. Remove sleeve and retainer. Detach shunt field coil ground wire from copper tab riveted to frame.

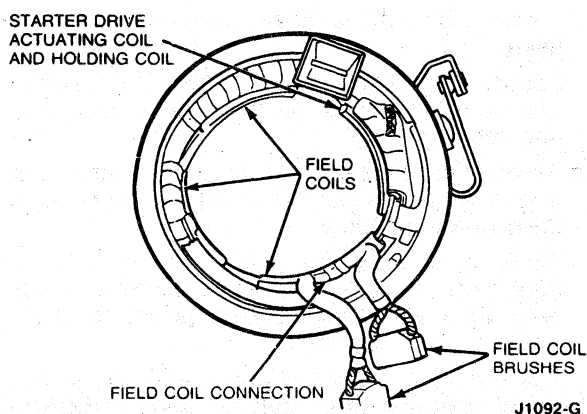


## DISASSEMBLY AND ASSEMBLY (Continued)

8. Remove three pole shoe retaining screws, using Starter Polescrew TOOL-10044-A or equivalent, and an arbor press. The arbor press prevents the wrench from slipping out the screw. Cut field coil connection at switch post lead and remove pole shoes and coils from frame.

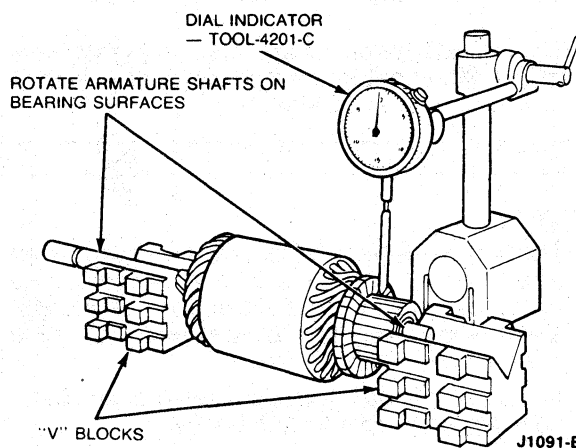


9. Cut positive brush leads from field coils, as close to field connection point as possible.



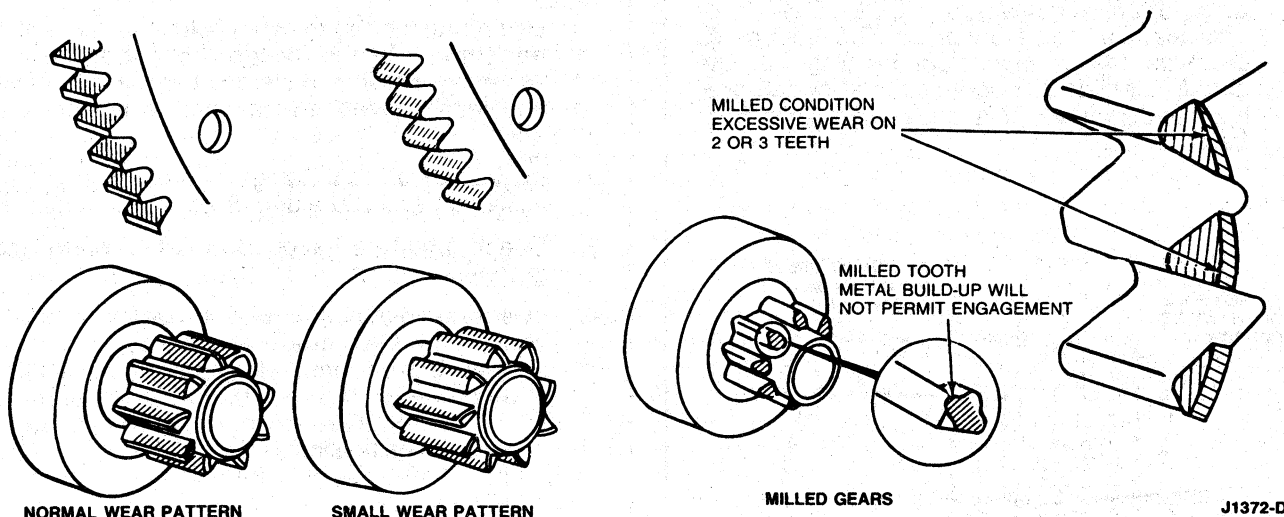
## Cleaning and Inspection

1. Use a brush or air to clean field coils, armature assembly, brush holder, brushes, drive assembly, brush end plate assembly, and drive end housing. Wash all other parts in solvent and dry.
2. Inspect armature windings for broken or burned insulation and unwelded or open connections.
3. Check armature for open circuits, shorts and grounds.
4. Check commutator for runout. Inspect armature shaft and two bearings for scoring and excessive wear with Dial Indicator TOOL-4201-C or equivalent. If commutator is rough, or more than 0.13 mm (0.005-inch) out-of-round, turn it down to specification.



5. Check plastic brush holder for cracks or broken mounting pads. Replace brushes if worn to 6.4mm (1/4-inch) in length.
6. Inspect field coils for burned or broken insulation and continuity.
7. Check field brush connections. A brush kit and contact kit are available. All other assemblies are to be replaced rather than serviced.
8. Examine wear pattern on starter drive teeth. The pinion teeth must penetrate to a depth greater than one-half the ring gear tooth depth to eliminate premature ring gear and starter drive failure.

## DISASSEMBLY AND ASSEMBLY (Continued)



9. Replace starter drives and ring gears that have milled, pitted or broken teeth or show evidence of inadequate engagement.

**Assembly**

1. Position coils and pole pieces, then install retaining screws. As the pole shoe screws are tightened, strike frame several sharp blows with a soft faced hammer to seat and align pole shoes, then stake screws.
2. Install plunger coil sleeve and retainer and bend tabs to retain coils to frame.
3. Position grommet on end terminal. Align into notch in frame.
4. Solder field coil to starter switch terminal post. Use 300-watt iron and rosin core solder.
5. Check for continuity and grounds in assembled coils.
6. Position ground brushes to starter frame and rivet securely.
7. Apply a thin coating of Lubriplate 777 or equivalent on armature shaft splines. Install starter motor drive gear assembly to armature shaft. Install a new stop ring. Install a new stop ring retainer and thrust washer.
8. Install armature in starter frame.
9. Position starter drive gear plunger lever to frame and starter drive assembly. Apply grease into end housing bearing bore (approximately 1/4 full). Position drive end housing to frame, ensuring lever return spring engages tang on lever. Install pivot pin.
10. Install brush holder, insert brushes in holder and install brush springs. Positive brush leads should be positioned in their respective slots in brush holder to prevent potential grounding.
11. Install brush end plate. Ensure end plate insulator is positioned properly on end plate.

12. Install two through bolts to the starter frame. Tighten to 6-9 N·m (55-80 lb-in).
13. Install starter drive plunger lever cover and tighten retaining screw.
14. Check starter no-load current draw. The no-load current draw specification is 80 amps.

**Starter Drive Replacement**

1. Remove plunger lever cover.
2. Remove pivot pin retaining starter drive plunger lever.
3. Loosen through bolts enough to allow removal of drive end housing, starter drive plunger lever and return spring.
4. Remove drive gear stop ring retainer and stop ring from groove in armature shaft and remove drive gear assembly.
5. Apply a thin coating of Lubriplate 777 or equivalent on armature shaft splines. Install new drive gear assembly on armature shaft. Install a new stop ring.
6. Position starter gear plunger lever on starter frame. **Ensure that plunger lever properly engages starter drive assembly.**
7. Install a new stop ring retainer. Partially fill drive end housing bearing bore with grease (approximately 1/4 full). Position starter drive plunger lever return spring and drive end housing to starter frame. Tighten through bolts to 6-9 N·m (55-80 lb-in). Install pivot pin.
8. Position starter drive plunger lever cover on starter. Tighten retaining screw.

**DISASSEMBLY AND ASSEMBLY (Continued)****Armature Replacement**

1. Remove plunger lever cover.
2. Remove through bolts, pivot pin, drive end housing, drive plunger lever return spring, and brush end plate.
3. Remove starter gear plunger lever. Remove brushes and lift out brush holder.
4. Remove armature. If starter drive gear assembly is being reused, remove stop ring retainer and stop ring from end of armature shaft. Remove drive gear assembly.
5. Place drive gear assembly on new armature with a new stop ring, thrust washer and retainer.
6. Install armature in starter frame.
7. Position drive gear plunger lever to frame and drive gear assembly.
8. Partially fill drive end housing bearing bore with grease (approximately 1/4 full). Position drive plunger lever return spring, and drive end housing to starter frame. Ensure stop ring retainer is seated properly in drive housing. Install pivot pin.
9. Install brush holder and insert brushes in holder. Install brush springs. Positive brush leads should be positioned in their respective slots to prevent grounding.
10. Install brush end plate. (Be certain end plate insulator is positioned properly on end plate).
11. Install two through bolts to starter frame. Tighten to 6-9 N·m (55-80 lb-in).
12. Install plunger lever cover and tighten retaining screw.
13. Check the starter no-load current draw. The starter no-load current draw specification is 80 amps.

**SPECIFICATIONS**

Positive Engagement Starter Motor								Starter Brushes				Torque Specifications					
Diameter		Current Draw Under Normal Load	Normal Engine Cranking Speed	Min. Stall @ 5 Volts		Max. Load	No Load	Mfg. Length		Spring Tension		Through Bolt		Mounting Bolt		Cable Attaching Screw	
mm	In	Amps	RPM	N-m	Lb-Ft	Amps	Amps	mm	In	N	oz.	N-m	Lb-In	N-m	Lb-Ft	N-m	Lb-In
102	4	150-250	190-260	12.9	9.5	500	80	11.4	.45	22	80	5.1-9.6	45-85	41-54	30-40	8.0-12.4	70-110

Maximum Commutator runout is 0.12 mm (0.005 inch) Maximum starting circuit voltage drop (battery positive terminal to starter terminal) at normal engine temperature is 0.5 volt.

CJ2258-C

**SPECIAL SERVICE TOOLS**

Tool Number	Description
T00L-4201-C	Dial Indicator
T00L-10044-A	Starter Polescrew Wrench

CJ2259-D

**ROTUNDA EQUIPMENT**

Model	Description
078-00005	Battery Tester

CJ2672-A



# CHARGING SYSTEM

# GROUP 31

(10000)

SECTION TITLE	PAGE	SECTION TITLE	PAGE
ALTERNATOR—ELECTRONIC REGULATOR . . . .	31-15-1	BATTERIES . . . . .	31-02-1
ALTERNATOR—INTEGRAL REGULATOR . . . .	31-17-1	CHARGING SYSTEM—SERVICE . . . . .	31-01-1
ALTERNATOR—SIDE TERMINAL . . . . .	31-12-1	IGNITION SWITCH . . . . .	31-20-1

## SECTION 31-01 Charging System—Service

SUBJECT	PAGE	SUBJECT	PAGE
ADJUSTMENTS		SPECIAL SERVICE TOOLS . . . . .	31-01-18
Drive Belt . . . . .	31-01-2	TESTING	
DESCRIPTION AND OPERATION		Charging System Tests . . . . .	31-01-5
Charging System . . . . .	31-01-1	Fuse Link Continuity . . . . .	31-01-10
Fuse Link . . . . .	31-01-2	Indicator Lamp System . . . . .	31-01-4
DIAGNOSIS		On Vehicle Tests . . . . .	31-01-3
Battery Check . . . . .	31-01-11	Regulator S and/or I Circuit . . . . .	31-01-9
Charging System Check . . . . .	31-01-11	VEHICLE APPLICATION . . . . .	31-01-1
Isolating the Problem . . . . .	31-01-11		
Preliminary Checks . . . . .	31-01-11		

### VEHICLE APPLICATION

Taurus/Sable.

### DESCRIPTION AND OPERATION

#### Charging System

##### EVR and IAR Systems

The External Voltage Regulator (EVR) system has the voltage regulator mounted on the RH fender apron of the vehicle.

The Integral Alternator/Regulator (IAR) system has a solid-state voltage regulator located in the alternator itself.

#### External Voltage Regulator (EVR)

The alternator charging system is a negative ground system consisting of an alternator, an external regulator, charge indicator, storage battery, fuse link and associated wiring. Refer to the Electrical and Vacuum Troubleshooting manual for schematics and locations of wiring harness.

**DESCRIPTION AND OPERATION (Continued)****Integral Alternator/Regulator (IAR)**

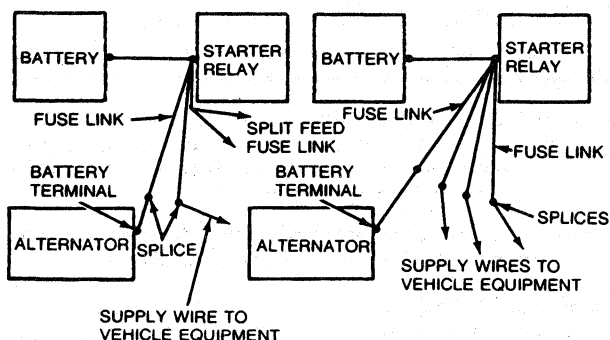
The integral alternator/regulator charging system is a negative ground system and consists of an alternator, an internal regulator, charge indicator, storage battery, fuse link and associated wiring. Refer to the Electrical and Vacuum Troubleshooting manual.

**Fuse Link**

The fuse link is a short length of insulated wire integral with the engine compartment wiring harness. It is four wire gauges smaller than the circuit which it protects. Production fuse links and their identification flags are identified by the flag color.

Service fuse links are Brown, Green or Black depending on usage. All fuse links have a flag moulded on the wire or on the terminal insulator. Color identification of the flag or connector for the external voltage regulator system is Dark Blue 20-gauge wire, Brown 18-gauge wire, Black 16-gauge wire, Dark Green 14-gauge wire, or Gray 12-gauge wire. The color identification on the IAR system is Blue 20-gauge wire, Red 18-gauge wire, Orange 16-gauge wire, Green 14-gauge wire, Yellow 12-gauge wire (used on Police and Taxi).

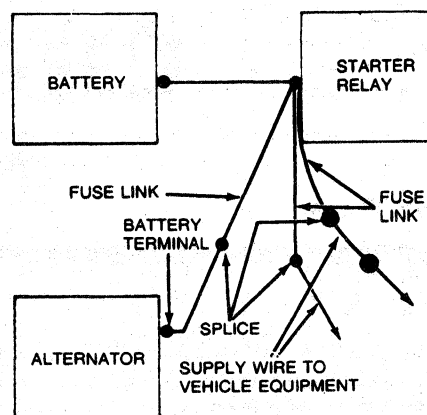
The following illustrations show typical fuse link installations for the EVR and IAR systems.

**EVR****EVR SYSTEM**

WITH INSTRUMENTS

WITH WARNING LAMPS

J2391-B

**IAR****IAR SYSTEM**

J1431-J

When heavy current flows, such as the result of a booster battery connected incorrectly, or when a short to ground occurs in the wiring harness, the fuse link burns out and protects the alternator or wiring.

A burned out fuse link may have bare wire ends protruding from the insulation, or it may only have expanded or bubbled insulation with unreadable identification. When it is hard to determine if the fuse link is burned out, perform a continuity test as outlined.

Refer to Section 34-50 for testing and service procedures for fuse links used in the charging system.

**ADJUSTMENTS****Drive Belt**

Refer to the Powertrain manual, Section 27-02 for drive belt adjustment.

**TESTING**

A voltmeter (0- to 20-volt scale), ohmmeter such as Rotunda Digital Volt-Ohmmeter 007-00001 or an equivalent, jumper wire and a test lamp (12-volt) are the only tools required to perform an accurate check of the complete charging system. Test meter calibration should be checked once a year and the date of calibration stamped on the meter face. It is recommended that this practice be followed by all technicians to maintain their test meters at acceptable accuracy.

The tests are divided into On Vehicle and On Bench test procedures. The On Bench procedures are described under the applicable component in Sections 31-02, 31-12, 31-15 or 31-17.

## TESTING (Continued)

Troubleshooting or diagnosis is required before actual service can be made in the electrical system. Even where an obvious condition makes replacement of a unit necessary, find out why the unit failed. When a condition is diagnosed correctly, unnecessary service is prevented, the time the vehicle is out of service will be decreased, and the condition will be properly corrected the first time.

### On Vehicle Tests

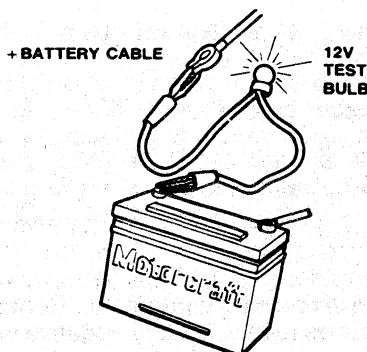
Before performing charging system tests on the vehicle, note conditions such as: slow cranking speed, battery dead, top of battery wet, alternator charge indicator lamp does not come on or never goes out. This information will aid in isolating the part of the system causing the problem. Refer to Section 31-02 for battery warnings and cautions.

### Visual Inspection

1. Check fuse link located between starter relay and alternator. If burned, determine cause, service system and replace fuse link.
2. The **battery** must be in proper state of charge (12.60 specific gravity). Check **battery posts** and **battery cable terminals** for clean and tight connections. Remove battery cables (if corroded), clean, and install them securely.
3. Check for **clean and tight wiring connections** on alternator, regulator and engine.
4. Check alternator belt tension and tighten to specification, if necessary, as outlined.

### Battery Drain

1. Connect a 12-volt test lamp in-series with positive battery terminal. Test with all switches off. Do not be misled by clock-winding current. Touch cable clamp to terminal to wind clock.
2. If lamp glows, pull fuses one at a time, and check each circuit for a short. Service wiring harnesses or components as required.



J2819-A

### Constant Current Drain Test

Discharged maintenance-free batteries could be caused by the following:

1. Glove compartment, hood, luggage compartment, or courtesy lamps staying on because of misaligned or inoperative switches.
2. Cooling fan relays, antenna motors, and other energized components remain on.
3. Pinched or grounded wire harness.

To determine whether a constant current drain condition exists, perform the following test:

#### Without Message Center

Use a 12-volt test lamp for this test:

1. Turn off all vehicle electrical circuits. To check for minimum battery charge and/or condition of bulb, connect test lamp across battery terminals. Lamp should light. Disconnect test lamp.
2. Disconnect either positive or negative battery cable. Connect 12-volt test lamp between cable terminal and battery post.
3. If lamp glows, connect terminal to post for 5 seconds, then repeat to verify results.

#### Test Conclusions

- Lamp does not glow: No current drain.
- Lamp does glow: Check individual circuits to locate cause of current drain. Underhood lamp, luggage compartment lamp, glove compartment lamp, reading or vanity mirror lamps are prime suspects.

#### With Message Center

1. Turn off all vehicle electrical circuits.
2. Disconnect either positive or negative battery cable.
3. Using Rotunda Digital Volt-Ohmmeter 007-00001 or equivalent, connect an ammeter (set at the highest current scale) between the cable terminal and battery post.
4. Reduce to an appropriate scale for an accurate reading (allow one minute to stabilize).

#### Test Conclusions

- Drain current less than 0.05A: No current drain problems.
- Drain current greater than 0.05A: Check individual circuits to locate cause of current drain. Underhood lamp, luggage compartment lamp, glove compartment lamp, reading or vanity mirror lamps are prime suspects.

NOTE: When the Message Center is initially powered-up (after a battery disconnect), the Message Center "computer" may be energized for as long as one minute causing a .25A current draw before returning to the normal .010 - .012A current draw. Therefore, it is important to allow at least one minute to pass (after ammeter hookup) before observing any current measurements.

**TESTING (Continued)**

NOTE: A voltmeter is sometimes used for this test but it will react to a very small normal drain caused by "always-on" electronic systems such as Starter Interlock, Anti-Theft Alarm, Illuminated Entry, etc., which are so small they cause no problem. The test lamp shows only drains which are large enough to cause a problem.

**Indicator Lamp System****Normal Charge Indication**

The new Integral Alternator Regulator (IAR) has a circuit in the regulator that will indicate a high battery voltage condition. With the IAR system, two conditions can cause the charge indicator lamp to come on during vehicle operation:

1. No alternator output: damaged alternator, regulator or wiring.
2. Over voltage correlation: shorted alternator rotor, regulator or wiring.

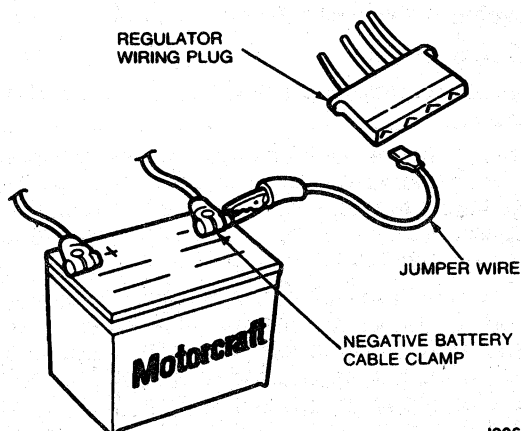
With ignition switch in the OFF position: Charge indicator battery symbol lamp is off.

With ignition switch in the RUN position (engine not running): Charge indicator (alternator) lamp is on.

With ignition switch in the RUN position (engine running): Charge indicator (alternator) lamp is off.

**EVR System**

1. If charge indicator lamp does not come on with ignition key in RUN position and engine not running, check the I wiring circuit (ignition switch to regulator I terminal) for open circuit or burned out charge indicator lamp.
2. If charge indicator lamp does not come on, disconnect wiring plug connector at regulator and connect a jumper wire from the I terminal of regulator wiring plug to negative battery post cable clamp.

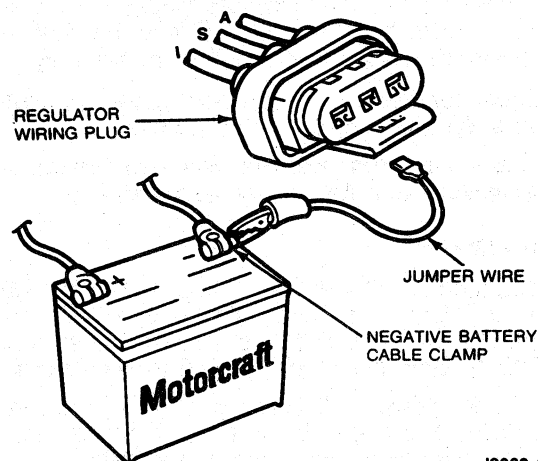


J3067-A

3. Charge indicator lamp should go on with ignition key turned to RUN position.
4. If charge indicator lamp does not go on, check for presence of bulb socket resistor. If resistor is missing, replace bulb socket. If resistor is present, check for contact of bulb socket leads to the flexible printed circuit. If good, check indicator bulb for continuity and replace if burned out.
5. If bulb and socket are good and socket leads are in contact with the flexible printed circuit, open circuit exists between ignition switch and regulator.
6. Check 500 ohm resistor across indicator lamp.

**IAR System**

1. If charge indicator lamp does not come on, disconnect wiring connector from regulator and connect a jumper wire from wiring connector I terminal to battery negative post cable clamp.

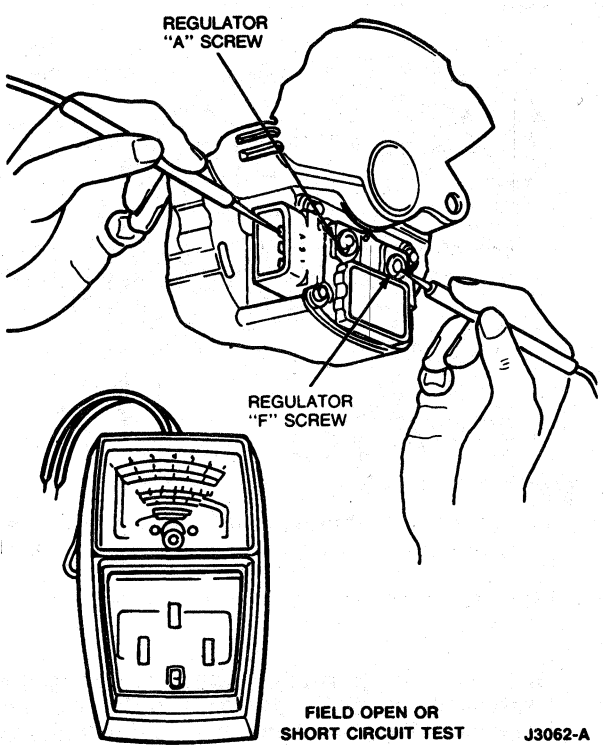


J3068-A

2. Turn ignition to RUN position with engine off. If indicator lamp does not light, check for presence of bulb socket resistor. If resistor is missing, replace bulb socket. If resistor is present, check for contact of bulb socket leads to the flexible printed circuit. If good, check indicator bulb for continuity and replace bulb if burned out. If bulb checks good, perform regulator I circuit test.
3. If indicator lamp does light, remove jumper wire and reconnect wiring plug to regulator. Connect voltmeter negative lead to battery negative post cable clamp and contact voltmeter positive lead to regulator A terminal screw. Battery voltage should be indicated. If battery voltage is not indicated, service A circuit wiring.



## TESTING (Continued)



REGULATOR "A" SCREW

REGULATOR "F" SCREW

FIELD OPEN OR SHORT CIRCUIT TEST

J3062-A

4. If battery voltage is indicated, clean and tighten ground connections to engine, alternator and regulator. Tighten loose regulator mounting screws to 1.7-2.8 N·m (15-24 lb-in).
5. Turn ignition to RUN position with engine off. If indicator lamp still does not light, replace regulator.

## Charging System Tests

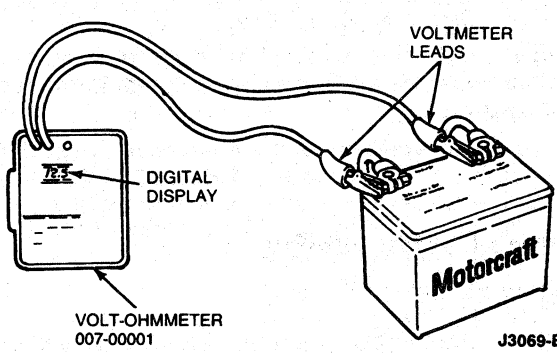
When performing charging system tests, turn off all lamps and electrical accessories. Place transmission in NEUTRAL and apply parking brake.

**CAUTION: Do not make jumper wire connections except as directed. To do so may damage regulator.**

NOTE: Battery posts and cable clamps must be clean and tight to ensure accurate meter indications.

## Base Voltage

1. With ignition switch in OFF position and no electrical load on, connect negative lead of test voltmeter to negative battery cable clamp.
2. Connect positive lead of voltmeter to positive battery cable clamp.



VOLTMETER LEADS

DIGITAL DISPLAY

VOLT-OHMMETER 007-00001

Motorcraft

J3069-B

3. Record battery voltage reading shown on voltmeter scale. (This is called base voltage).

**No Load**

1. Connect a tachometer to engine.
2. Start engine and increase speed to approximately 1500 rpm. With no other electrical load (foot off brake pedal and vehicle doors closed), voltmeter pointer should move upward (increase) but not more than 2.0 volts above base voltage (the first recorded battery voltage reading). The reading should be taken when voltmeter pointer stops rising. It may take a few minutes to reach this point.

If voltage increases the proper amount, go to Load Test. If voltage increases over 2 volts, perform the Over Voltage Tests. If voltage does not increase, perform Under Voltage Tests.

**Load**

1. With engine running, turn heater/air conditioner blower motor on (high speed) and headlamps on (high beam).
2. Increase engine speed to 2000 rpm. Voltmeter should indicate a minimum of 0.5 volt above base voltage. If not, perform Under Voltage Test.

If above tests indicate proper voltage readings, charging system is operating normally. Use test lamp and check for battery drain.

## Over Voltage

## EVR System

1. If voltmeter reading indicates more than 2.0 volts above base battery voltage, connect a jumper wire between regulator base and alternator frame. Repeat No Load Test. If over voltage condition disappears, check ground connections on alternator, regulator and from engine to dash panel and to battery. Clean and tighten connections securely.

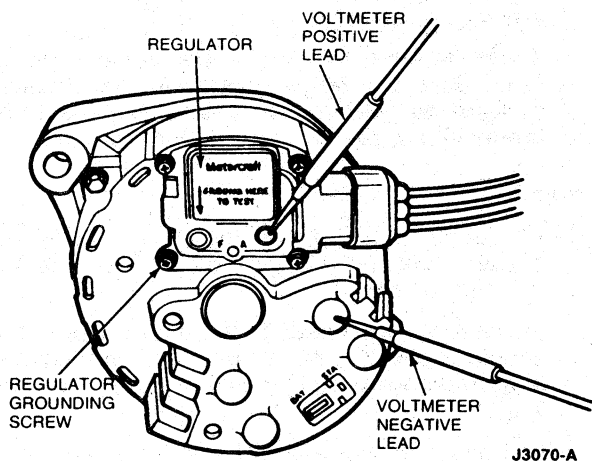
## TESTING (Continued)

2. **If over voltage condition still exists**, disconnect regulator wiring plug from regulator and repeat No Load Test.
3. **If over voltage condition disappears** (voltmeter reads base voltage), replace voltage regulator.
4. **If over voltage still exists with regulator wiring plug disconnected**, check for short between circuits A and F in wiring harness, and service as necessary. Then, connect regulator wiring plug to regulator.

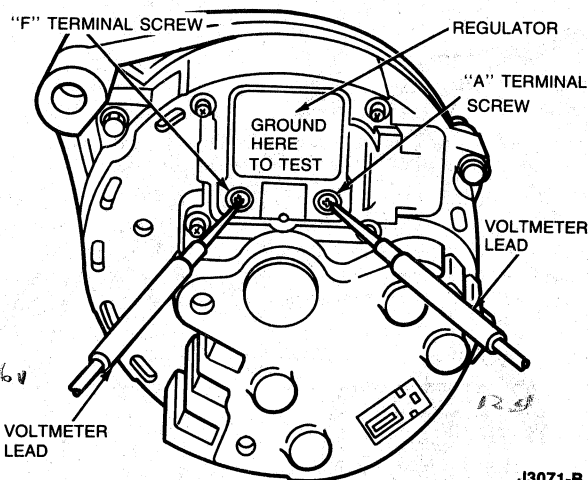
## IAR System

If the voltmeter indicates more than 2.5 volts above base voltage in the No Load Test, follow these procedures:

1. With ignition switch in RUN position and engine off, connect voltmeter negative lead to alternator rear housing. Contact voltmeter positive lead first to alternator output connection at starter solenoid and then to regulator A screw head.
2. If voltage difference between the two locations is greater than 0.5 volt, service A wiring circuit to eliminate high resistance condition indicated by excessive voltage drop.



3. **If over voltage condition still exists**, check for loose regulator-to-alternator grounding screws. Tighten loose regulator grounding screws to 1.7-2.8 N·m (15-24 lb-in).
4. **If over voltage condition still exists**, connect voltmeter negative lead to alternator rear housing. With ignition switch in OFF position, contact voltmeter positive lead first to regulator A screw head and then to regulator F screw head. Different voltage readings at two screw heads indicate damaged regulator, grounded brush lead, or grounded rotor coil. Service entire integral alternator/regulator assembly.

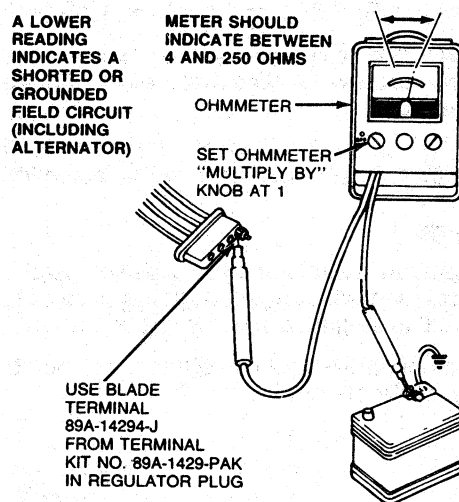


5. **If same voltage reading (battery voltage) is obtained at both screw heads**, replace regulator. Refer to illustration under Indicator Lamp System Normal Charge Indication, IAR System.

## Under Voltage

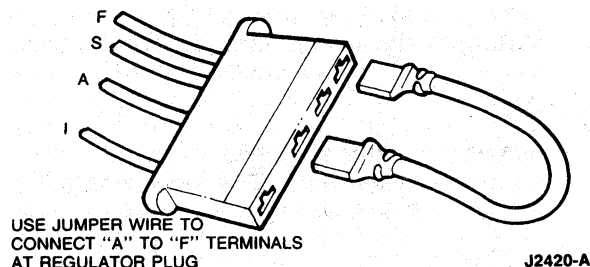
## EVR System

1. **If voltmeter does not indicate more than 0.5 volt above base voltage**, disconnect wiring plug from regulator and connect an ohmmeter from F terminal of plug to ground. Meter should indicate more than 2.4 ohms. If less than 2.4 ohms is indicated, service grounded field circuit in wire harness or alternator and repeat Load Test.



## TESTING (Continued)

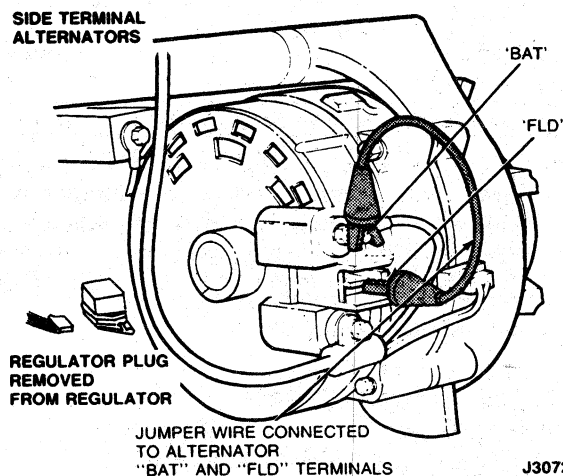
2. If ohmmeter indicates more than 2.4 ohms, connect a jumper wire from A to F terminals of plug and repeat Load Test.



J2420-A

Perform S and I Circuit Tests, and service wiring or regulator as required.

3. If voltmeter still indicates a problem of under voltage, remove jumper wire from regulator plug and leave plug disconnected from the regulator. Disconnect FLD terminal on alternator and pull back protective cover from BAT terminal. Then, connect a jumper wire to FLD and BAT terminals on alternator and repeat Load Test.



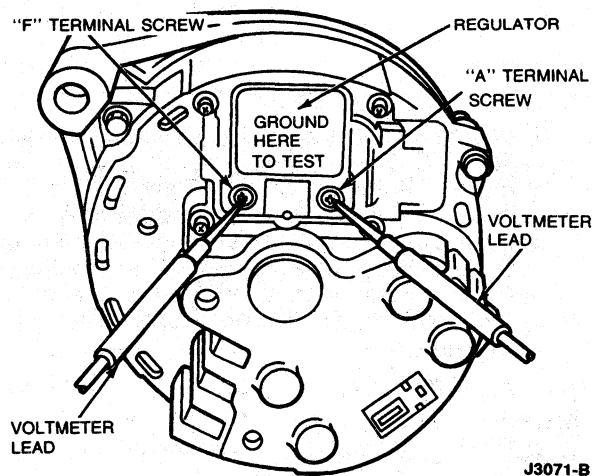
J3072-A

4. If voltmeter now indicates a 0.5 volt or more increase above base voltage, perform S and I Circuit Tests and service wiring or regulator as indicated.
5. If voltmeter still indicates under voltage, stop engine and move positive voltmeter lead to BAT terminal of alternator.
6. If voltmeter now indicates base voltage, service alternator. Refer to Section 31-12. If voltmeter indicates zero volts, service alternator-to-starter relay wire (Circuit 38).

## IAR System

If voltmeter does not indicate more than 0.5 volt above base voltage:

1. Disconnect wiring plug from regulator and connect an ohmmeter between regulator A and F terminal screws. The meter should indicate more than 2.4 ohms. If less than 2.4 ohms is indicated, service integral alternator/regulator unit for failed regulator and check alternator for shorted rotor or field circuit. Perform Load Test after servicing.

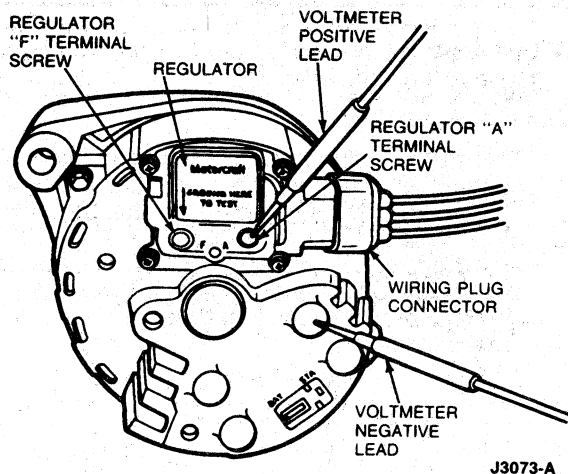


J3071-B

## TESTING (Continued)

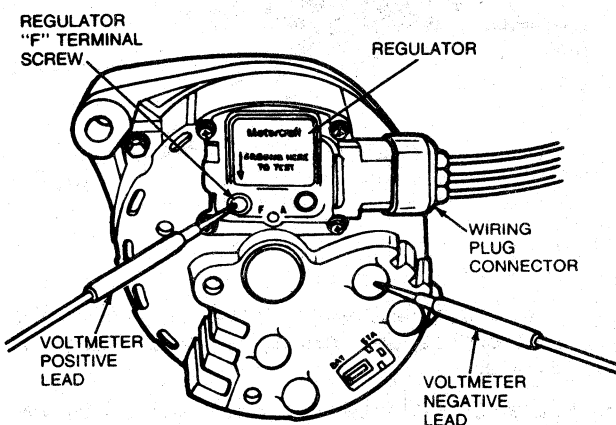
**CAUTION:** Do not replace the regulator before a shorted rotor coil or field circuit has been serviced. Regulator damage could result.

2. If above ohmmeter reading is greater than 2.4 ohms, connect regulator wiring plug and connect voltmeter ground lead to alternator rear housing. Contact voltmeter positive lead to regulator A terminal screw. The meter should indicate battery voltage. If there is no voltage, service the A wiring circuit. Perform Load Test after servicing.



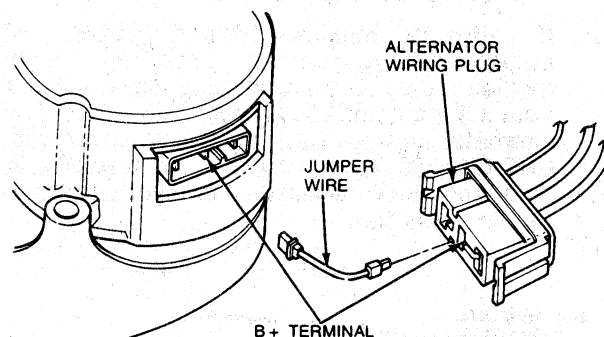
J3073-A

3. If voltmeter indicates battery voltage, connect voltmeter ground lead to alternator rear housing. With the ignition switch in OFF position, contact voltmeter positive lead to regulator F terminal screw. The meter should indicate battery voltage. If there is no voltage, service integral alternator/regulator unit for an open field circuit. Perform Load Test after servicing.



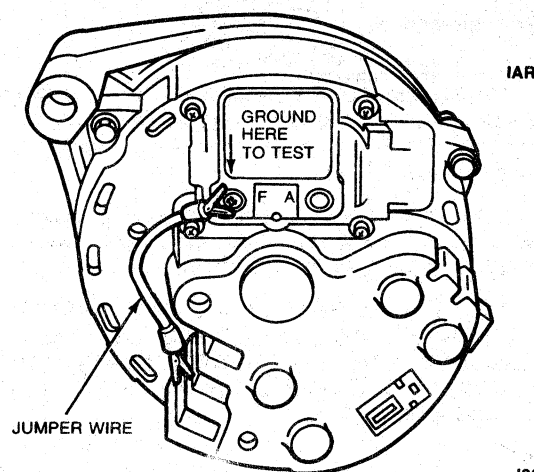
J3065-A

4. If voltmeter indicates battery voltage, connect voltmeter negative lead to alternator rear housing. Turn ignition switch to RUN (engine off) and contact voltmeter positive lead to regulator F terminal screw. Refer to illustration under Step 3. The voltmeter should indicate 1.5 volts or less. If more than 1.5 volts is indicated, perform I circuit tests and service I circuit if needed. If I circuit checks normal, replace regulator if needed and perform Load Test.
5. If 1.5 volts or less is indicated, disconnect alternator wiring plug and connect a set of 12-gauge jumper wires between alternator B(+) terminal blades and mating wiring connector terminals. Perform Load Test, but connect voltmeter positive to one of B(+) jumper wire terminals. If voltage rises more than 0.5 volt above base voltage, service alternator-to-starter relay wiring. Repeat Load Test, measuring voltage at battery cable clamps after servicing.



J3063-A

6. If voltage does not rise more than 0.5 volt above base voltage, connect a jumper wire from alternator rear housing to regulator F terminal. Repeat Load Test with voltmeter positive lead connected to one of B(+) jumper wire terminals. If voltage rises more than 0.5 volt, replace regulator.



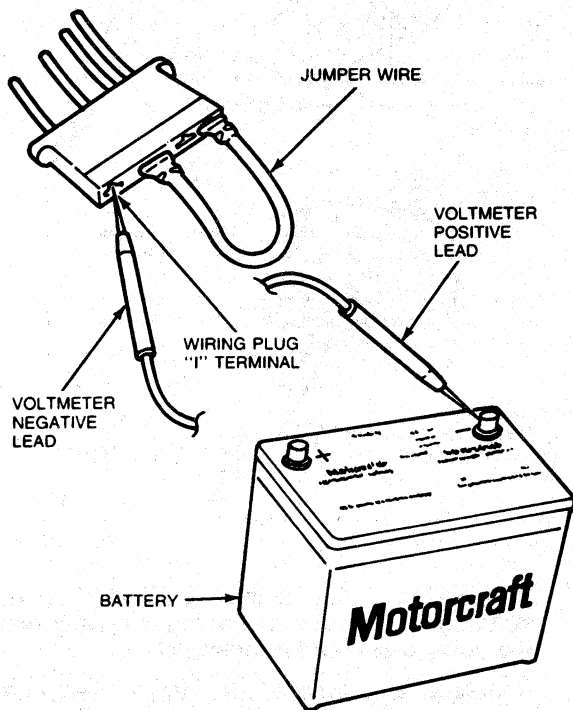
J3075-B

**TESTING (Continued)**

7. If voltage does not rise more than 0.5 volt, service alternator. Refer to illustration under Indicator Lamp System Normal Charge Indication, IAR System.

**Regulator S and/or I Circuit****EVR System**

1. Disconnect regulator wiring plug and install jumper wire between A and F terminals.

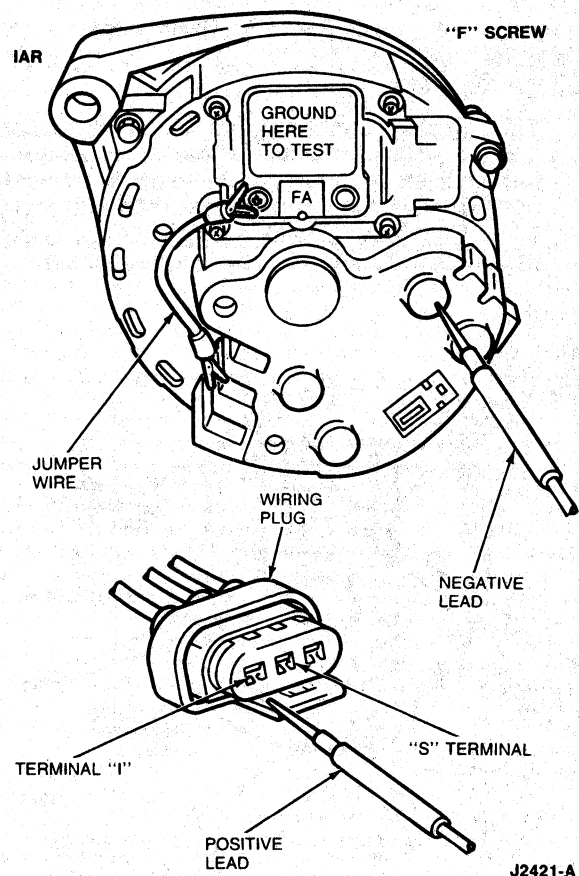


J3101-A

2. With engine idling and negative voltmeter lead connected to battery ground terminal, connect positive lead of voltmeter to "S" terminal and then to "I" terminal of regulator wiring plug. Voltage of "S" circuit should read approximately one-half of "I" circuit. If voltage readings are normal, remove jumper wire, replace regulator and connect wiring plug. Repeat Load Test.
3. If no voltage is present, service wiring circuit is at fault. Connect positive voltmeter lead to positive battery cable terminal.
4. Remove jumper wire from regulator wiring plug and connect wiring plug to regulator. Repeat Load Test. Refer to illustration of jumper wire connections in Under Voltage, External Voltage Regulator System.

**IAR System**

1. Disconnect the wiring plug from the regulator. Connect a jumper wire from the regulator "A" terminal to the wiring plug "A" lead. Add a jumper wire from the regulator "F" screw to the alternator rear housing.
2. With the engine idling and the voltmeter negative lead connected to the alternator rear housing, connect the voltmeter positive lead to the "S" terminal and then to the "I" terminal of the regulator wiring plug. The voltage at the "S" circuit should read approximately one-half that of the "I" circuit. If voltage readings are normal, remove the jumper wire. Replace the regulator and connect the wiring plug to the regulator. Repeat the Load Test.



J2421-A

3. If no voltage is present, remove the jumper wire and service the damaged wiring circuit or alternator.
4. Connect the voltmeter positive lead to the positive battery terminal. Connect the wiring plug to the regulator. Repeat the Load Test.

**TESTING (Continued)****Fuse Link Continuity**

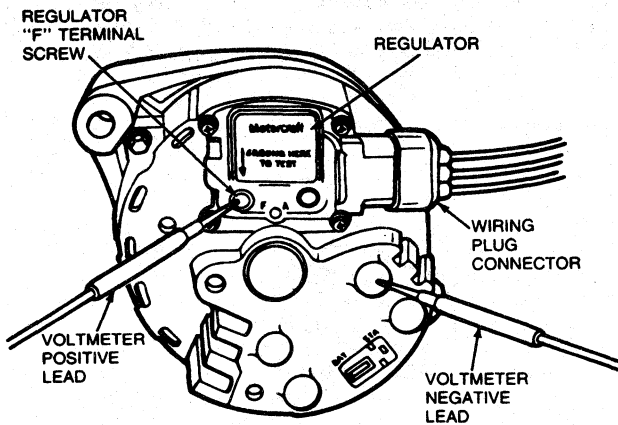
1. Ensure first that battery is OK, then turn on headlamps or any accessory. If headlamps or accessory do not operate, fuse link is probably burned out.
2. On some vehicles there are several fuse links. Use same procedure as in Step 1 to test fuse link that protects vehicle equipment.

To test fuse link that protects alternator, ensure that battery is OK, then check with a voltmeter for voltage at BAT terminal of alternator. No voltage indicates that fuse link is probably burned out.

**Field Circuit Drain****IAR System**

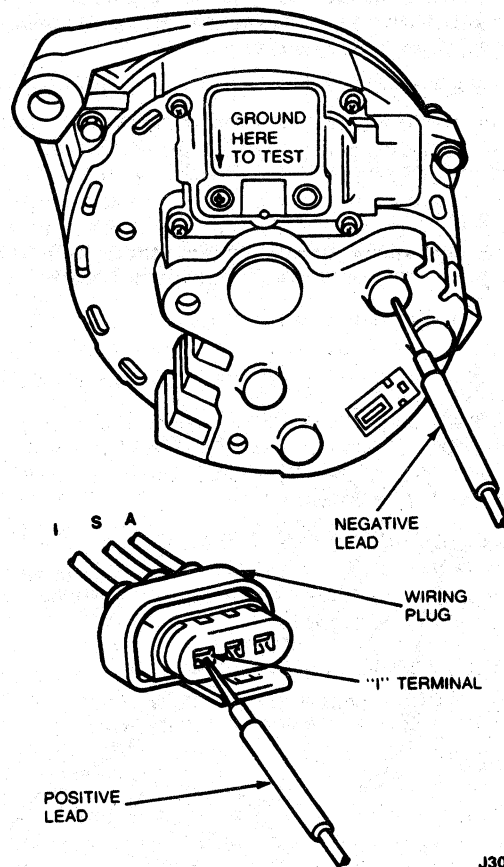
Connect the voltmeter negative lead to the alternator rear housing for all of the following voltage readings:

1. With ignition switch turned to OFF position, contact voltmeter positive lead to regulator F terminal screw. The meter should indicate battery voltage if system is operating normally. If less than battery voltage is indicated, proceed with Step 2 to find cause of current drain.



J3065-A

2. Disconnect wiring plug from regulator and contact voltmeter positive lead to wiring plug I terminal. No voltage should be indicated. If voltage is indicated, service I lead from ignition switch to identify and eliminate voltage source.



J3066-A

3. If no voltage was indicated in Step 2, contact voltmeter positive lead to wiring plug S terminal. No voltage should be indicated.
4. If voltage was indicated in Step 3, disconnect wiring plug from the alternator. Again, contact voltmeter positive lead to regulator wiring plug S terminal. If voltage is still indicated, service S lead to alternator plug to eliminate voltage source. If no voltage is indicated, replace alternator rectifier assembly. Refer to illustration under Indicator Lamp System Normal Charge Indication IAR System.

## DIAGNOSIS

Certain tests outlined in the Sections in this Group are illustrated in schematic and in pictorial form. Schematic drawings of the charging system are shown in Sections 31-12, 31-15 or 31-17.

### Preliminary Checks

Before performing charging or starting system tests on the vehicle, note conditions such as: slow cranking, battery dead, ammeter shows charge at all times or no charge, alternator warning lamp does not come on or never goes out. This information will aid in isolating the part of the system causing the symptom.

Next, visually inspect as follows:

1. Check fuse link located between starter relay and alternator. Replace link if burned out.
2. Check battery terminals and battery cable clamps for clean and tight connections. Remove battery cables (if corroded), clean and install them securely.
3. Check for clean and tight wiring connections at alternator, regulator and engine.
4. Check and adjust alternator belt tension. Refer to Section 27-02.

### Isolating the Problem

Battery, starting system, and lamp system problems can be caused by poor charging system performance. It is also possible to suspect the charging system if an overload condition has occurred in another area of the electrical system.

To avoid guesswork, it is necessary to isolate battery, charging system and electrical circuits to locate the area where the difficulty lies. Check the

battery first before beginning any electrical system diagnosis. The battery must be in proper state of charge and operating properly before the other areas of the electrical system can perform normally.

### Battery Check

The battery should be checked to see if it has the capacity and ability to accept and hold a charge. Refer to Section 31-02. If battery is OK, then the charging system should be checked to see that it performs its function of keeping the battery charged.

The battery capacity test will determine the ability of a battery to accept and hold a charge. If the battery does not meet specification, it should be replaced with a fully charged battery before further diagnosis of other areas of the electrical system.

If the battery meets required specifications, it should be fully charged before proceeding with the diagnosis of other electrical system components.

### Charging System Check

The charging system test should be performed before testing any individual charging system components. Its type of layout should reduce questions about what to do next, and speed up diagnosis. Component tests will determine the type of component service required.

Test instruments used in the charging system test are a voltmeter (0-20- or 0-30-volt scale) and an ohmmeter.

**WARNING: SPECIAL CARE SHOULD BE TAKEN WHEN USING THE OHMMETER NEAR "HOT" CIRCUITS. DISCONNECT THE COMPONENT TO BE CHECKED OR THE BATTERY CABLES TO PREVENT DAMAGE TO THE OHMMETER.**



**DIAGNOSIS (Continued)**

Continue through Diagnosis charts until service is completed. Then, test system again to see if service has corrected the condition.

**CHARGING SYSTEM TESTS**

<b>CONDITION</b>	<b>POSSIBLE SOURCE</b>	<b>ACTION</b>
<ul style="list-style-type: none"> <li>● Battery does not stay charged — engine starts OK</li> </ul>	<ul style="list-style-type: none"> <li>● Battery.</li> <li>● Loose or worn alternator belt.</li> <li>● Wiring or cables.</li> <li>● Alternator.</li> <li>● Regulator.</li> <li>● Other vehicle electrical systems.</li> </ul>	<ul style="list-style-type: none"> <li>● Test battery, replace if necessary (b).</li> <li>● Adjust or replace belt (a).</li> <li>● Service as required (a).</li> <li>● Test and/or replace components as required (c).</li> <li>● Test, replace if necessary (d).</li> <li>● Check other systems for current draw. Service as required (a).</li> </ul>
<ul style="list-style-type: none"> <li>● Alternator noisy</li> </ul>	<ul style="list-style-type: none"> <li>● Loose or worn alternator belt.</li> <li>● Bent pulley flanges.</li> <li>● Alternator.</li> </ul>	<ul style="list-style-type: none"> <li>● Adjust tension or replace belt (a).</li> <li>● Replace pulley (c).</li> <li>● Service or replace alternator (c).</li> </ul>
<ul style="list-style-type: none"> <li>● Lamps and/or fuses burn out frequently</li> </ul>	<ul style="list-style-type: none"> <li>● Wiring.</li> <li>● Alternator/Regulator.</li> <li>● Battery.</li> </ul>	<ul style="list-style-type: none"> <li>● Service as required (a).</li> <li>● Test, service, replace if necessary (c/d).</li> <li>● Test, replace if necessary (b).</li> </ul>
<ul style="list-style-type: none"> <li>● Charge indicator lamp flickers after engine starts or comes on while vehicle is being driven</li> </ul>	<ul style="list-style-type: none"> <li>● Loose or worn alternator belt.</li> <li>● Alternator.</li> <li>● Field circuit ground.</li> <li>● Regulator.</li> <li>● Lamp circuit wiring and connector.</li> <li>● Operation at low engine speed (idle) with heavy electrical load — IAR alternator only.</li> </ul>	<ul style="list-style-type: none"> <li>● Adjust tension or replace (a).</li> <li>● Service or replace (c).</li> <li>● Service or replace worn or damaged wiring.</li> <li>● Test, replace if necessary (d).</li> <li>● Service as required.</li> <li>● Test, replace if necessary.</li> </ul>
<ul style="list-style-type: none"> <li>● Charge indicator lamp flickers while vehicle is being driven</li> </ul>	<ul style="list-style-type: none"> <li>● Loose or worn alternator belt.</li> <li>● Loose or improper wiring connections.</li> <li>● Alternator.</li> <li>● Regulator.</li> </ul>	<ul style="list-style-type: none"> <li>● Adjust tension or replace belt (a).</li> <li>● Service as required (a).</li> <li>● Service or replace (c).</li> <li>● Test, replace if necessary (d).</li> </ul>

(a) Refer to procedure in this Section.

(b) Refer to Section 31-02.

(c) Refer to Section 31-12.

(d) Refer to Section 31-15 or 31-17.

**CJ2205-G**







## DIAGNOSIS (Continued)

## CHARGING SYSTEM TEST — EVR ALTERNATOR

TEST STEP		RESULT	ACTION TO TAKE
<b>A1</b>	<b>PRELIMINARY CHECKS</b>		
	Check the following: <ul style="list-style-type: none"> <li>• Fuse link</li> <li>• Battery terminals and cable clamps.</li> <li>• Wiring connections at alternator, electronic voltage regulator (EVR) and engine-to-body grounds.</li> <li>• Alternator belt tension.</li> </ul>	(OK) ► GO to <b>A2</b> . (X) ► SERVICE and/or REPLACE as necessary. GO to <b>A2</b> .	
<b>A2</b>	<b>BASE VOLTAGE AND NO-LOAD TEST</b>		
	<ul style="list-style-type: none"> <li>• Connect voltmeter to battery posts. Record battery voltage — this is base voltage.</li> <li>• Start engine and run at 1500 rpm with no electrical load. Voltage should increase, but not more than 2.0 V.</li> </ul>	Increased, but not more than 2.0 V ► GO to <b>A3</b> . No increase ► GO to <b>A6</b> . Increases more than 2.0 V ► GO to <b>A14</b> .	
<b>A3</b>	<b>LOAD TEST</b>		
	<ul style="list-style-type: none"> <li>• Increases engine speed to 2000 rpm.</li> <li>• Turn heater/A/C blower and headlamps on High.</li> <li>• Voltage should read a minimum of 0.5 V over base voltage.</li> </ul>	Increases .05 V or more ► GO to <b>A4</b> . Increases .05 V or more, but alternator indicator lamp stays On ► GO to <b>A12</b> . Increases less than 0.5 V ► GO to <b>A6</b> .	
<b>A4</b>	<b>BATTERY DRAIN TEST — KEY OFF</b>		
	<ul style="list-style-type: none"> <li>• Perform battery drain test as described in this section.</li> </ul>	Battery drain ► GO to <b>A5</b> . No battery drain ► REFER to Section 31-02.	
<b>A5</b>	<b>EVR DRAIN TEST</b>		
	<ul style="list-style-type: none"> <li>• Remove connector from EVR.</li> <li>• Perform battery drain test as described in this section.</li> </ul>	Battery drain ► CHECK other vehicle circuits for drain. No battery drain ► REPLACE EVR.	
<b>A6</b>	<b>UNDER VOLTAGE TEST</b>		
	<ul style="list-style-type: none"> <li>• Disconnect EVR.</li> <li>• Measure resistance between F terminal of EVR harness connector and ground.</li> <li>• Resistance should be more than 3.0 ohms.</li> </ul>	Less than 3.0 ohms ► SERVICE grounded field circuit. CHECK wiring and alternator. GO to <b>A2</b> . More than 3.0 ohms ► GO to <b>A7</b> .	

## DIAGNOSIS (Continued)

## CHARGING SYSTEM TEST — EVR ALTERNATOR — Continued

TEST STEP		RESULT	ACTION TO TAKE
<b>A7</b>	<b>JUMPER TERMINALS A TO F</b>		
<ul style="list-style-type: none"> <li>• Jumper A to F terminal at EVR connector.</li> <li>• Voltage should read a minimum of 0.5 V over base voltage, with load test conditions in effect.</li> </ul>		Less than 0.5 V	▶ GO to A8.
		0.5 V or more vehicles with alternator warning lamp	▶ GO to A10.
		0.5 V or more vehicles with ammeter	▶ GO to A11.
<b>A8</b>	<b>JUMPER BAT TO FLD TERMINALS</b>		
<ul style="list-style-type: none"> <li>• Remove jumper from A to F terminals, but leave EVR disconnected.</li> <li>• Jumper BAT to FLD terminals at alternator.</li> <li>• Voltage should read a minimum of 0.5 V over base voltage, with load test conditions in effect.</li> </ul>		0.5 V or more	▶ SERVICE inoperative or worn A or F circuits. GO to A2.
		Less than 0.5 V	▶ GO to A9.
<b>A9</b>	<b>CHECK ALTERNATOR OUTPUT</b>		
<ul style="list-style-type: none"> <li>• Stop Engine.</li> <li>• Move voltmeter positive lead to BAT terminal of alternator.</li> </ul>		Base voltage	▶ SERVICE or REPLACE alternator. GO to A2.
		Zero voltage	▶ SERVICE or REPLACE circuit from alternator to battery. GO to A2.
<b>A10</b>	<b>CHECK FOR POWER AT S AND I TERMINALS</b>		
<p><b>NOTE: This test is only for vehicles equipped with indicator lamps.</b></p> <ul style="list-style-type: none"> <li>• Turn off all load.</li> <li>• With engine at idle and jumper on terminals A and F, check for power at the S and I terminals at the EVR connector.</li> <li>• Voltage at the S terminal should be approximately 1/2 of voltage at the I terminal.</li> </ul>		 ▶	SERVICE inoperative S and/or I circuits as necessary. GO to A2.
		 ▶	REPLACE EVR. GO to A2.
<b>A11</b>	<b>CHECK FOR POWER TO S TERMINAL</b>		
<p><b>NOTE: This test is only for vehicles equipped with ammeters.</b></p> <ul style="list-style-type: none"> <li>• Turn off all load.</li> <li>• Engine off.</li> <li>• Ignition switch on.</li> <li>• Check for power to S terminal at EVR harness connector.</li> </ul>		 ▶	SERVICE inoperative S circuit as necessary. GO to A2.
		 ▶	REPLACE EVR. GO to A2.

CJ2408-C

## DIAGNOSIS (Continued)

## CHARGING SYSTEM TEST — EVR ALTERNATOR — Continued

TEST STEP		RESULT	ACTION TO TAKE
A12	S CIRCUIT TEST		
<ul style="list-style-type: none"><li>• Engine at idle.</li><li>• Check for power at S terminal on EVR connector.</li><li>• Voltage should be approximately 1/2 of base voltage at BAT terminal.</li></ul>		<div>OK▶</div> <div>No voltage▶</div>	<div>REPLACE EVR. REPEAT Test Step A12.</div> <div>GO to A13.</div>
A13	ALTERNATOR STATOR VOLTAGE TEST		
<ul style="list-style-type: none"><li>• Engine at idle.</li><li>• Check voltage at alternator S terminal.</li><li>• Voltage should be approximately 1/2 of base voltage at BAT terminal.</li></ul>		<div>OK▶</div> <div>OK▶</div>	<div>SERVICE S circuit between alternator and EVR.</div> <div>SERVICE or REPLACE alternator. GO to A12.</div>
A14	OVER VOLTAGE TEST		
<ul style="list-style-type: none"><li>• Connect jumper between EVR and ground.</li></ul>		<div>Over voltage DOES go away▶</div> <div>Over voltage DOES NOT go away▶</div>	<div>SERVICE EVR ground. GO to A2.</div> <div>GO to A15.</div>
A15	DISCONNECT EVR		
<ul style="list-style-type: none"><li>• Disconnect EVR.</li><li>• Over voltage should go away.</li></ul>		<div>OK▶</div> <div>OK▶</div>	<div>REPLACE EVR. GO to A2.</div> <div>SERVICE shorted harness between EVR and alternator. GO to A2.</div>

CJ2409-C

## DIAGNOSIS (Continued)

## CHARGING SYSTEM TEST — IAR ALTERNATOR

TEST STEP		RESULT	ACTION TO TAKE
<b>B1</b>	<b>PRELIMINARY CHECKS</b>		
	Preliminary Checks — <ul style="list-style-type: none"> <li>• Fuse Link</li> <li>• Battery Terminals and Cable Clamps</li> <li>• Wiring and Ground Connections to Alternator Regulator and Engine</li> <li>• Alternator Belt Tension</li> </ul>	(OK) ► (OK) ►	GO to <b>B2</b> . SERVICE and/or REPLACE as necessary. GO to <b>B2</b> .
<b>B2</b>	<b>BASE VOLTAGE AND NO LOAD TEST</b>		
	<ul style="list-style-type: none"> <li>• Connect voltmeter to battery posts. Read battery voltage — this is base reading.</li> <li>• Start engine, run at 1500 rpm with no electrical load. Voltage should increase but not more than 2.0 V.</li> </ul>	Increases, but not more than 2.0 V ► No increase ► Increases more than 2.0 V ►	GO to <b>B3</b> . GO to <b>B5</b> . GO to <b>B12</b> .
<b>B3</b>	<b>LOAD TEST</b>		
	<ul style="list-style-type: none"> <li>• Increase engine speed to 2000 rpm.</li> <li>• Turn heater A/C, blower and headlamps on high.</li> <li>• Voltage should read a minimum of 1/2 V over base voltage.</li> </ul>	Increases 1/2 V or more ► Increases less than 1/2 V ►	GO to <b>B4</b> . GO to <b>B5</b> .
<b>B4</b>	<b>BATTERY DRAIN TEST — KEY OFF</b>		
	Problem can still be battery drain. Turn Off ignition, install test lamp in series with positive battery cable and check to isolate problem circuit.	Battery drain ► No battery drain ►	CHECK vehicle circuits for drain. REFER to Section 31-02.
<b>B5</b>	<b>UNDER VOLTAGE TEST</b>		
	<ul style="list-style-type: none"> <li>• Disconnect regulator.</li> <li>• Check resistance between regulator A and F terminals on regulator.</li> <li>• Resistance should be more than 2.4 ohms.</li> </ul>	2.4 ohms or less ► More than 2.4 ohms ►	CHECK alternator for shorted field circuit and service if required. REPLACE regulator — GO to <b>B2</b> . GO to <b>B6</b> .
<b>B6</b>	<b>A TERMINAL VOLTAGE CHECK</b>		
	<ul style="list-style-type: none"> <li>• Reconnect regulator.</li> <li>• Measure A terminal voltage.</li> </ul>	No voltage ► Battery voltage ►	SERVICE A circuit wiring. GO to <b>B7</b> .

## DIAGNOSIS (Continued)

## CHARGING SYSTEM TEST — IAR ALTERNATOR — Continued

TEST STEP		RESULT	ACTION TO TAKE
<b>B7</b>	<b>F TERMINAL VOLTAGE CHECK — IGNITION OFF</b>		
	<ul style="list-style-type: none"> <li>Measure regulator F terminal voltage with ignition off.</li> </ul>	No voltage	SERVICE IAR for open or grounded field circuit — GO to <b>B2</b> .
		Battery voltage	GO to <b>B8</b> .
<b>B8</b>	<b>F TERMINAL VOLTAGE CHECK — IGNITION ON</b>		
	<ul style="list-style-type: none"> <li>Turn ignition on with engine off.</li> <li>Measure regulator F terminal voltage.</li> </ul>	More than 1.5 V	GO to <b>B9</b> .
		1.5 V or less	GO to <b>B10</b> .
<b>B9</b>	<b>I CIRCUIT TESTS</b>		
	Perform I circuit tests.	<div>OK</div>	REPLACE regulator — GO to <b>B2</b> .
		<div>OK</div>	SERVICE I circuit wiring. GO to <b>B2</b> .
<b>B10</b>	<b>JUMPERED LOAD TEST</b>		
	<ul style="list-style-type: none"> <li>Disconnect alternator plug.</li> <li>Connect jumper wires between B+ blades and wiring plug.</li> <li>Repeat load test measuring voltage to jumper wires from battery negative clamp.</li> <li>Voltage should rise 1/2 V or more.</li> </ul>	Voltage rise — 1/2 V or more	SERVICE alternator to starter relay wiring — GO to <b>B2</b> .
		Voltage rise — less than 1/2 V	GO to <b>B11</b> .
<b>B11</b>	<b>LOAD TEST REPEAT — F TERMINAL</b>		
	<ul style="list-style-type: none"> <li>Keep B+ jumper wires in place.</li> <li>Connect another jumper wire from alternator rear housing to regulator F terminal.</li> <li>Repeat load test measuring voltage at B+ jumper wires.</li> <li>Voltage should rise 1/2 V or more.</li> </ul>	Voltage rise 1/2 V or more	REPLACE regulator. GO to <b>B2</b> .
		Voltage rise less than 1/2 V	SERVICE alternator. GO to <b>B2</b> .
<b>B12</b>	<b>OVER VOLTAGE TEST</b>		
	<ul style="list-style-type: none"> <li>Turn ignition on with engine off.</li> <li>Measure voltage at regulator A terminal and starter solenoid.</li> <li>Voltage difference should be 1/2 V or less.</li> </ul>	Voltage difference 1/2 V or less	GO to <b>B13</b> .
		Voltage difference more than 1/2 V	SERVICE A circuit wiring. GO to <b>B2</b> .
<b>B13</b>	<b>REGULATOR GROUND CHECK</b>		
	Check for loose regulator ground screws.	<div>OK</div>	GO to <b>B14</b> .
		<div>OK</div>	SERVICE ground screws. GO to <b>B2</b> .

## DIAGNOSIS (Continued)

## CHARGING SYSTEM TEST — IAR ALTERNATOR — Continued

TEST STEP		RESULT	ACTION TO TAKE
<b>B14</b>	<b>ENGINE GROUND CHECK</b>		
	Check for bad engine ground.	(OK) ► GO to <b>B15</b> . (X) ► SERVICE engine ground. GO to <b>B2</b> .	
<b>B15</b>	<b>ALTERNATOR GROUND CHECK</b>		
	Check alternator ground.	(OK) ► GO to <b>B16</b> . (X) ► SERVICE alternator ground. GO to <b>B2</b> .	
<b>B16</b>	<b>REPEAT NO LOAD TEST</b>		
	<ul style="list-style-type: none"> <li>Start engine, run at 1500 rpm with no electrical load. Voltage should increase but not more than 2.0 V</li> </ul>	Increases 2.0 V or less ► GO to <b>B3</b> . Increases more than 2.0 V ► GO to <b>B17</b> .	
<b>B17</b>	<b>A AND F VOLTAGE CHECKS</b>		
	<ul style="list-style-type: none"> <li>Turn ignition off.</li> <li>Measure voltage at regulator A and F terminals.</li> <li>Terminal voltages should be the same. — Battery voltage</li> </ul>	Battery voltage ► REPLACE regulator. GO to <b>B2</b> . Different than battery voltage ► SERVICE integral assembly for grounded field circuit or bad regulator. GO to <b>B2</b> .	

CJ3060-B

## SPECIAL SERVICE TOOLS

ROTUNDA EQUIPMENT	
Model	Description
007-00001	Digital Volt — Ohmmeter
CJ2820-B	

# SECTION 31-02 Batteries

SUBJECT	PAGE	SUBJECT	PAGE
<b>MAINTENANCE</b>		<b>SERVICE (Cont'd.)</b>	
Battery Cleaning .....	31-02-7	Tools .....	31-02-5
Jump Starting .....	31-02-7	<b>SPECIAL SERVICE TOOLS</b> .....	31-02-7
<b>REMOVAL AND INSTALLATION</b>		<b>TESTING</b>	
Battery .....	31-02-4	Battery Charging .....	31-02-3
Battery Tray .....	31-02-5	Battery State of Charge .....	31-02-1
<b>SERVICE</b>		Tests Using Variable High Rate	
Adding Water .....	31-02-7	Discharge Tester (078-00005) .....	31-02-1
Battery Carrier .....	31-02-7	<b>VEHICLE APPLICATION</b> .....	31-02-1

## VEHICLE APPLICATION

Taurus/Sable.

## TESTING

Tests are made on a battery to determine the state of charge and also its capacity or ability to crank an engine. The ultimate result of these tests is to show that the battery is good, needs recharging, or must be replaced.

Before attempting to test a battery, it is important to give it a thorough examination to determine if it has been damaged.

**WARNING: HYDROGEN AND OXYGEN GASES ARE PRODUCED DURING NORMAL BATTERY OPERATION. THIS GAS MIXTURE CAN EXPLODE IF FLAMES, SPARKS OR LIGHTED TOBACCO ARE BROUGHT NEAR THE BATTERY. WHEN CHARGING OR USING A BATTERY IN AN ENCLOSED SPACE, ALWAYS PROVIDE VENTILATION AND SHIELD YOUR EYES.**

**WARNING: KEEP OUT OF REACH OF CHILDREN. BATTERIES CONTAIN SULFURIC ACID. AVOID CONTACT WITH SKIN, EYES, OR CLOTHING. ALSO, SHIELD YOUR EYES WHEN WORKING NEAR THE BATTERY TO PROTECT AGAINST POSSIBLE SPLASHING OF THE ACID SOLUTION. IN CASE OF ACID CONTACT WITH SKIN OR EYES, FLUSH IMMEDIATELY WITH WATER FOR A MINIMUM OF FIFTEEN MINUTES AND GET PROMPT MEDICAL ATTENTION. IF ACID IS SWALLOWED, CALL A PHYSICIAN IMMEDIATELY.**

### Tests Using Variable High Rate Discharge Tester (078-00005)

Refer to the Battery Testing procedure.

## Battery State of Charge

### Maintenance Free Batteries

Read the battery open circuit terminal voltage with a digital voltmeter capable of reading 1/100 of a volt. If open circuit voltage of battery is below 12.4 volts and the battery has passed the capacity test, charge the battery.

### Conventional Batteries

Use a hydrometer to check the specific gravities of all cells.

In order to obtain an accurate specific gravity reading, it must be corrected to the standard temperature of 26°C (78°F). The correction factor of four points (0.004) is used for each 6°C (10°F) change in temperature. Four points (0.004) are added to the indicated reading for each 6°C (10°F) increment above 26°C (78°F) and four points (0.004) are subtracted for each 6°C (10°F) increment below 26°C (78°F).









If the difference between cells is 50 points (0.050) or more, the battery is not satisfactory for service and should be replaced.

If the difference between cells is less than 50 points (0.050) and one or more cells are less than 1.225, charge the battery for 20 minutes at 35 amps and conduct the capacity test. If the battery fails, replace the battery. If it passes, add water if necessary and charge the battery.

If the difference between cells is less than 50 points (0.050) and all cells are above 1.225, conduct the capacity test. If the battery fails, replace the battery. If it passes, return to service.

## TESTING (Continued)

## BATTERY TESTING PROCEDURE

TEST STEP		RESULT	ACTION TO TAKE																												
A0	VISUAL INSPECTION																														
<ul style="list-style-type: none"><li>Remove negative cable, then positive cable.</li><li>Check for dirty or corroded connections.</li></ul>		<div></div> <div></div>	<div>CLEAN terminals and clamps. GO to A1.</div> <div>GO to A1.</div>																												
A1	LOOSE BATTERY POST																														
<ul style="list-style-type: none"><li>Check for loose battery post.</li></ul>		<div></div> <div></div>	<div>REPLACE battery.</div> <div>GO to A2.</div>																												
A2	CRACKED BATTERY COVER																														
<ul style="list-style-type: none"><li>Remove holddowns and shields.</li><li>Check for broken/cracked case or cover.</li></ul>		<div></div> <div></div>	<div>REPLACE battery.</div> <div>GO to A3.</div>																												
A3	BATTERY CAPACITY TEST																														
<ul style="list-style-type: none"><li>Use a high rate discharge tester with a variable rate control or a fixed rate tester with meter compensation for different battery electrical sizes. Follow instructions supplied with tester for the battery capacity test.</li></ul> <div><div>RECOMMENDED DISCHARGE RATES</div><table><tr><th>Battery Capacity (Ampere Hrs.)</th><th>Discharge Rate (Amperes)</th></tr><tr><td>CCA</td><td></td></tr><tr><td>460</td><td>230</td></tr><tr><td>540</td><td>270</td></tr><tr><td>850</td><td>425</td></tr></table><p>Voltage Readings at 15 seconds for good battery.</p><table><tr><th>Approximate Battery Temp.</th><th>Minimum Voltage</th></tr><tr><td>21°C (70°F)</td><td>9.6</td></tr><tr><td>16°C (60°F)</td><td>9.5</td></tr><tr><td>10°C (50°F)</td><td>9.4</td></tr><tr><td>4°C (40°F)</td><td>9.3</td></tr><tr><td>-1°C (30°F)</td><td>9.1</td></tr><tr><td>-7°C (20°F)</td><td>8.9</td></tr><tr><td>-12°C (10°F)</td><td>8.7</td></tr><tr><td>-18°C (0°F)</td><td>8.5</td></tr></table></div>		Battery Capacity (Ampere Hrs.)	Discharge Rate (Amperes)	CCA		460	230	540	270	850	425	Approximate Battery Temp.	Minimum Voltage	21°C (70°F)	9.6	16°C (60°F)	9.5	10°C (50°F)	9.4	4°C (40°F)	9.3	-1°C (30°F)	9.1	-7°C (20°F)	8.9	-12°C (10°F)	8.7	-18°C (0°F)	8.5	<div></div> <div></div>	<div>CHARGE battery for 20 minutes at 35 amps. REPEAT A3. (If battery fails second check, replace battery.)</div> <div>GO to A4.</div>
Battery Capacity (Ampere Hrs.)	Discharge Rate (Amperes)																														
CCA																															
460	230																														
540	270																														
850	425																														
Approximate Battery Temp.	Minimum Voltage																														
21°C (70°F)	9.6																														
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-1°C (30°F)	9.1																														
-7°C (20°F)	8.9																														
-12°C (10°F)	8.7																														
-18°C (0°F)	8.5																														
A4	VOLTAGE CHECK																														
<ul style="list-style-type: none"><li>Measure open circuit voltage of battery with a digital voltmeter capable of reading 1/100 V.</li></ul>		<div>Over 12.4 V</div> <div>12.4 V or less</div>	<div>Battery OK.</div> <div>CHARGE battery.</div>																												



**TESTING (Continued)****Battery Charging**

Before recharging a discharged battery, inspect and service the following conditions, if they exist:

1. Loose alternator belt.
2. Pinched or grounded alternator/voltage regulator wiring harness.
3. Loose harness connections at the alternator and/or voltage regulator.
4. Loose or corroded connections at battery, starter relay and/or engine ground.
5. Excessive battery drain due to hood, deck lid, glove compartment and courtesy lamps remaining energized (damaged or misadjusted switch, glove compartment left open, etc.).

**Maintenance Free and Conventional Batteries**

Cold batteries will not readily accept a charge. Therefore, batteries should be allowed to warm up to approximately 5°C (41°F) before charging. This may require 4 to 8 hours at room temperature depending on the initial temperature and battery size.

A battery which has been completely discharged may be slow to accept a charge initially, and in some cases may not accept a charge at the normal charger setting. When batteries are in this condition, charging can be started by using the dead battery switch on chargers so equipped.

Completely discharged batteries, which have been discharged for a prolonged period of time (over one month) or which have an open circuit voltage of less than two volts, may show no indication of accepting a charge even when the battery switch is used. The initial charge rate accepted by batteries in this condition is so low that the ammeter on some chargers will not show any indication of charge for up to ten minutes.

A method of determining whether a battery is accepting a charge is as follows: Follow charger manufacturer's instructions for use of dead battery switch. If dead battery switch is the spring-loaded type, it should be held in the ON position for up to three minutes.

After releasing dead battery switch and with charger still on, measure battery voltage. If it shows 12 volts or higher, the battery is accepting a charge and is capable of being recharged. However, it may require up to two hours of charging, with cold batteries, below 5°C (41°F), before the charge rate is high enough to show on the charger ammeter. It has been found that all non-damaged batteries can be charged by this procedure. If a battery cannot be charged by this procedure it should be replaced.

Once it has been determined that the battery has begun to accept a charge, it can be charged to a serviceable state or a full state of charge by one of two methods.

- The **first method** is to use the AUTOMATIC setting on chargers so equipped. This setting maintains the charging rate within safe limits by adjusting voltage and current to prevent excessive gassing and spewing of electrolyte. Approximately 2 to 4 hours will be required to charge a completely discharged battery to a serviceable state. If a full state of charge is desired, the charge can be completed by a low current rate of 3 to 5 amps for several additional hours.
- The **second method** is to use the MANUAL or constant current setting on the charger. Initially set the charging rate for 30 to 40 amps and maintain this setting for approximately 30 minutes or as long as there is no excessive gassing and electrolyte spewing. If gassing results, the charge rate must be reduced to a level where gassing will stop. Excessive gassing will result in non-replaceable loss of electrolyte, thus shortening battery life.

The total charge required will vary with battery size and its initial state of charge. In general, to bring a discharged battery to a serviceable state of charge, current-time input should equal the battery amp-hour capacity. For example: a 45 AH battery will require 15 amps of charge for 3 hours, or 9 amps of charge for 5 hours. Again, if a full state of charge is desired, the charge can be completed by a low constant current of 3 to 5 amps for several hours.

If the battery has failed, or is low in charge, it may be necessary to refer to Diagnosis, Section 31-01.

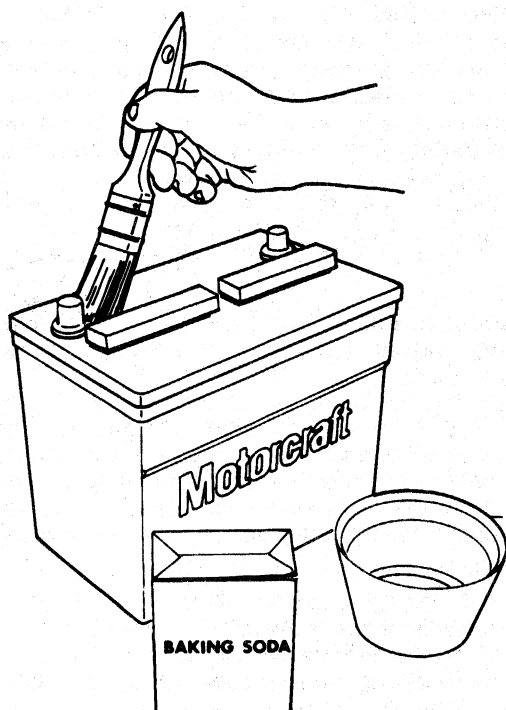
## REMOVAL AND INSTALLATION

## Battery

## Removal

NOTE: The illustrations used in the following procedures show typical battery locations and connections.

1. Remove battery cables from battery terminals (negative first).
2. Clean cable terminals with an acid neutralizing solution and terminal cleaning brush.

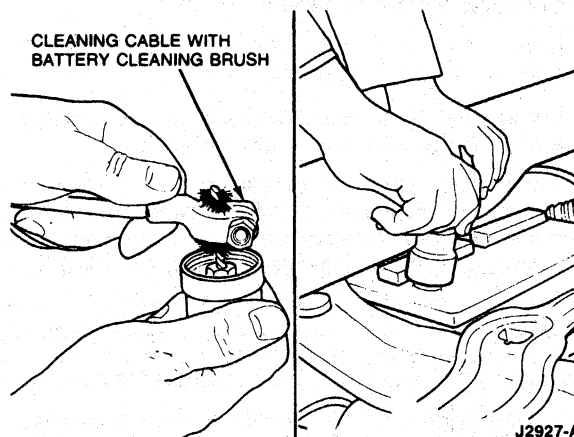


J2847-A

3. Remove hold-down clamps.
4. Test battery and determine if it should be:
  - Placed back in service.
  - Recharged before placing back in service.
  - Replaced with a Motorcraft or equivalent battery.

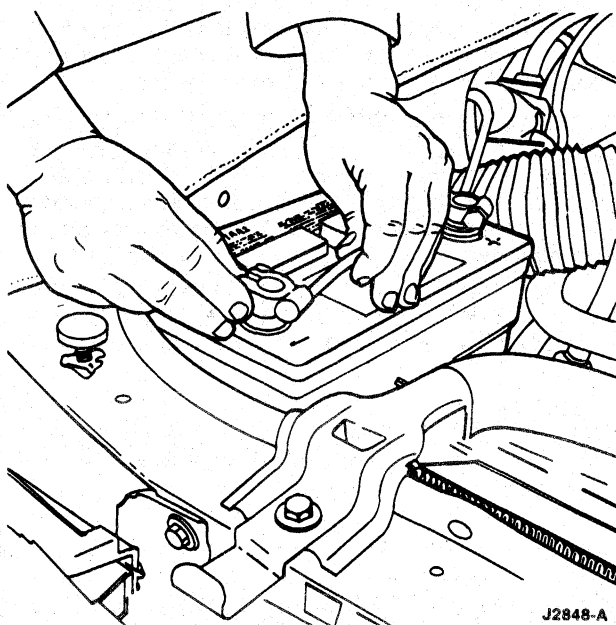
## Installation

1. Clean cable terminals and hold-down with a wire brush. Replace all cables or parts that are worn or frayed.



J2927-A

2. Clean battery tray with a wire brush and scraper.
3. Place battery in tray with positive and negative terminals in same position as previous battery. Assemble and tighten hold-down hardware so battery is secure. Do not over-tighten.
4. Secure cables (positive first) to proper terminals. **Do not over-tighten.** Apply petroleum jelly to terminals.



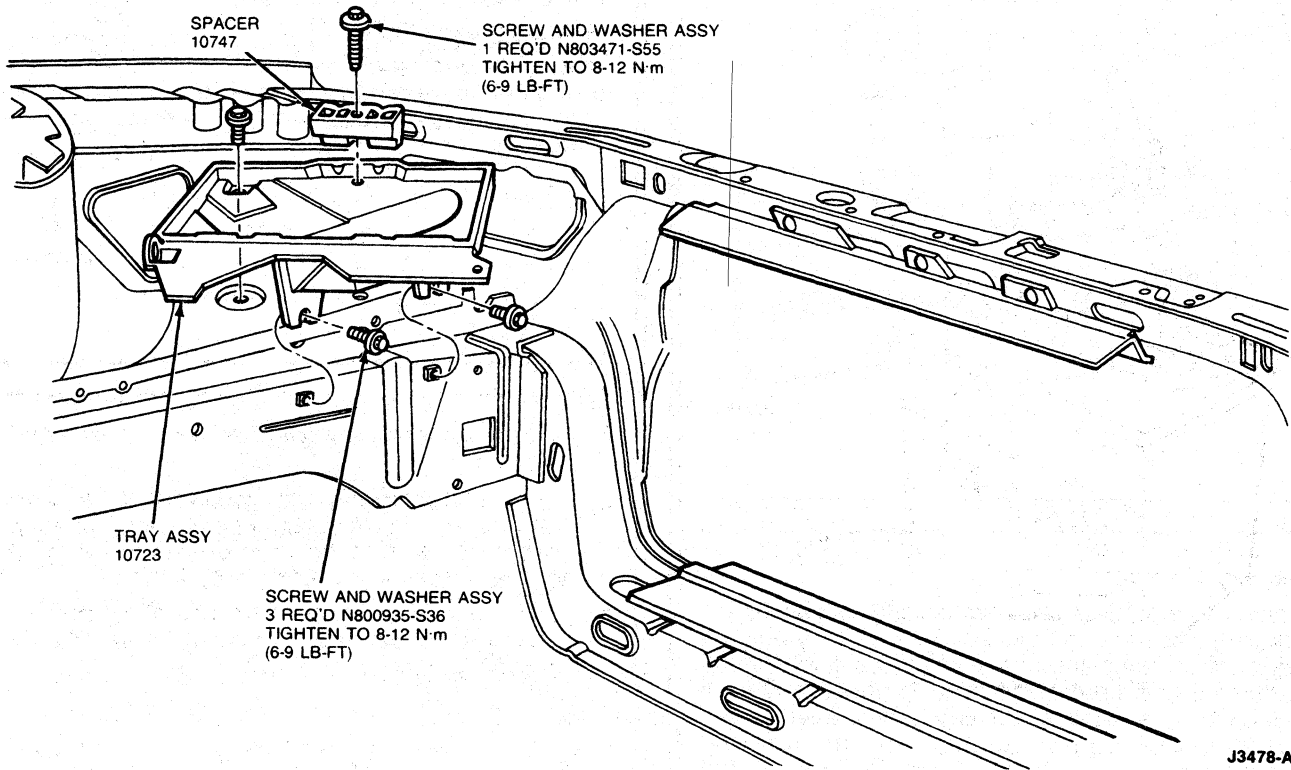
J2848-A

**REMOVAL AND INSTALLATION (Continued)****Battery Tray****Removal**

1. Remove battery from vehicle as outlined.
2. Remove attaching bolts, screws and washers from battery tray.
3. Remove battery tray from vehicle.

**Installation**

1. Position battery tray to inside fender in engine compartment.
2. Install attaching bolts, screws and washers. Tighten each to 8-12 N·m (6-9 lb-ft).
3. Install battery in engine compartment, as outlined.
4. Tighten hold-down bracket bolt to 7-10 N·m (5-7 lb-ft).



J3478-A

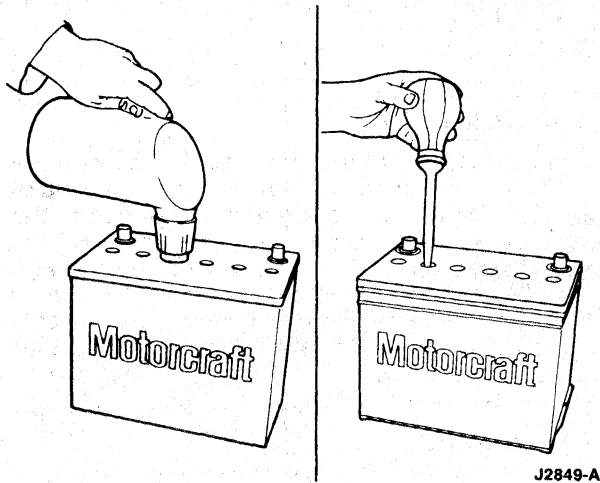
**SERVICE****Tools**

Anyone working with a battery needs the proper tools. Using the right tools will prevent damage to the battery, battery cables and hold-down bracketry.

Tools and equipment manufactured for servicing batteries have parts insulated to help prevent arcing, should the tool be dropped or placed accidentally between a terminal and some other contact surface.

**SERVICE (Continued)****Battery Filling Devices****Batteries with Removable Vent Caps**

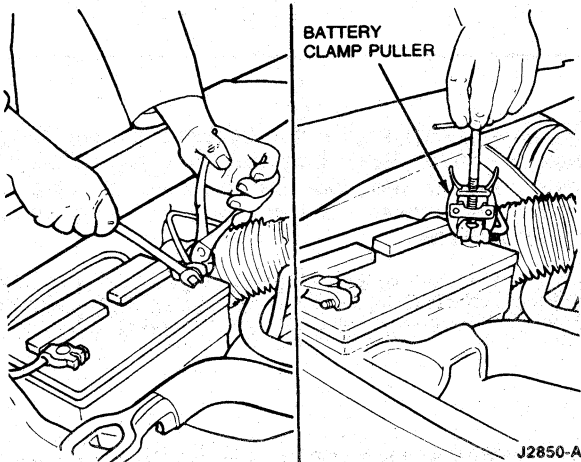
One of the most important on-the-vehicle services is to maintain the correct electrolyte level. Two devices are available for this purpose: a self-leveling filler which allows the battery to be filled to a predetermined level automatically, and the syringe type filler.



J2849-A

**Battery Pliers**

Battery pliers have jaws specifically designed for gripping cable clamp bolts securely. Care should be taken when removing or replacing the cable clamp bolts so that the battery terminal is not subjected to any excessive lateral or twisting forces. Such forces could cause major damage to the internal components of the battery, and leakage at the terminals.



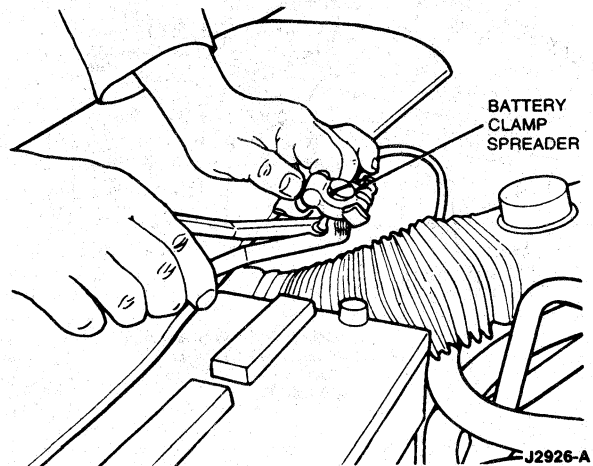
J2850-A

**Battery Cable Puller**

Use a cable puller to remove a cable clamp from the battery terminal. Jaws, gripping the underside of the cable clamp, pull the clamp up by means of pressure exerted against the top of the battery terminal. Proper use of this tool avoids the damaging lateral or twisting forces that result when using a pry bar or plier. Refer to the illustration shown under Battery Pliers.

**Battery Cable Clamp Spreader**

The spreader is used to expand the cable clamp after it has been removed from the terminal and the clamp bolt has been loosened. The cable clamp can then be easily placed in its correct position completely on the terminal.



J2926-A

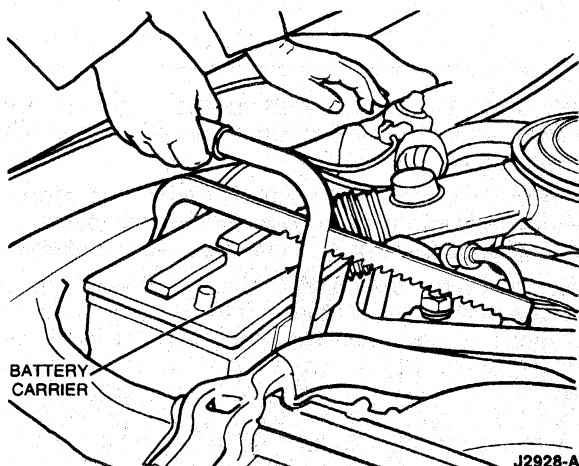
**Terminal Cleaning Brush**

The terminal cleaning brush is designed with units to clean both the tapered battery terminal and the mating surface of the cable clamp. Refer to illustration under Battery Installation, Step 1.

**SERVICE (Continued)****Battery Carrier**

Use a suitable battery carrier for lifting and transporting the battery. The illustration shows a clamp-type carrier used to grip the sidewalls of the container just below the lip of the cover. The carrier is used on the sidewalls, rather than the endwalls, since the sidewalls have additional strength from the inner cell partitions. This is particularly important with the polypropylene cased battery which has endwalls that are flexible.

**CAUTION:** Gripping the endwalls on the polypropylene battery could cause electrolyte to spew from some of the cells, and possibly cause damage to some of the internal components.

**Adding Water**

Some batteries have removable vent caps and may occasionally require the addition of water. If the electrolyte level is below the level indicator in any cell, add enough pure water to bring the level up to the indicator. In batteries without level indicator, maintain electrolyte level at 6.3 to 12.7mm (1/4 to 1/2 inch) above the plates. **Never add electrolyte ("battery acid") to the battery.** This could shorten the battery's life.

**MAINTENANCE****Battery Cleaning**

Keeping the battery top clean and dry reduces the need for service and extends battery life. Also, make certain the cable clamps are tightly fastened to the battery posts. If corrosion is found, disconnect the cables and clean clamps and posts with a wire brush. Neutralize the corrosion with a solution of baking soda and water. After installing cables, apply a small quantity of Multi-Purpose Long-Life Lubricant C1AZ-19590-B or equivalent grease to each battery post to help prevent corrosion.

**Jump Starting**

Refer to Powertrain manual, Section 28-02.

**SPECIAL SERVICE TOOLS****ROTUNDA EQUIPMENT**

Model	Description
078-00005	Battery Tester

CJ2659-B

## SECTION 31-12 Alternator—Side Terminal

SUBJECT	PAGE	SUBJECT	PAGE
ADJUSTMENTS .....	31-12-3	REMOVAL AND INSTALLATION .....	31-12-5
DESCRIPTION AND OPERATION .....	31-12-1	SPECIAL SERVICE TOOLS .....	31-12-9
DISASSEMBLY AND ASSEMBLY		SPECIFICATIONS .....	31-12-9
Assembly .....	31-12-7	TESTING	
Cleaning and Inspection .....	31-12-7	Bench Tests .....	31-12-3
Disassembly .....	31-12-6	VEHICLE APPLICATION .....	31-12-1

### VEHICLE APPLICATION

Taurus/Sable.

### DESCRIPTION AND OPERATION

The alternator is belt-driven from the engine. Current from the electronic voltage is supplied to the rotating field of the alternator through two brushes and two slip rings.

The alternator produces power in the form of alternating current. The alternating current is rectified to direct current by six diodes. The alternator regulator automatically adjusts the alternator field current to maintain the alternator output voltage within prescribed limits to correctly charge the battery. The alternator is self-current limiting.

The warning lamp control circuit passes current to the warning lamp when the ignition switch is in the RUN position and there is no alternator voltage at terminal S. When the voltage at terminal S rises to a preset value, current is cut off to the warning lamp.

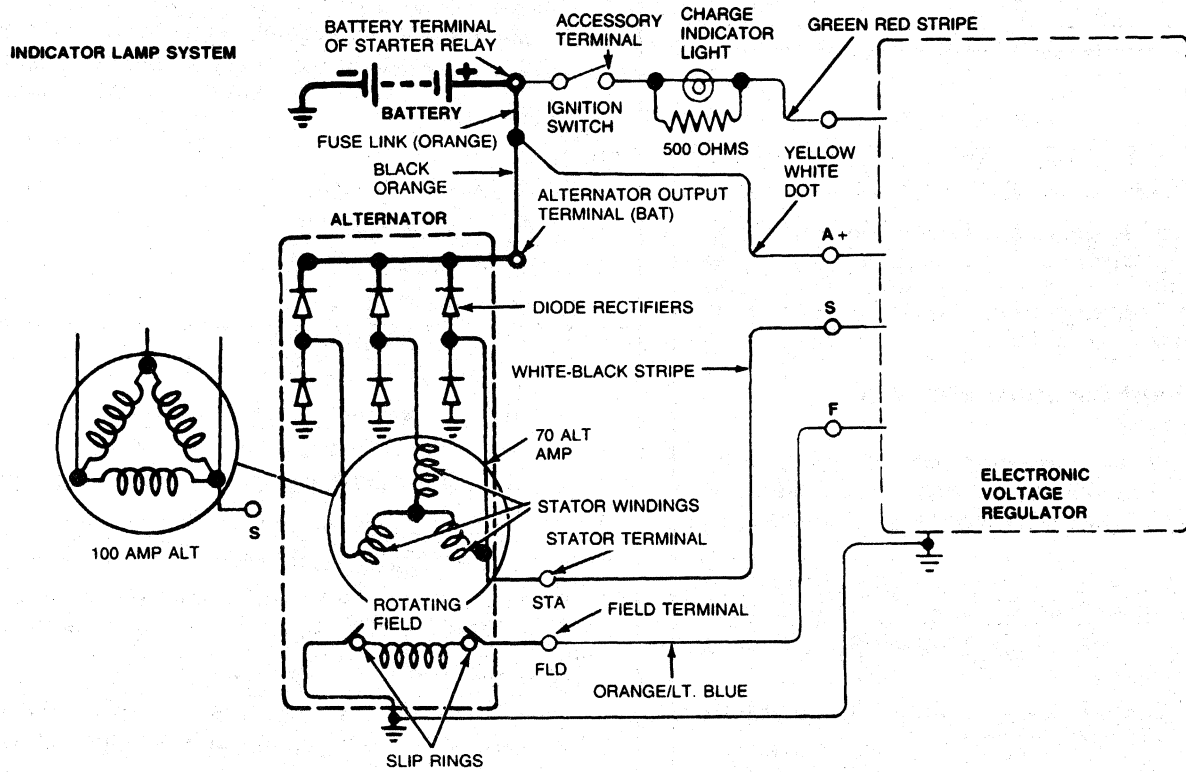
This circuit is not included in the regulator for vehicles equipped with an ammeter rather than the warning lamp.

A 500 ohm, 1/4 watt resistor is connected across the terminals of the lamp at the instrument cluster in vehicles equipped with an indicator warning lamp.

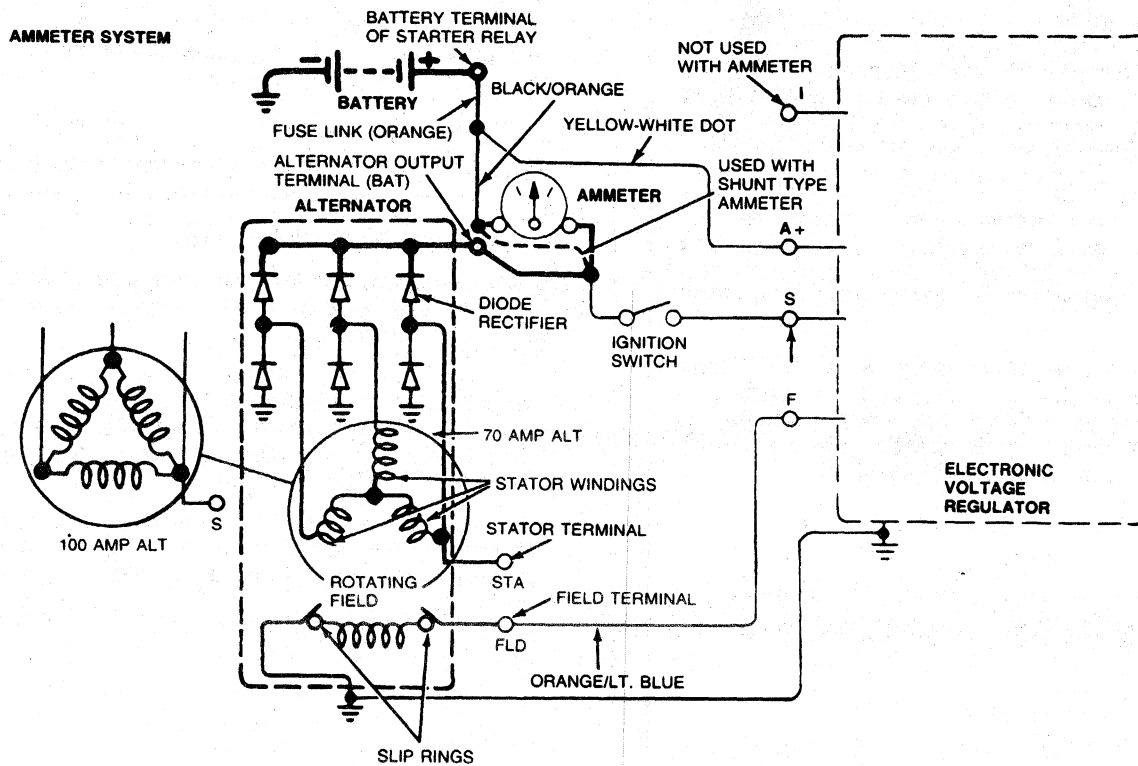
The regulator switching circuit receives voltage from the ignition switch through the warning lamp at terminal I on vehicles equipped with an indicator warning lamp, or through terminal S on vehicles equipped with an ammeter. With an input voltage present, the switching circuit turns on the voltage control circuit which, in turn, adjusts field current to control alternator output voltage.

Fuse links are included in the charging system wiring on all models. This fuse link is used to prevent damage to the wiring harness and alternator if the wiring harness should become grounded, or if a booster battery is connected to the charging system with the wrong polarity.

## DESCRIPTION AND OPERATION (Continued)



J2383-D



J2384-D

## ADJUSTMENTS

For alternator drive belt adjustments refer to Section 27-02.

## TESTING

### Bench Tests

If a charging system test in Section 13-01 has isolated the problem to the alternator, remove the alternator from the vehicle for bench testing and service, or replacement. Refer to Alternator Removal and Disassembly.

### Rectifier Short Grounded and Stator Grounded Test

These tests are performed with a Rotunda Volt/Ohmmeter 059-00010 or equivalent. Set the Multiply-By knob at 1 and calibrate the ohmmeter as directed.

NOTE: Meters other than Rotunda 059-00010 may give different values for these test measurements. Use known good parts to establish reference values for a different meter.

**CAUTION: Digital meters cannot be used to perform these rectifier tests.**

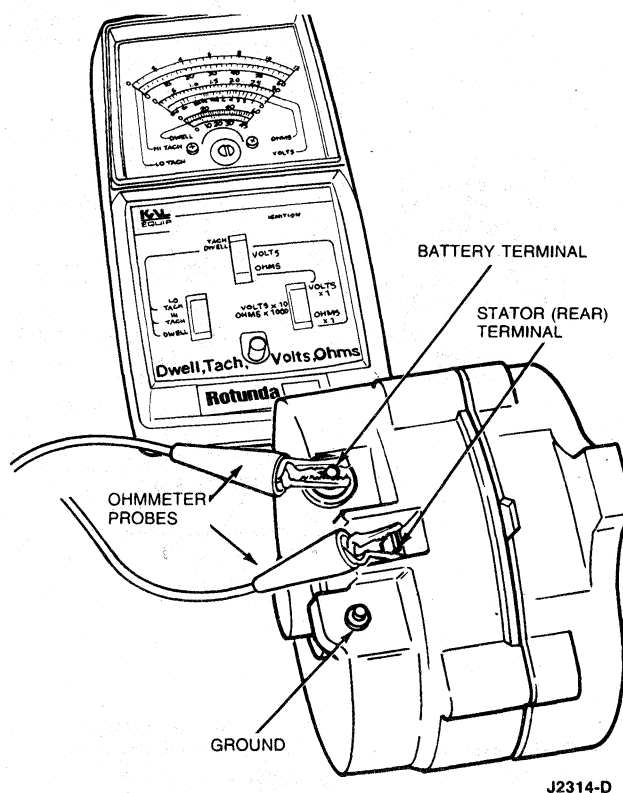
1. Contact one ohmmeter probe to alternator BAT terminal (red insulator) and other probe to STA terminal (rear blade terminal). Then, reverse ohmmeter probes and repeat test.

Normally, there will be no needle movement in one direction, indicating rectifier diodes are being checked in reverse current direction and are not shorted. A low reading with probes reversed indicates that rectifier positive diodes are being checked in forward current direction.

Using referenced tester, low reading should be about 6 ohms, but may vary if another type of tester is used. A reading in both directions indicates a damaged positive diode, a grounded positive diode plate, or a grounded BAT terminal.

2. Perform same test using STA and GND (ground) terminals of alternator. A reading in both directions indicates either a damaged negative diode, a grounded positive diode plate, or a grounded BAT terminal.

3. If there is no needle movement with probes in one direction, and no needle movement or high resistance (significantly over 6 ohms) in opposite direction for Tests 2 and 3, a bad connection exists in stator circuit inside alternator.



J2314-D

### Field Open or Short Circuit Test

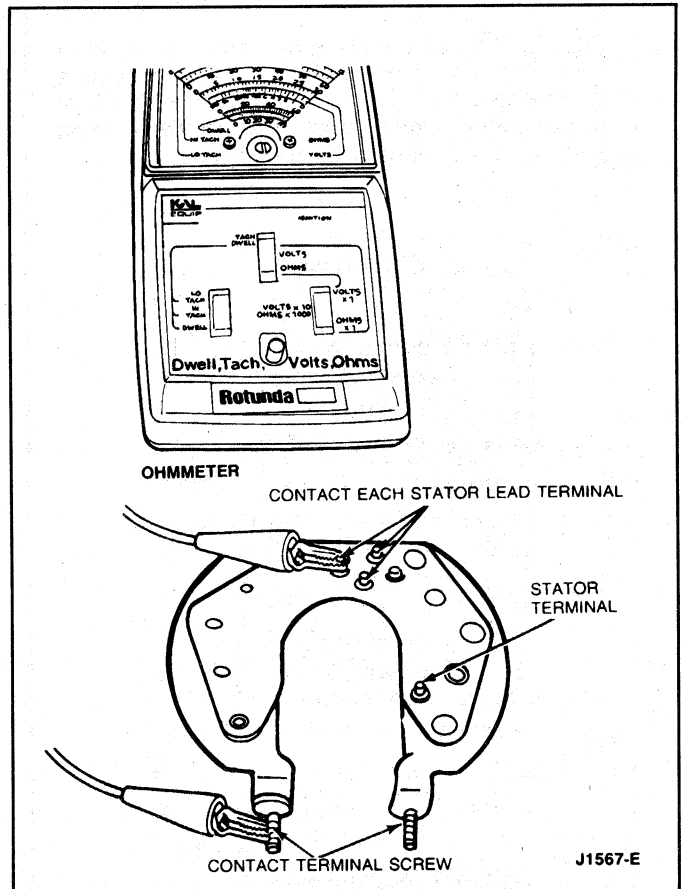
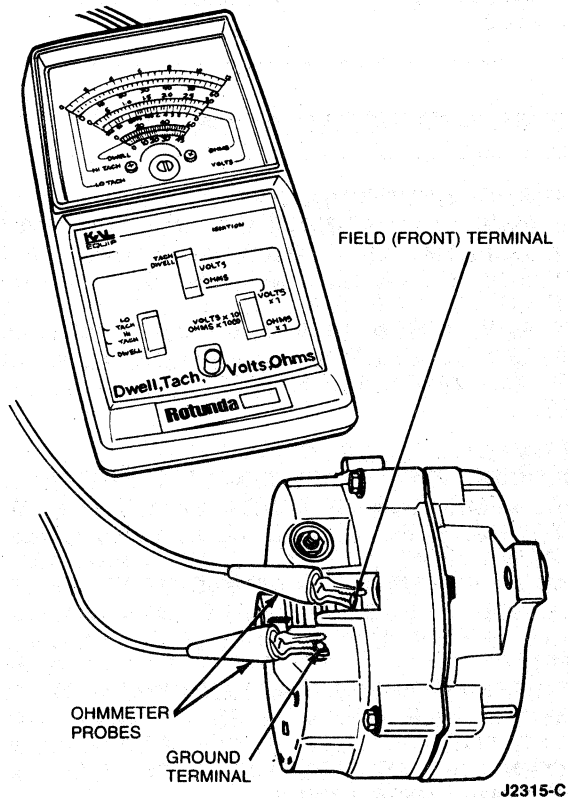
This test is performed with an ohmmeter. Set the ohmmeter Multiply-By knob at 1 and calibrate the ohmmeter as directed.

1. Contact alternator field terminal with one probe and ground terminal with other probe. Then, spin alternator pulley. Ohmmeter reading should be between 2.4 and 100 ohms and should fluctuate while pulley is turning.
2. An infinite reading (no meter movement) indicates a grounded brush lead, worn or stuck brushes, or a worn or damaged rotor assembly.



**TESTING (Continued)**

3. An ohmmeter reading less than 2.4 ohms indicates a grounded brush assembly, a grounded field terminal or a worn or damaged rotor.

**Diode Test**

Remove rectifier assembly from alternator and stator. Set Rotunda Ohmmeter 059-00010 or equivalent Multiply-By knob at 1 and calibrate the meter as directed.

NOTE: Meters other than Rotunda 059-00010 may give different values for these test measurements. Use known good parts to establish reference values for a different meter.

**CAUTION: Digital meters cannot be used to perform these diode tests.**

1. To test one set of diodes, contact one probe to one terminal screw and contact each of three stator lead terminals with other probe. Reverse probes and repeat test. All diodes should show a low reading of about 6 ohms in one direction, and an infinite reading (no needle movement) with probes reversed. Low reading may vary with type of ohmmeter used.
2. Repeat preceding tests for other set of diodes by contacting other terminal screw and three stator lead terminals.
3. If meter readings are not as specified, replace rectifier assembly.

**Stator Coil Grounded Test**

These tests are made to determine if the stator coil is operating properly. Remove the stator from the alternator.

Set the ohmmeter Multiply-By knob at 1000 and calibrate the meter as directed.

1. Connect ohmmeter probes to one stator lead and to stator laminated core. Ensure that probe makes a good electrical connection with stator core. The meter should show an infinite reading (no meter movement).
2. If meter does not indicate an infinite reading (needle moves), stator winding is shorted to core and must be replaced.
3. Repeat this test for each stator lead.

NOTE: Do not touch the metal probes or stator leads with the hands. Such contact will result in an incorrect reading.

**Stator Coil Open Test**

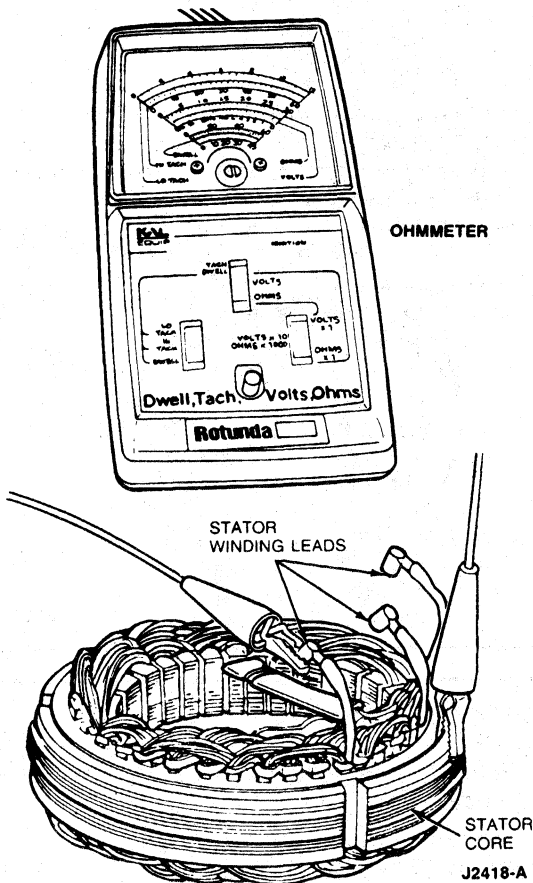
Set the ohmmeter Multiply-By knob at 1 and calibrate the meter as directed.

**CAUTION: A single open phase will not be discovered by this test on a 100 amp alternator, which has a delta-connected stator.**

1. Connect ohmmeter probe to a stator phase lead and touch other probe to another stator lead. Check meter reading.

**TESTING (Continued)**

2. Repeat this test with other two stator lead combinations. If no meter movement occurs (infinite resistance) on a lead paired with either of the other phase leads, that phase is open and the stator should be replaced.



5. A reading other than infinite indicates rotor is shorted to shaft. Inspect slip ring soldered terminals to assure they are not bent and not touching rotor shaft, or that excess solder is not grounding rotor coil connections to shaft. Replace the rotor if it is shorted and cannot be serviced.

**REMOVAL AND INSTALLATION**

**WARNING: HYDROGEN AND OXYGEN GASES ARE PRODUCED DURING NORMAL BATTERY OPERATION. THIS GAS MIXTURE CAN EXPLODE IF FLAMES, SPARKS OR LIGHTED TOBACCO ARE BROUGHT NEAR THE BATTERY. WHEN CHARGING OR USING A BATTERY IN AN ENCLOSED SPACE, ALWAYS PROVIDE VENTILATION AND SHIELD YOUR EYES.**

**WARNING: KEEP OUT OF REACH OF CHILDREN. BATTERIES CONTAIN SULFURIC ACID. AVOID CONTACT WITH SKIN, EYES OR CLOTHING. ALSO, SHIELD YOUR EYES WHEN WORKING NEAR THE BATTERY TO PROTECT AGAINST POSSIBLE SPLASHING OF THE ACID SOLUTION. IN CASE OF ACID CONTACT WITH SKIN, EYES OR CLOTHING, FLUSH IMMEDIATELY WITH WATER FOR A MINIMUM OF FIFTEEN MINUTES. IF ACID IS SWALLOWED, DRINK LARGE QUANTITIES OF MILK OR WATER, FOLLOWED BY MILK OF MAGNESIA, A BEATEN EGG, OR VEGETABLE OIL. CALL A PHYSICIAN IMMEDIATELY.**

**Removal**

1. Disconnect battery ground cable.
2. Loosen alternator pivot bolt and remove adjusting bolt.
3. Disengage alternator drive belt from drive pulley.
4. Disconnect wiring terminals from back of alternator. Stator and field wiring terminals are push-on type. After depressing lock tab, push-on type terminal should be pulled straight off terminal to prevent damage.
5. Remove alternator pivot bolt.
6. Remove alternator.

**Installation**

1. Position alternator on engine.
2. Install alternator pivot bolt and adjusting bolt. Do not tighten bolts until drive belt is tensioned.
3. Connect wiring terminals to alternator.
4. Install drive belt over alternator drive pulley.

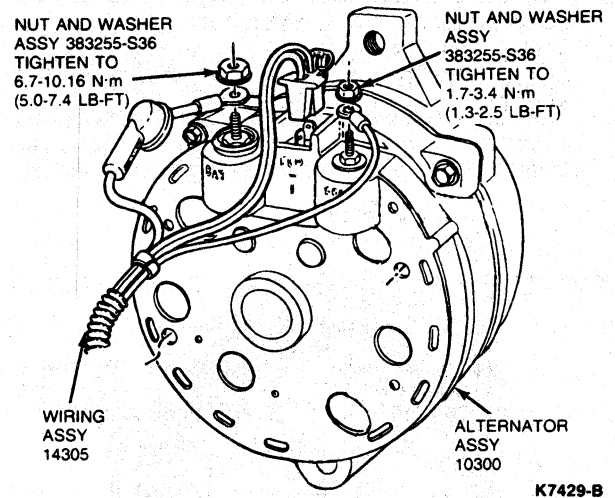
**Rotor Open or Short Circuit Test**

Remove the rotor from the alternator. Set the ohmmeter Multiply-By knob at 1 and calibrate the meter as directed.

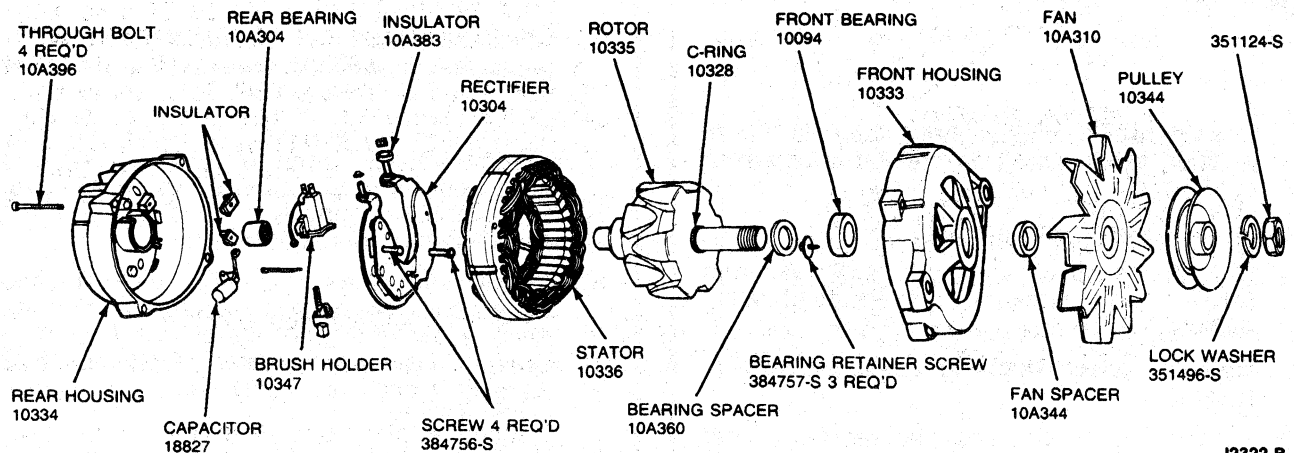
1. Contact each ohmmeter probe to a rotor slip ring. The meter reading should be 2.3 to 2.5 ohms.
2. A higher reading indicates a damaged slip ring solder connection or a broken wire.
3. A lower reading indicates a shorted wire or slip ring. Replace rotor if it is damaged and cannot be serviced.
4. Contact one ohmmeter probe to a slip ring and the other probe to rotor shaft. Meter reading should be infinite (no deflection).

## REMOVAL AND INSTALLATION (Continued)

5. Adjust drive belt tension using Belt Tension Gauge 021-00019 or equivalent. Refer to the Powertrain manual, Section 27-02. Tighten adjusting bolt to 41-61 N·m (30-45 lb-ft). Tighten pivot bolt to 68-94 N·m (50-70 lb-ft). Apply pressure on front housing only when adjusting belt tension.
6. Connect battery ground cable.



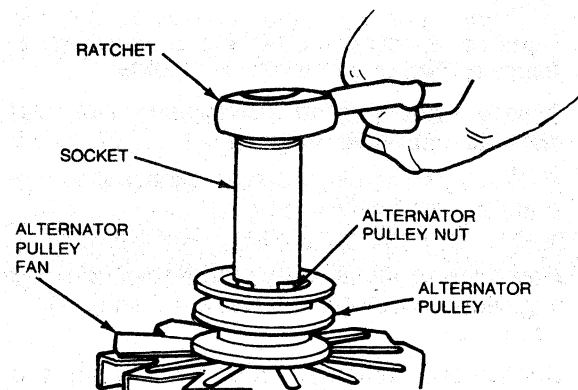
## DISASSEMBLY AND ASSEMBLY



## Disassembly

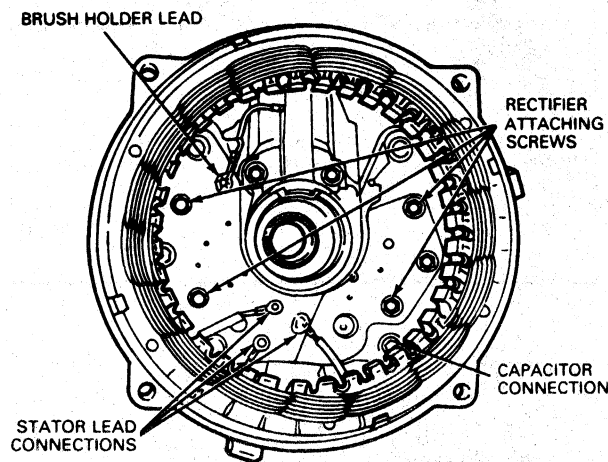
NOTE: All of these Steps may not be necessary to perform a particular test or service. Perform only those Steps that apply.

1. Mark both end housings and stator with a scribe mark for assembly.
2. Remove four housing through bolts, and separate front housing and rotor from rear housing and stator. Slots are provided in front housing to aid in disassembly. Do not separate rear housing from stator at this time.
3. Place rotor in a vise with soft jaws and remove pulley nut using deep well socket.



**DISASSEMBLY AND ASSEMBLY (Continued)**

4. Pull rotor and shaft from front housing and remove spacer from rotor shaft.
5. Remove three screws retaining bearing to front housing. If bearing is damaged or has lost lubricant, remove bearing from housing. To remove bearing, support housing close to bearing boss and press bearing from housing.



J2417-A

6. Unsolder and disengage three stator leads from rectifier. Work quickly to prevent overheating rectifier.
7. Lift stator from rear housing.
8. Unsolder and disengage brush holder lead from rectifier. Work quickly to prevent overheating rectifier.
9. Remove screw attaching capacitor lead to rectifier.
10. Remove four screws attaching rectifier to rear housing.
11. Remove two terminal nuts and insulator from outside housing. Remove rectifier from housing.
12. Remove two screws attaching brush holder to housing. Remove brushes and holder.
13. Remove any sealing compound from rear housing and brush holder.
14. Remove one screw attaching capacitor to rear housing and remove capacitor.
15. If bearing replacement is necessary, support rear housing close to bearing boss and press bearing out of housing.

**Cleaning and Inspection**

**CAUTION:** When rebuilding a high-temperature alternator, use only high-temperature rectifier assembly and bearings. Use of standard parts will result in alternator failure.

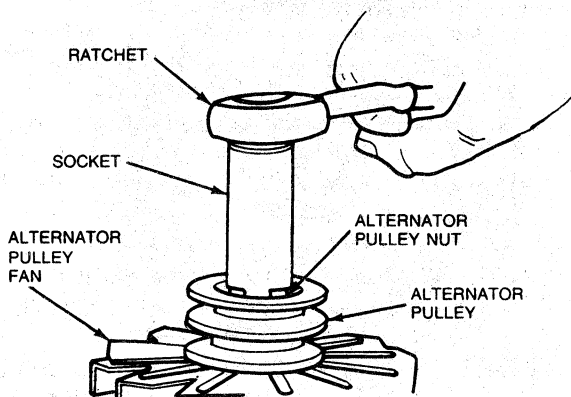
1. Wipe rotor, stator, and bearings with a clean cloth. Do not clean these parts with solvent.
2. Rotate front bearing on drive end of rotor shaft. Check for any scraping noise, looseness or roughness. Look for excessive lubricant leakage. If any of these conditions exist, replace bearing.
3. Inspect rotor shaft rear bearing surface for roughness or severe chatter marks. Replace rotor assembly if shaft is not smooth.
4. Place rear bearing on slip ring end of rotor shaft and rotate bearing. Make the same check for noise, looseness, or roughness as was made for front bearing. Inspect rollers and cage for damage. Replace bearing if these conditions exist, or if lubricant is lost or contaminated.
5. Check pulley and fan for excessive looseness on rotor shaft. Replace any pulley or fan that is loose or bent out of shape.
6. Check both front and rear housing for cracks, particularly in webbed areas and at mounting ear. Replace damaged or cracked housing.
7. Check all wire leads on both stator and rotor assemblies for loose or broken soldered connections and for burned insulation. Resolder poor connections. Replace parts that show signs of burned insulation.
8. Check slip rings for nicks and surface roughness. Nicks and scratches may be removed by turning down slip rings. Do not go beyond minimum diameter of 31mm (1.22 inches). If rings are badly damaged, replace rotor assembly.
9. Replace brushes if they are worn shorter than 6.35mm (1/4 inch).

**Assembly**

1. If front housing bearing is being replaced, press new bearing in housing. Apply pressure on bearing outer race only. Then, install bearing retaining screws and tighten to 2.9-4.5 N·m (25-40 lb-in).
2. Place inner spacer on rotor shaft and insert rotor shaft into front housing and bearing.

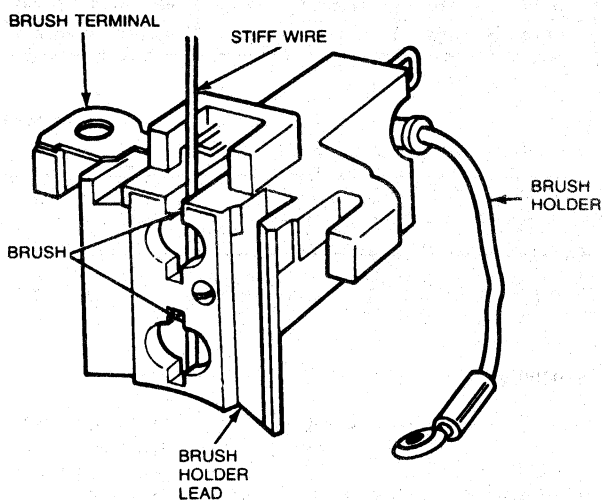
## DISASSEMBLY AND ASSEMBLY (Continued)

3. Install fan spacer, fan, pulley, lockwasher and nut on rotor shaft. Place rotor in a vise with soft jaws and tighten pulley retaining nut.



J3482-A

4. If rear bearing is being replaced, press a new bearing in from inside housing until rear bearing face is flush with boss outer surface.
5. Position brush terminal on brush holder. Install springs and brushes in brush holder and insert a piece of stiff wire to hold brushes in place.



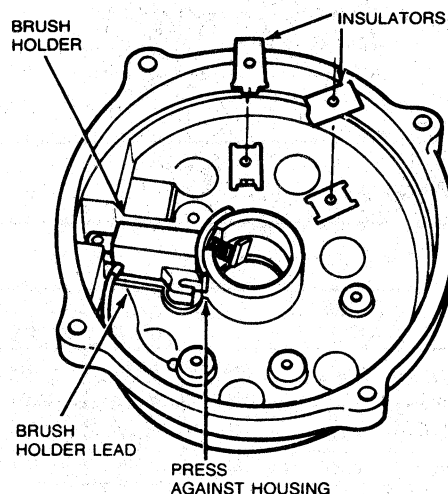
J2304-C

6. Brushes and springs are serviced as part of brush holder assembly. Position brush holder in rear housing and install attaching screws. Brush retaining wire must stick out enough to be grabbed and pulled from housing assembly. Waterproof glue sealer may have to be pushed out of pin hole in housing.

Push brush holder toward brush holder attaching screws. Reseal crack between brush holder and brush cavity in rear housing with Caulking Cord D6AZ-19560-A or equivalent body sealer.

NOTE: Do not use silicone base sealer for this application.

7. Position capacitor to rear housing and install attaching screw.
8. Place two rectifier insulators on bosses inside housing.



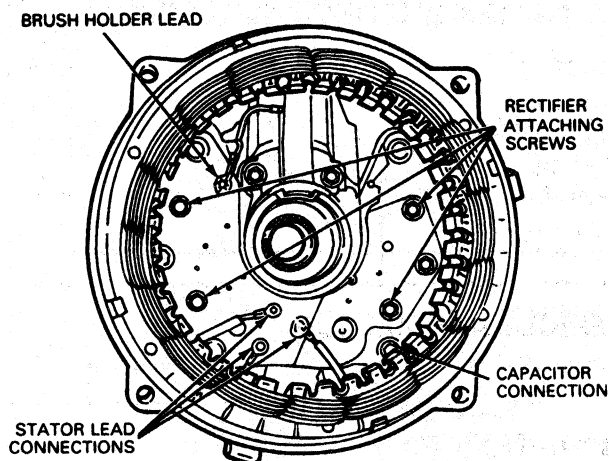
J2303-C

9. Place insulator on BAT (large) terminal of rectifier and position rectifier in rear housing. Place outside insulator on BAT terminal and install nuts on BAT and GRD terminals finger-tight.
10. Install, but do not tighten, four rectifier attaching screws.
11. Tighten the BAT terminal nuts to 4.0-5.6 N·m (35-50 lb-in) and GRD terminal nuts to 2.8-3.9 N·m (25-35 lb-in) on outside of rear housing. Then, tighten four rectifier attaching screws to 4.6-5.6 N·m (40-50 lb-in).
12. Position capacitor lead to rectifier and install attaching screw.
13. Press brush holder lead on rectifier pin and solder securely. Work quickly to prevent overheating rectifier.

**DISASSEMBLY AND ASSEMBLY (Continued)**

14. Position stator in rear housing and align scribe marks. Press three stator leads on rectifier pins and solder securely using resin core electrical solder. Work quickly to prevent overheating rectifier.
15. Position rotor and front housing into stator and rear housing. Align scribe marks and install four through bolts. Tighten two opposing bolts and then two remaining bolts.
16. Spin fan and pulley to be sure nothing is binding within alternator.
17. Remove brush retracting wire and place a daub of waterproof cement over hole to seal it.

NOTE: Do not use silicone sealer on hole.



J2417-A

**SPECIFICATIONS**

Rating		Field Current	Slip Ring Turning				Brush Length				Pulley Nut	
Amperes @15V	Watts @15V	Amps @	Min. Diameter		Max. Runout		New <sup>①</sup>		Wear Limit		N-m	Lb-Ft
			mm	Inches	mm	Inches	mm	Inches	mm	Inches		
70	1050	4.25	31	1.22	.0127	.0005	12.19	.480	6.35	.25	82-135	60-100
100	1500	4.25	31	1.22	.0127	.0005	12.19	.480	6.35	.25	82-135	60-100

①Add .635mm (.025 in.) to positive brush length.

For belt tension specifications, refer to Powertrain manual, Section 27-02.

CJ2282-F

**SPECIAL SERVICE TOOLS**

Tool Number	Description
Rotunda 059-00010	Ohmmeter
Rotunda 021-00019	Belt Tension Gauge

CJ2320-F

# SECTION 31-15 Alternator—Electronic Regulator

SUBJECT	PAGE	SUBJECT	PAGE
DESCRIPTION		DIAGNOSIS (Cont'd.)	
Indicator Lamp Regulators .....	31-15-1	Alternator Voltage Regulator .....	31-15-4
DIAGNOSIS		Heated Windshield System .....	31-15-3
Visual Inspection .....	31-15-3	VEHICLE APPLICATION .....	31-15-1

## VEHICLE APPLICATION

Taurus/Sable.

## DESCRIPTION

The electrical charging systems incorporate an electronic voltage regulator consisting of transistors, diodes and resistors. The working functions are achieved using electronic components arranged in basically three circuit divisions: the output stage, the voltage control stage and the solid-state relay. The regulators are calibrated and preset by the manufacturer. No readjustment is required or possible on these units.

### Indicator Lamp Regulators

Closing the ignition switch energizes the warning lamp and turns on the regulator output stage. The alternator is now receiving maximum field current and is ready to generate an output voltage. Once the alternator rotor speed increases from zero, the output terminal voltage increases to a system regulation level determined by the voltage control stage.

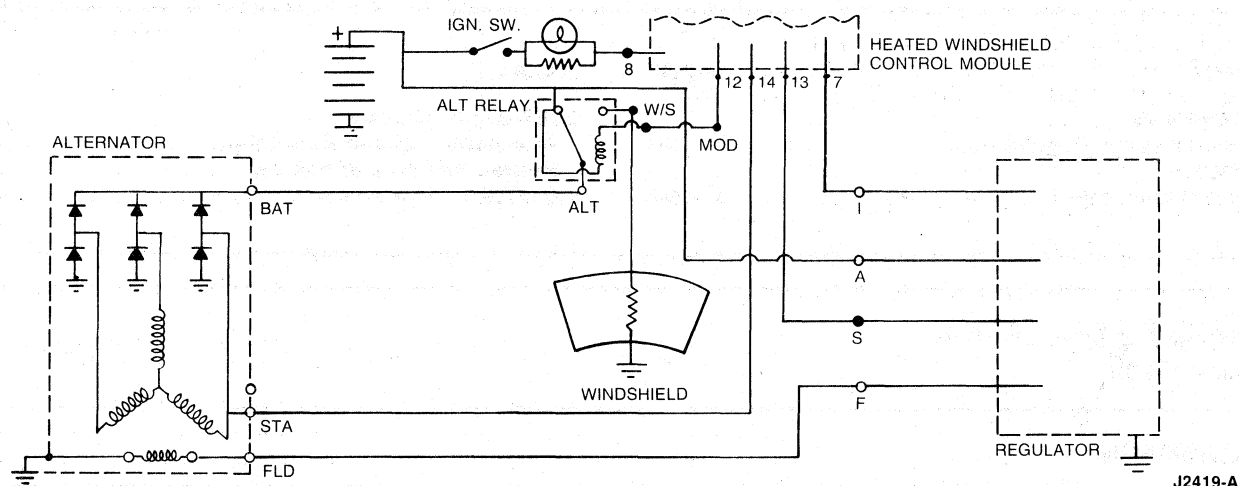
The stator terminal voltage is one-half the output voltage and extinguishes the indicator lamp through the action of the solid state relay circuit.

When the ignition switch is turned to OFF, the solid state relay circuit causes the output stage to be turned off, interrupting all current flow through the regulator so that there is no stand-by current drain on the battery.

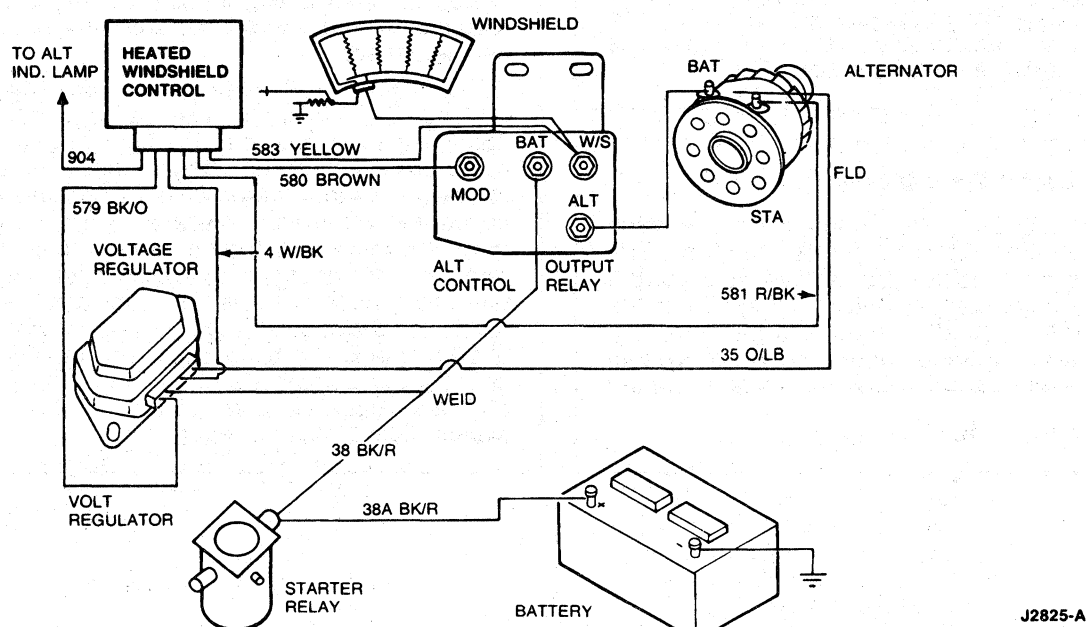
The field circuit overcurrent protection stage protects the electronic voltage regulator against damage due to shorts in the field circuit. With the overcurrent protection stage, shorts in the field circuit (field wire, alternator rotor and brushes) will cause the alternator indicator lamp to energize. After the ignition is turned to OFF and the short removed, the charging system will resume normal operation upon vehicle start-up and hence no service to the regulator is required. However, if the alternator indicator lamp fails to go out after start-up or repeated complaints of "indicator lamp coming on" are reported, then service of the charging system field circuit is required.

**DESCRIPTION (Continued)**

## System Schematic



## System Components



## Service Precautions

Whenever the system components are being replaced, the following precautions should be followed so that the charging system will work properly and components will not be damaged:

- Service Precautions**

Whenever the system components are being replaced, the following precautions should be followed so that the charging system will work properly and components will not be damaged:

  1. Always use the proper alternator in the system being serviced.
  2. The external regulators are color coded for proper installation. Always use the black color coded regulator in systems which use the warning lamp indicator. The neutral color coded service regulator also may be used.
  3. The charging systems use a 500 ohm resistor on the back of the instrument cluster on vehicles with warning indicator lamp.

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## DIAGNOSIS

**WARNING: HIGH VOLTAGE: THE ELECTRICALLY HEATED WINDSHIELD SYSTEM WILL OPERATE AT 30 TO 70 VOLTS WHEN ACTIVATED. EXERCISE CAUTION TO AVOID POSSIBLE PERSONAL INJURY WHEN SERVICING OR TESTING THE FOLLOWING COMPONENTS:**

- ALTERNATOR.
- ALTERNATOR OUTPUT RELAY.
- CONTROL MODULE.
- ASSOCIATED WIRING (DO NOT PROBE).

### Visual Inspection

1. Check battery for proper state of charge (at least 1.200 specific gravity).
2. Check and clean all terminal connections at battery, alternator, regulator and engine to body.
3. Check fuse link between starter relay and alternator.
4. Check alternator drive belt for proper tension.

**CAUTION: Ensure terminal connectors are installed properly at alternator.**

**On external voltage regulators, always disconnect the connector plug from the regulator before checking alternator output with test probes or a jumper wire.**

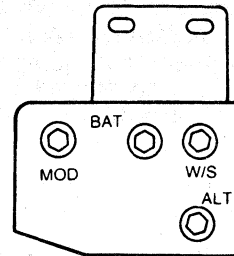
**Always disconnect the connector plug from the regulator before removing regulator mounting screws. Removing the connector from an ungrounded regulator with the ignition switch ON or turning the ignition switch OFF will destroy the regulator.**

### Heated Windshield System

The electrically Heated Windshield System (HWS) operates from the charging system alternator when turned on. No charge is supplied to the battery when the HWS is on. Refer to Section 43-20 for operation and diagnosis of the heated windshield system. Failure of the heated windshield control module or alternator output relay can cause a no-charge condition. The following procedure should be followed to determine if the HWS is the cause for a no-charge condition:

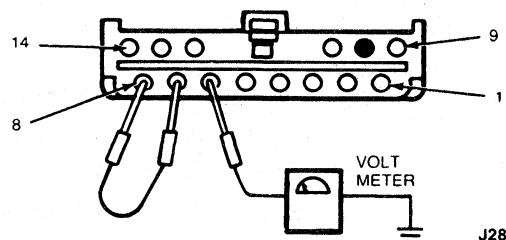
1. Measure voltage at alternator BAT terminal with the HWS off. Battery voltage should be present.

2. If there is no voltage at the alternator BAT terminal, remove cover from the alternator relay located behind the splash shield under the RH front fender. Measure voltage at the BAT and ALT terminals.



J2822-A

3. If battery voltage is present at the BAT terminal and not at the ALT terminal, remove the push-on connector at the MOD terminal. If the ALT terminal remains at zero volts, replace the alternator relay. If the voltage at the ALT terminal goes to battery voltage when the connector is removed from the MOD terminal (HWS off), the wire to the MOD terminal is shorted or the control module is damaged. Refer to Section 43-20 to service the control module.
4. Verify that the alternator charge lamp comes on with the ignition in RUN (engine not running, HWS off). If the charge lamp stays off, check voltage at the voltage regulator I terminal. If there is one volt or more at the regulator I terminal, the lamp or lamp circuit is damaged. If there is zero volts at the regulator I terminal, remove the heated windshield control module connector and connect a jumper from Pin 7 to Pin 8. The HWS control module is located under the instrument panel on the steering column support.

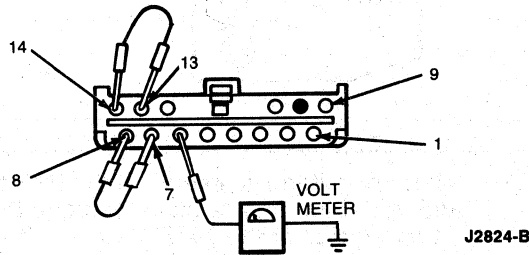


J2823-A

If there is one volt or more at the regulator I terminal and/or the charge lamp now comes on with the ignition in RUN (engine not running), check for voltage at the HWC module connector Pin 6. If battery voltage is present, replace the HWC module. If no voltage is present at Pin 6 refer to Section 43-20 for diagnosis of the heated windshield system. If the voltage at the regulator I terminal is still zero, there is an open in circuit 904. Refer to Section 31-01.

**DIAGNOSIS (Continued)**

5. If the charge indicator lamp stays on and the alternator output is OK (about 14 volts), there is a problem in the alternator stator circuit. Measure voltage at the alternator stator terminal with the engine running and the HWS off. If the meter reads about 7 volts, measure voltage at the regulator S terminal. If the voltage is zero, remove HWC module connector and connect two jumpers, one between terminals 7 and 8 and the other between terminals 13 and 14.



If the charge lamp now functions properly, the HWC module is not being powered up or is damaged. Check voltage at Pin 6 of the HWC module connector with ignition in RUN. Battery voltage should be present. If battery voltage is present, replace the HWC module. If no voltage is present at Pin 6 with the ignition in RUN, refer to Section 43-20 for diagnosis of the heated windshield system.

**Alternator Voltage Regulator****Removal and Installation**

1. Remove battery ground cable.
2. Disconnect regulator from wiring harness.
3. Remove regulator mounting screws.
4. Mount new regulator.
5. Connect new regulator to wiring harness.
6. Connect battery ground cable.
7. Test the system for proper voltage regulation.

# SECTION 31-17 Alternator—Integral Regulator

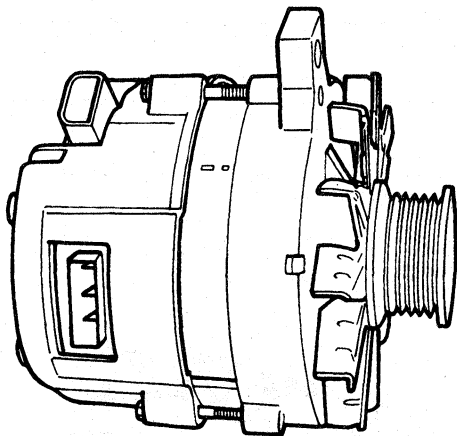
SUBJECT	PAGE	SUBJECT	PAGE
ADJUSTMENTS .....	31-17-2	SPECIFICATIONS .....	31-17-14
DESCRIPTION AND OPERATION .....	31-17-1	TESTING	
DISASSEMBLY AND ASSEMBLY .....	31-17-8	Bench Tests .....	31-17-2
REMOVAL AND INSTALLATION .....	31-17-7	VEHICLE APPLICATION .....	31-17-1
SPECIAL SERVICE TOOLS .....	31-17-14		

## VEHICLE APPLICATION

Taurus/Sable.

## DESCRIPTION AND OPERATION

The integral alternator/regulator (IAR) is belt-driven from the engine. Field current is supplied from the alternator regulator, mounted on the rear of the alternator, to the rotating field of the alternator through two brushes and two slip rings.



J2932-A

The alternator produces power in the form of alternating current. The alternating current is rectified to direct current by six diodes. The alternator regulator automatically adjusts the

alternator field current to maintain the alternator output voltage within prescribed limits to correctly charge the battery. The alternator is self-current limiting.

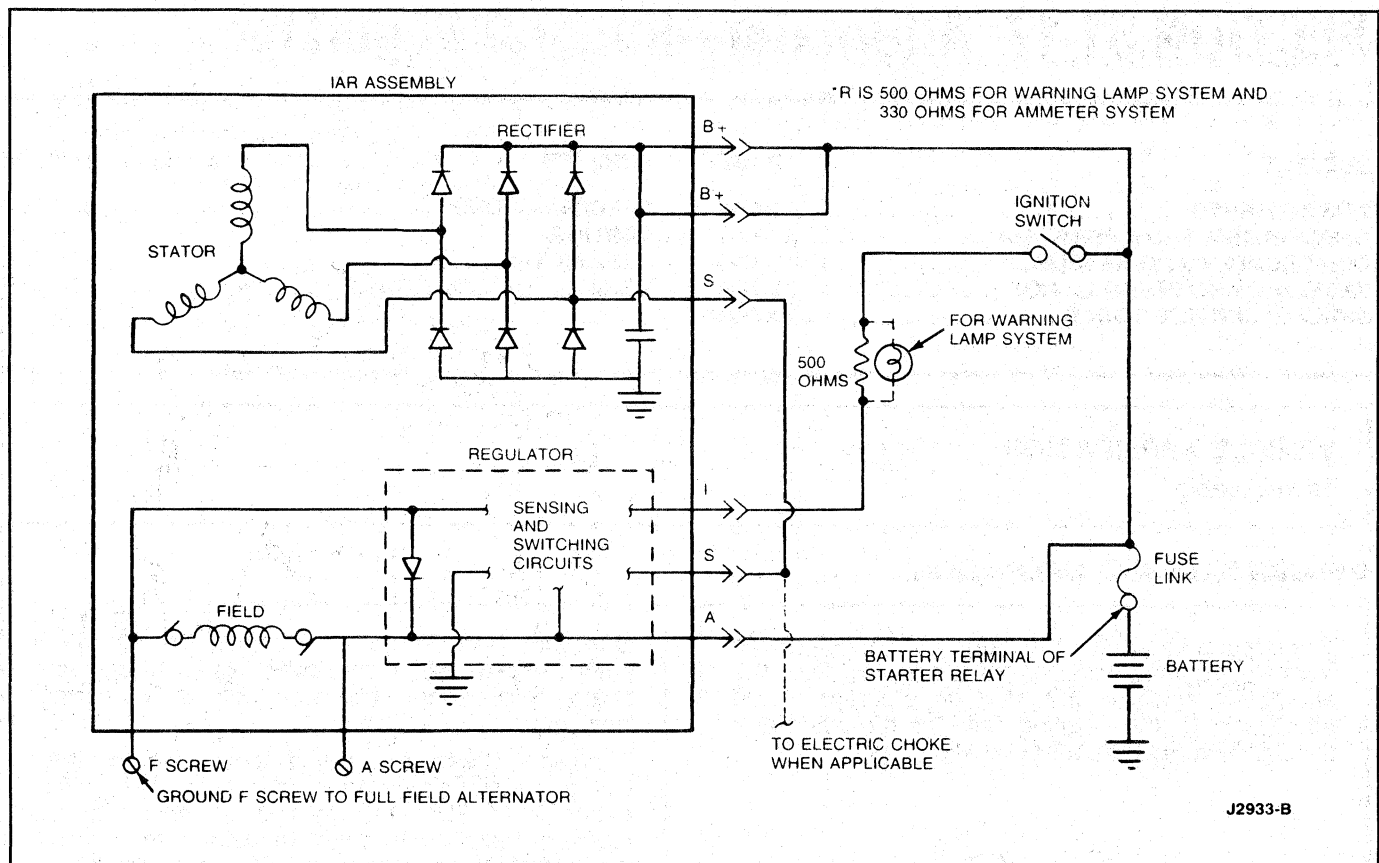
If equipped with a warning lamp, the regulator voltage control circuit is turned on when the ignition switch is in RUN and voltage is applied to the regulator I terminal through a resistor in the I circuit. When the ignition switch is in OFF, the control circuit is turned off and no field current flows to the alternator.

On warning lamp equipped vehicles, the warning lamp is connected across the terminals of a 500 ohm resistor at the instrument cluster. Current passes through the warning lamp when the ignition switch is in RUN and there is no voltage at terminal S. When voltage at S rises to a preset value, the regulator switching circuits stop the flow of current into terminal I and the lamp turns off.

System voltage is "sensed" and alternator field current is drawn through terminal A. The regulator switching circuits will turn the warning lamp on, indicating a system fault, if terminal A voltage is excessively high or if the terminal S voltage signal is abnormal.

A fuse link is included in the charging system wiring on all models. The fuse link is used to prevent damage to the wiring harness and alternator if the wiring harness should become grounded, or if a booster battery is connected to the charging system with the wrong polarity.

## DESCRIPTION AND OPERATION (Continued)



## ADJUSTMENTS

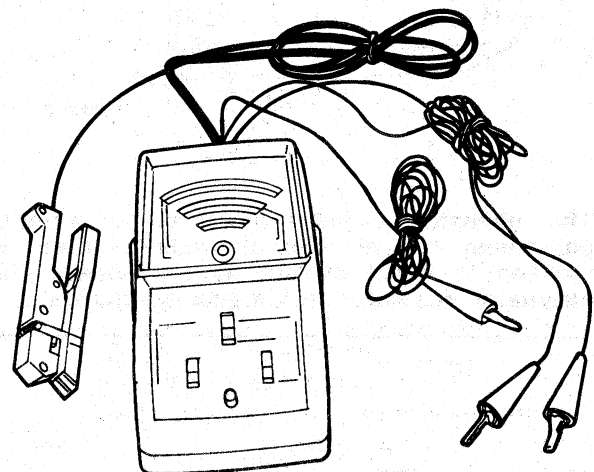
Refer to Section 27-02 for drive belt adjustments.

## TESTING

## Bench Tests

If system diagnosis has isolated a problem in the integral alternator/regulator assembly, remove it from vehicle for bench testing and service or replace. Refer to Removal and Disassembly. In some cases, it may be possible to replace a damaged regulator or brushes without removing the IAR assembly.

The following tests are performed with a needle-type ohmmeter. Test values shown are referenced to Rotunda Ohmmeter 059-00010 or equivalent. THESE VALUES MAY BE DIFFERENT FOR OTHER OHMMETERS. If you do not have model 059-00010, use known good parts to establish reference values for your own meter. These values can be written into the spaces provided in the meter reading charts for future reference.



J2934-A

## TESTING (Continued)

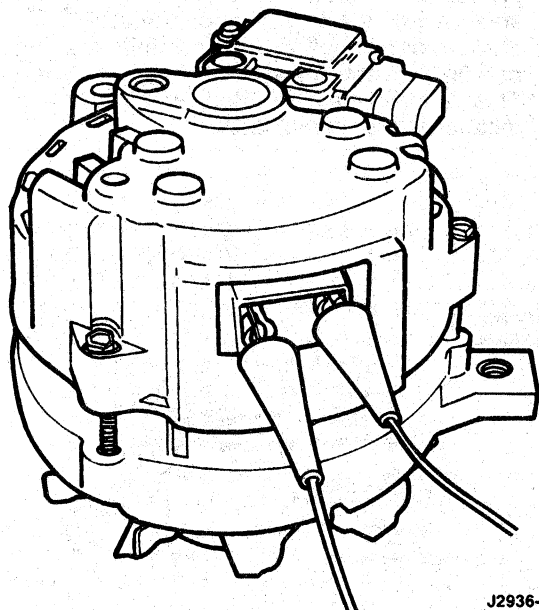
**Rectifier and Stator Grounded Tests**

This test is performed with an ohmmeter, Rotunda 059-00010 or equivalent. Place the Multiply-By setting at 1 and calibrate the ohmmeter as directed.

NOTE: Text values shown in brackets [ ] \_\_\_\_ are referenced to Rotunda Model 059-00010, and may be different if another tester is used.

**CAUTION: Digital meters cannot be used to perform these rectifier tests.**

1. Contact one ohmmeter probe of one of the alternator B+ blade terminals and the other probe to the STA blade terminal. Then, reverse the ohmmeter probes and repeat the test. Normally, there will be no needle movement in one direction, indicating the rectifier diodes are being checked in the reverse current direction and are not shorted. A low reading of about [6.5] \_\_\_\_ ohms with the probes reversed indicates that rectifier positive diodes are being checked in the forward current direction. A reading in both directions indicates a bad positive diode or shorted radio suppression capacitor. The radio suppression capacitor is built into the rectifier assembly and is not individually serviceable.

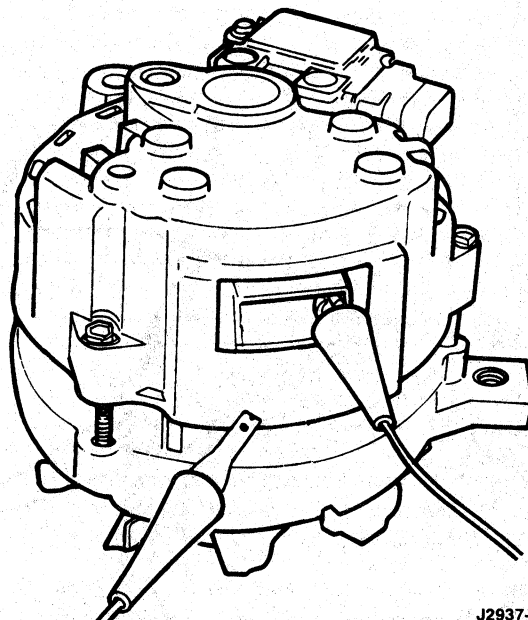


J2936-B

METER READING			
Set meter to Ohms x 1. Make reading in both directions.			
Resistance Measurement		Acceptable Reading	
BAT Terminal	to STA Terminal	Model 059-00010	Reference For Another Meter
One probe position		∞	∞
Other probe position		About [6.5] ohms	About ____ ohms

CJ3051-B

2. Perform the same test using the STA blade terminal and alternator rear housing. A reading in both directions indicates either a grounded stator winding, a damaged negative diode, a grounded stator lead wire or a shorted radio suppression capacitor.



J2937-B

METER READING		
Set meter at Ohms x 1. Make reading in both directions.		
Resistance Measurement		Acceptable Reading
GND	to STA Terminal	Model 059-00010
One probe position		∞
Other probe position		About 6.5 ohms

CJ2673-A

3. If there is no needle movement with the probes in one direction and no needle movement or high resistance (significantly over [6.5] \_\_\_\_ ohms) in the opposite direction for Test 1 and 2, a bad connection exists in the rectifier assembly.

**Field Open or Short Circuit Test**

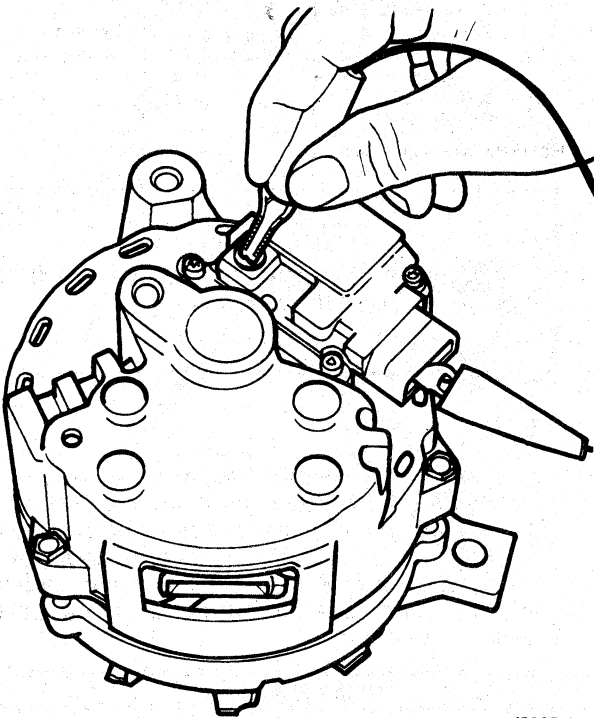
This test is performed with an ohmmeter, Rotunda Dwell Tach Volt-Ohmmeter 059-00010 or equivalent.

Place the Multiply-By setting at 1 and calibrate the ohmmeter as directed.

1. Contact the regulator A blade terminal with one probe and the regulator F screw head with the other probe. Spin the alternator pulley.

## TESTING (Continued)

Reverse the ohmmeter probes and repeat the test. In one probe direction, the ohmmeter reading should be between 2.2 and 100 ohms (on Rotunda meter) and may fluctuate while the pulley is turning. In the other probe direction, the reading should fluctuate between 2.2 and about [9] \_\_\_\_ ohms.



J2935-A

## METER READING

Set meter at Ohms x 1. Make readings in both directions. Spin pulley while taking reading.

Resistance Movement		Acceptable Reading	
Regulator A Blade Terminal	to Regulator F Screw Head	Tool 059-00010	Reference For Another Meter
One probe position		2.2 to 100 ohms	2.2 to 100 ohms
Other probe position		2.2 to [9] ohms	2.2 to ____ ohms

CJ3053-B

- An infinite reading (no meter movement) in one direction and approximately [9] \_\_\_\_ ohms in the other, indicates an open brush lead, worn or stuck brushes, a damaged rotor or a loose regulator to brush holder attaching screw.
- An ohmmeter reading less than [2.2] \_\_\_\_ ohms in both directions indicates a shorted rotor or damaged regulator.
- An ohmmeter reading significantly over [9] \_\_\_\_ ohms in both directions indicates an inoperative regulator or loose F terminal screw.

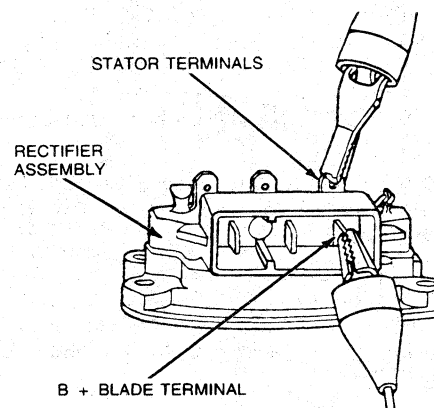
- Contact the alternator rear housing with one ohmmeter probe and touch the other probe to the regulator F terminal. Reverse the probes and repeat the test. The ohmmeter reading should be infinite in one probe direction and approximately [9] \_\_\_\_ ohms in the other. A reading less than infinite in both directions indicates a grounded brush lead or an inoperative regulator. A reading significantly over [9] \_\_\_\_ ohms in both directions indicates an inoperative regulator or a damaged A terminal connection.

## Rectifier Assembly Test

Remove the rectifier assembly from the alternator. Place the ohmmeter, Rotunda 059-00010 or equivalent, Multiply-By setting at 1 and calibrate the meter as directed.

**CAUTION: Digital meters cannot be used to perform these tests.**

- To test the positive diodes, contact one probe to one of the rectifier assembly B+ blade terminals and contact each of the three stator terminals with the other probe. Reverse the probes and repeat the test. All diodes should show a low reading of approximately [7] \_\_\_\_ ohms in one direction and an infinite reading (no needle movement) with the probes reversed. This reading may be checked against a good rectifier if one is available.



J2815-B

## METER READING

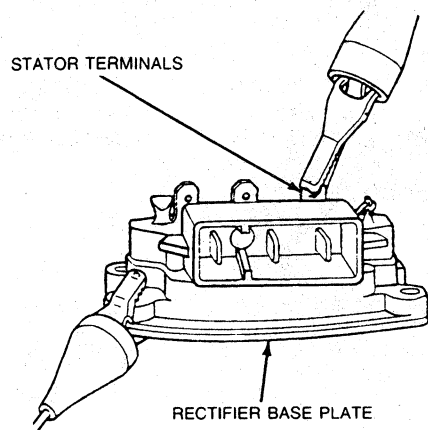
Set meter at Ohms x 1. Make readings in both probe directions to all three phase terminals.

Resistance Measurement		Acceptable Reading	
B+ Terminal	to Phase Terminal	Tool 059-00010	Reference For Another Meter
One probe direction to each phase terminal		About 7.0 ohms	About ____ ohms
Other probe direction to each phase terminal		∞	∞

CJ2674-A

**TESTING (Continued)**

2. Perform the preceding tests for the negative diodes by contacting the rectifier assembly base plate and the three stator terminals.



J2816-B

METER READING			
Set meter at Ohms x 1. Make readings in both probe directions to all three phase terminals.			
Resistance Measurement		Acceptable Reading	
Base Plate	to Phase Terminal	Tool 059-00010	Reference For Another Meter
One probe direction to each phase terminal		About 7.0 ohms	About ____ ohms
Other probe direction to each phase terminal		$\infty$	$\infty$

CJ2675-A

3. If the meter readings are not as specified, replace the rectifier assembly.

**Radio Suppression Capacitor Open or Short Test**

**NOTE:** This is an open or short circuit test only and does not measure capacitance value. Actual capacitance value should be measured on a capacitance bridge at 1 kHz at a maximum voltage of 350 mV rms.

The radio noise suppression capacitor is built into the rectifier assembly and cannot be serviced by itself. To test the capacitor, place the ohmmeter, Rotunda 059-00010 or equivalent, Multiply-By setting at 1000 and zero the meter. Text values shown in brackets [ ] \_\_\_\_ are referenced to Rotunda Model 059-00010 and may be different if another tester is used.

**CAUTION:** Digital meters cannot be used to perform this capacitor test. The rectifier assembly must be dry.

1. Contact one probe to one of the rectifier assembly B+ blade terminals and contact the other probe to the rectifier assembly base plate. Reverse the probes and repeat the test. One

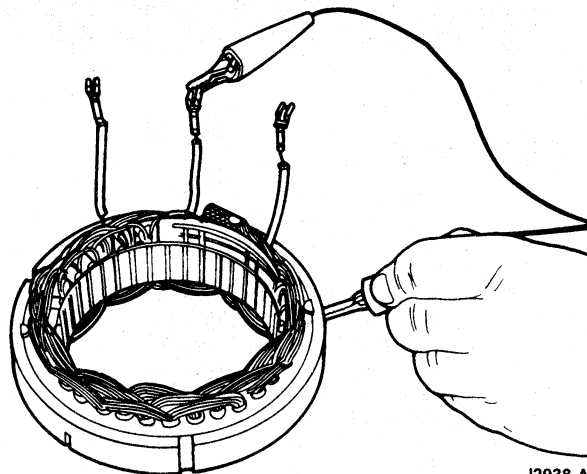
position should give an infinite reading, indicating the reverse current direction through the diodes and the other position should give a reading of about [1000] \_\_\_\_ ohms, indicating the forward current direction. The same reading in both directions indicates an inoperative rectifier assembly.

2. To check the capacitor, contact the probes to the rectifier assembly B+ terminal and base plate in the forward current [1000] \_\_\_\_ ohms reading direction. While observing the meter indicator needle, reverse the probes and again contact them to the rectifier assembly B+ terminal and base plate. The indicator needle should jump slightly (indicating that the ohmmeter batteries are charging the capacitor) and then return to its original position (infinite reading). If the needle does not jump, the capacitor is open. Replace the rectifier assembly.

**TESTING (Continued)****Stator Coil Grounded Test**

These tests are made to determine if the stator coil is shorted to ground. Remove the stator from the alternator and disconnect it from the rectifier assembly as outlined. Place the ohmmeter Multiply-By setting at 1000.

1. Connect the ohmmeter probes to one of the stator lead terminals and to the stator laminated core. Ensure that the probe makes a good electrical connection with the stator core. The meter should show an infinite reading (no needle movement).
2. If the meter does not indicate an infinite reading (needle moves), the stator winding is grounded to the core and the stator must be replaced.



J2938-A

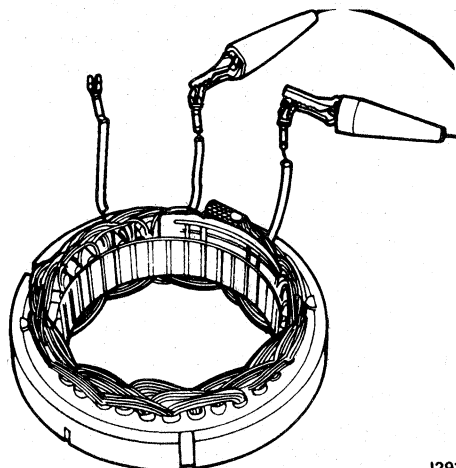
METER READING			
Set meter at Ohms x 1000. Make readings for all stator leads. DO NOT TOUCH LEADS WITH HANDS.			
Resistance Measurement		Acceptable Reading	
Stator Terminal	to Stator Core	Tool 059-00010	Reference For Another Meter
All Stator lead combinations: Probe polarity optional		$\infty$	$\infty$

CJ2810-A

**Stator Coil Open Test**

This test determines if there is an open stator circuit. Disconnect the stator from the rectifier assembly. Place the ohmmeter Multiply-By setting at 1.

1. Connect one ohmmeter probe to a stator phase lead terminal and touch the other probe to another stator lead terminal. Check the meter reading.
2. Repeat this test with the other two stator lead combinations. If no meter movement occurs (infinite resistance) on a lead paired with either of the other phase leads, that phase is open and the stator must be replaced.



J2939-B

METER READING			
Set meter at Ohms x 1. Make readings for all stator lead combinations.			
Resistance Measurement		Acceptable Reading	
Stator Terminal	to Stator Terminal	Tool 059-00010	Reference For Another Meter
All lead combinations: Probe polarity optional		Less than 0.5 ohms	Less than 0.5 ohms

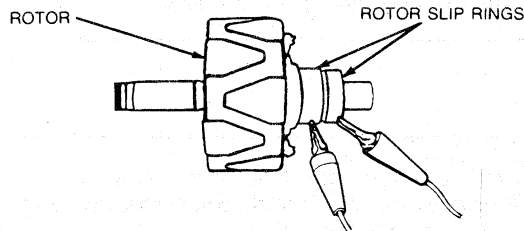
CJ2811-A



**TESTING (Continued)****Rotor Open or Short Test**

Remove the rotor from the alternator. Place the ohmmeter Multiply-By setting at 1 and calibrate the meter as directed.

1. Contact each ohmmeter probe to a rotor slip ring. The meter reading should be [2.0-3.9] \_\_\_\_\_ ohms.



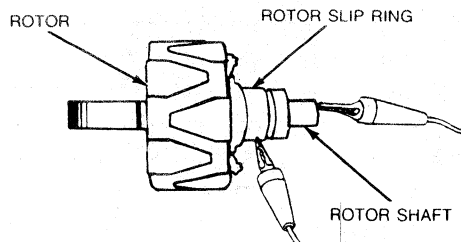
J2818-A

2. A higher reading indicates a damaged slip ring, welded connection or a broken wire. A lower reading indicates a shorted wire or slip ring. Replace the rotor if it is damaged and cannot be serviced.

METER READING			
Set meter at Ohms x 1.			
Resistance Measurement		Acceptable Reading	
Slip Ring	to Slip Ring	Tool 059-00010	Reference For Another Meter
Probe polarity optional		2.0 to 3.9 ohms	2.0 to 3.9 ohms

CJ2812-A

3. Contact one ohmmeter probe to a slip ring and the other probe to the rotor shaft. The meter reading should be infinite (no needle movement).



J2817-A

4. A reading other than infinite indicates the rotor coil is grounded to the shaft. Replace the rotor if it is grounded and cannot be serviced.

METER READING			
Set meter at Ohms x 1.			
Resistance Measurement		Acceptable Reading	
Slip Ring	to Rotor Shaft	Tool 059-00010	Reference For Another Meter
Either slip ring; Probe polarity optional		∞	∞

CJ2813-A

**REMOVAL AND INSTALLATION**

**WARNING: HYDROGEN AND OXYGEN GASES ARE PRODUCED DURING NORMAL BATTERY OPERATION. THIS GAS MIXTURE CAN EXPLODE IF FLAMES, SPARKS OR LIGHTED TOBACCO ARE BROUGHT NEAR THE BATTERY. WHEN CHARGING OR USING A BATTERY IN AN ENCLOSED SPACE, ALWAYS PROVIDE VENTILATION AND SHIELD YOUR EYES.**

**WARNING: KEEP BATTERIES OUT OF REACH OF CHILDREN. BATTERIES CONTAIN SULFURIC ACID. AVOID CONTACT WITH SKIN, EYES OR CLOTHING. ALSO, SHIELD YOUR EYES WHEN WORKING NEAR THE BATTERY TO PROTECT AGAINST POSSIBLE SPLASHING OF THE ACID SOLUTION. IN CASE OF ACID CONTACT WITH THE SKIN, EYES OR CLOTHING, FLUSH IMMEDIATELY WITH WATER FOR A MINIMUM OF FIFTEEN MINUTES. IF ACID**

**IS SWALLOWED, DRINK LARGE QUANTITIES OF MILK OR WATER, FOLLOWED BY MILK OF MAGNESIA, A BEATEN EGG, OR VEGETABLE OIL. CALL A PHYSICIAN IMMEDIATELY.**

**Removal**

1. Disconnect battery ground cable.
2. Disconnect the wire harness attachments to the integral alternator/regulator assembly. Pull the two connectors straight out.
3. Loosen the alternator pivot bolt. Remove the adjustment arm bolt from the alternator.
4. Disengage the alternator drive belt from the alternator pulley.
5. Remove the alternator pivot bolt and alternator/regulator assembly.
6. Remove the alternator fan shield, if so equipped.

## REMOVAL AND INSTALLATION (Continued)

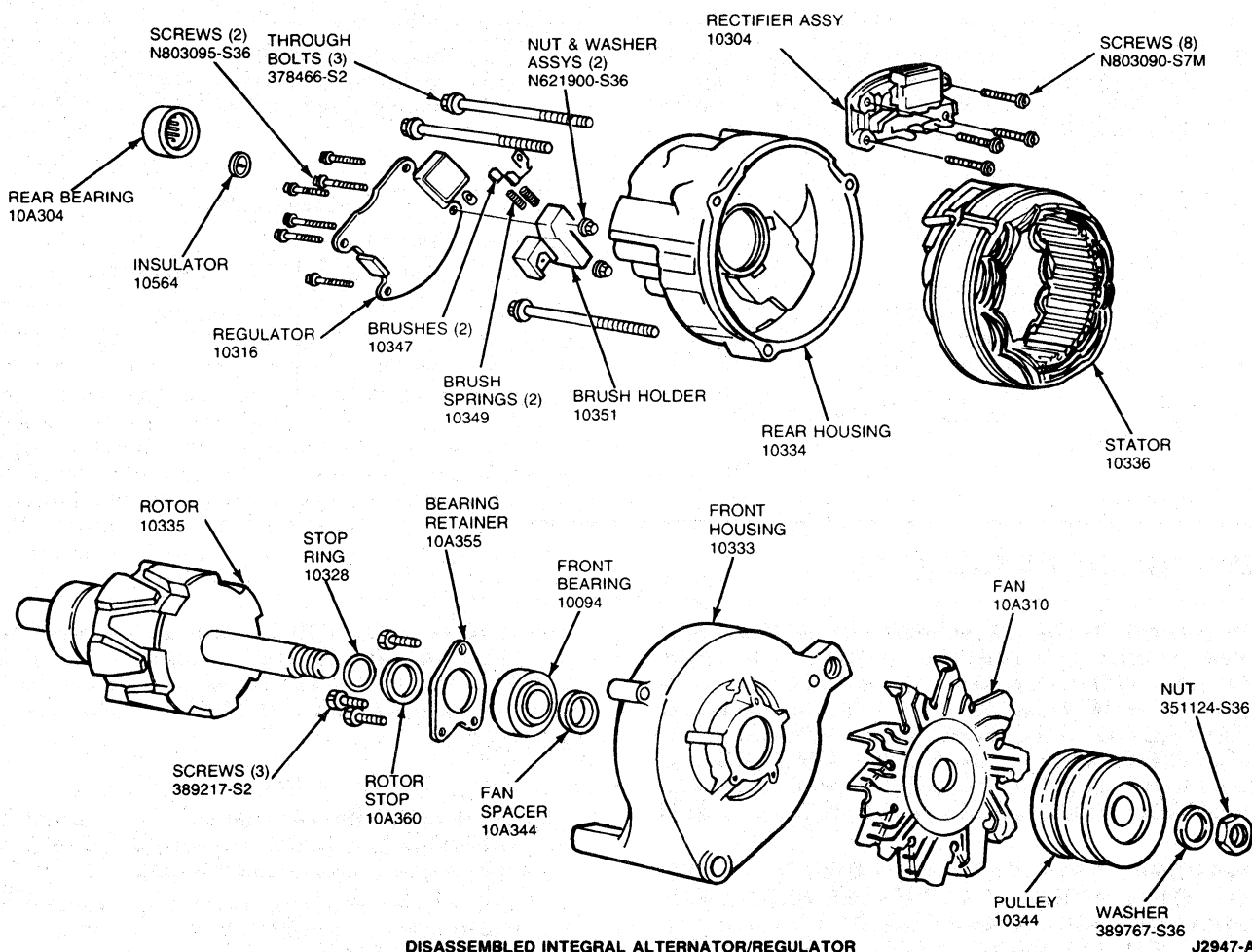
### Installation

1. Position the integral alternator/regulator assembly on the engine.
2. Install the alternator pivot and adjuster arm bolts, but do not tighten the bolts until the belt is tensioned.
3. Install the drive belt over the alternator pulley.
4. Adjust the belt tension and tighten the adjuster and pivot bolts to specification. Apply pressure to alternator front housing only when adjusting belt tension. Refer to Section 27-02.
5. Connect the wiring harness to the alternator/regulator assembly. Push the two connectors straight in.
6. Attach the alternator fan shield to the alternator, if so equipped.
7. Connect battery ground cable.

## DISASSEMBLY AND ASSEMBLY

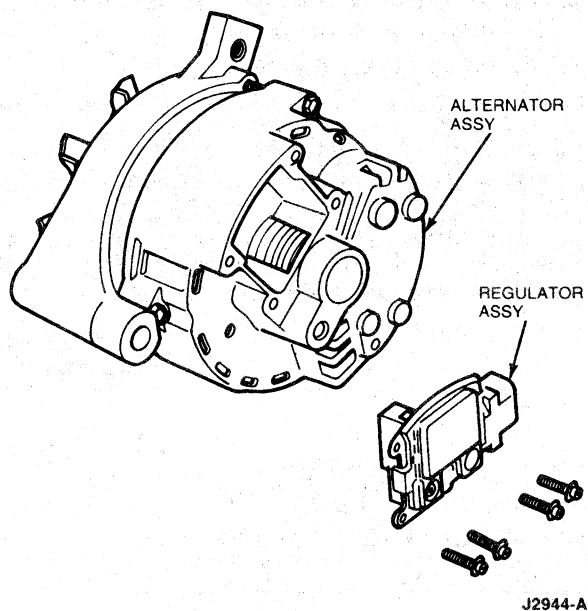
NOTE: All of the following Disassembly Steps may not be necessary to perform a particular test or service. Perform only those steps that apply. The following illustration is a disassembled view of the

integral alternator/regulator assembly. On alternators with fan shield, remove attaching clip and then remove fan shield.

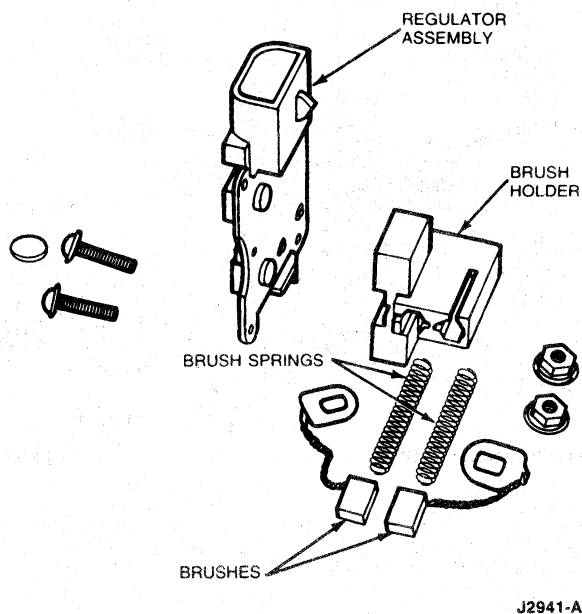


**DISASSEMBLY AND ASSEMBLY (Continued)****Disassembly**

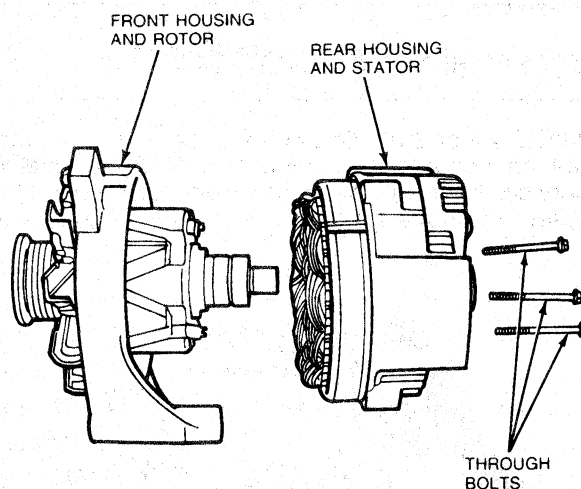
1. Remove the four screws (T20 TORX-type head) attaching the regulator to the alternator rear housing. Remove the regulator, with brush holder attached, from the alternator.



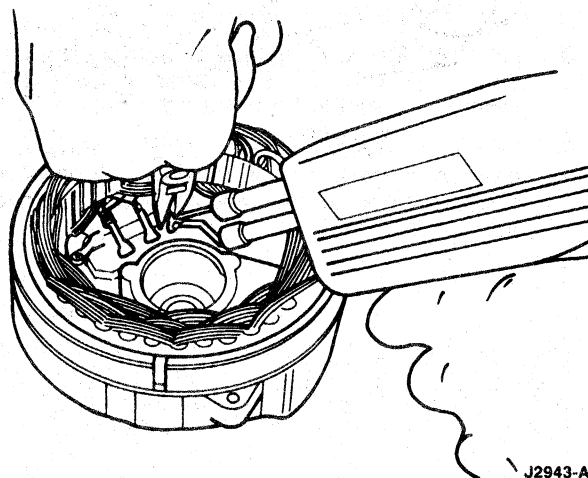
2. Remove the A terminal insulator and two screws (T20 TORX-type head) attaching the regulator to the brush holder. Separate the regulator, attaching nuts, brushes and brush springs from the brush holder.



3. Scribe a line across the end housings and stator laminated core for reference during alternator assembly.
4. Remove the three through bolts.
5. Separate the front housing and rotor assembly from the stator and rear housing. It may be necessary to tap the front housing with a plastic tipped hammer to loosen the front housing from the stator core.

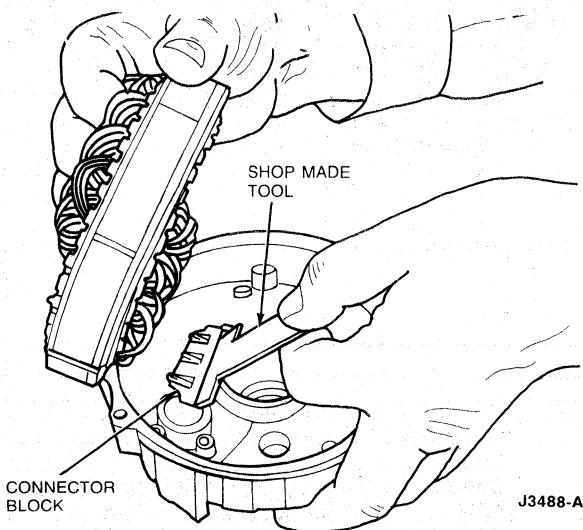
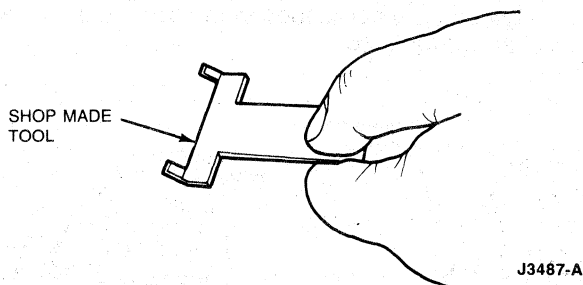


6. Remove the three stator lead terminals from the rectifier. If the terminals are soldered in place, unsolder the connections using a 100-watt soldering iron. Do not allow the soldering iron to overheat the rectifier. Use needlenose pliers to pull the stator lead terminals upward from the rectifier assembly. Separate the stator from the rear housing.

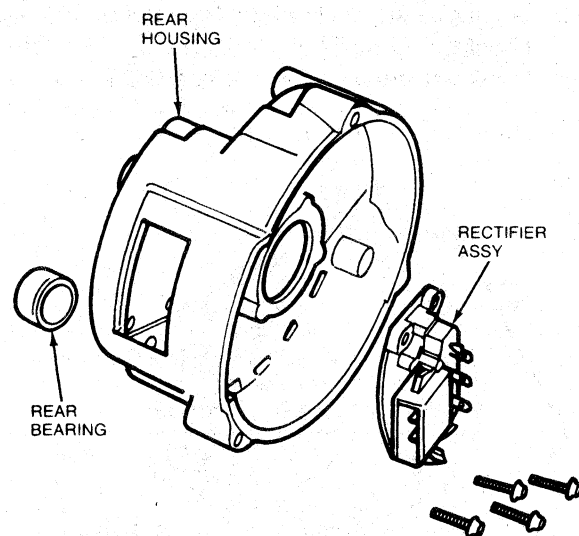


**DISASSEMBLY AND ASSEMBLY (Continued)**

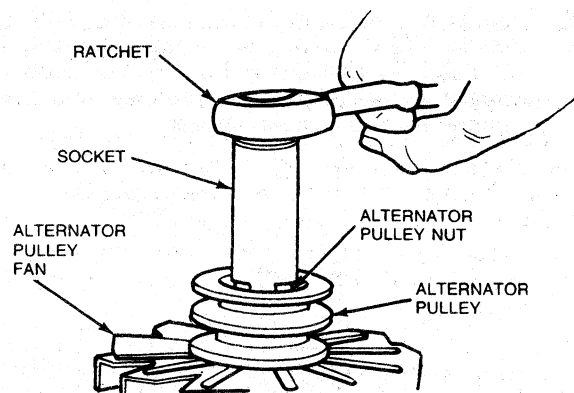
7. Some alternators are designed with a connector block. In these designs, the terminals are not soldered to the rectifier. Using a shop made tool, carefully pry the connector block straight up to avoid bending the terminals.



8. Remove the four rectifier assembly attaching screws (T20 TORX-type head). Remove the rectifier assembly from the housing.
9. Using a suitable arbor press, remove the bearing from the rear housing. Support the housing close to the bearing boss to prevent housing damage.

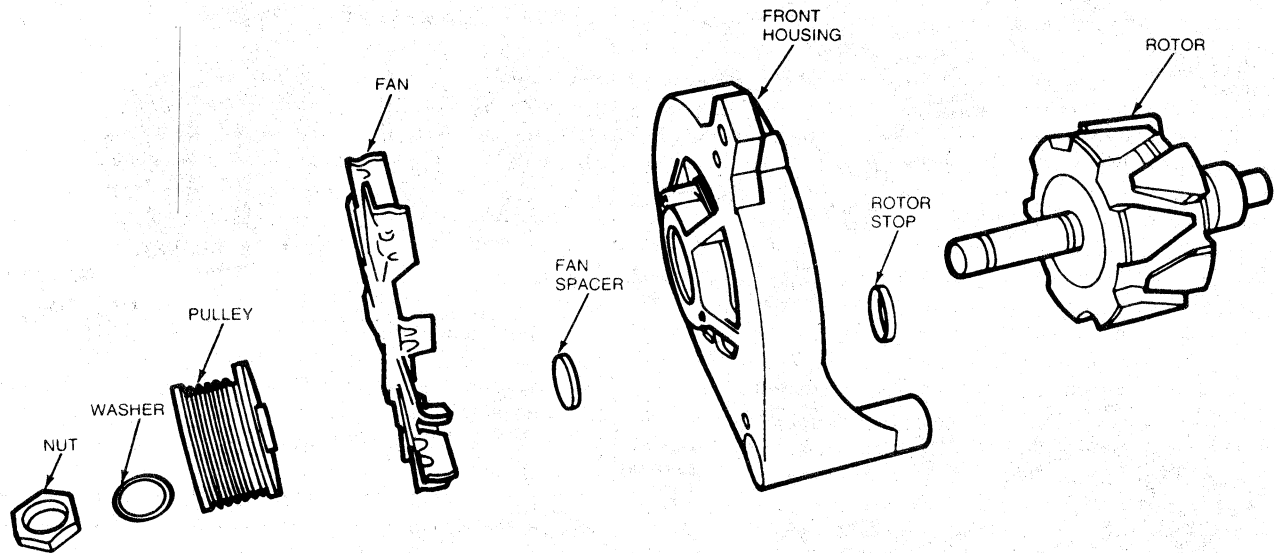


10. Clamp the rotor in a soft jaw vise.
11. Remove the pulley nut with a socket wrench.



**DISASSEMBLY AND ASSEMBLY (Continued)**

12. Remove the flatwasher, drive pulley, fan and fan spacer from the rotor shaft.
13. Remove the housing from the rotor and remove the rotor from the vise.
14. Remove the front rotor stop from the rotor shaft. Do not remove the stop ring from the rotor shaft unless it is damaged.
15. Remove the screws attaching the bearing retainer to the front housing and remove the retainer.
16. Remove the bearing from the front housing. If the bearing will not slide out, remove it using a suitable arbor press. Support the bearing close to the bearing boss to prevent damage to the housing.



J2946-A

**Cleaning and Inspection**

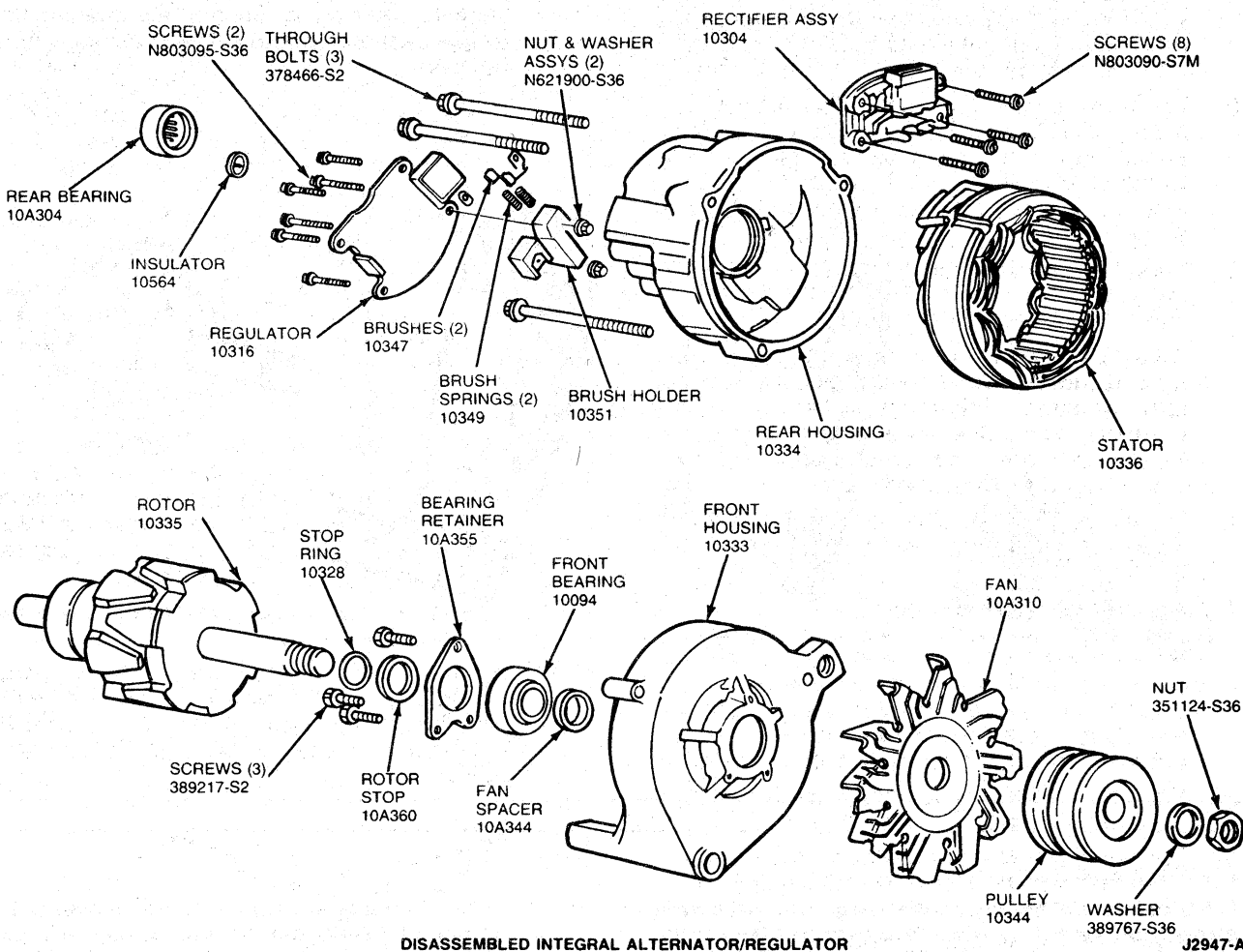
**CAUTION:** When rebuilding an integral alternator, use only high temperature bearings. Use of standard parts will result in alternator failure.

1. Wipe the stator, rotor and front bearing with a clean cloth. Do not clean these parts with solvent.
2. Rotate the front bearing on the drive end of the rotor shaft. Check for any scraping noise, looseness or roughness. Look for excessive lubricant leakage. If any of these conditions exist, replace the bearing.
3. Inspect the rotor shaft rear bearing surface for roughness or severe chatter marks. Replace the rotor assembly if the shaft is not smooth.
4. Place the rear bearing on the slip ring end of the rotor shaft and rotate the bearing. Make the same check for noise, looseness and roughness as was made for the front bearing. Inspect the rollers and cage for damage. Replace the rear bearing if these conditions exist or if the lubricant is lost or contaminated.
5. Check the slip rings for nicks and scratches. These may be removed by turning down the slip rings. Do not go beyond a minimum diameter of 31mm (1.22-inches). If the rings are badly damaged, replace the rotor assembly.
6. Check all wire leads on both the rotor and stator assemblies for loose or broken connections. Check the windings for burned insulation. Replace parts that show signs of burned insulation.
7. Check the pulley and fan for excessive looseness on the rotor shaft and for cracks or other damage. Replace any pulley or fan that is loose, cracked or bent out of shape.
8. Check both the front and rear housings for cracks, particularly in the webbed areas at the mounting ear. Replace a damaged or cracked housing.
9. Wipe the heat transfer grease from the rectifier assembly base and rectifier mounting area of the rear housing with a clean cloth.
10. Replace the brushes if they are worn shorter than 6.35mm (1/4-inch) from the shunt.

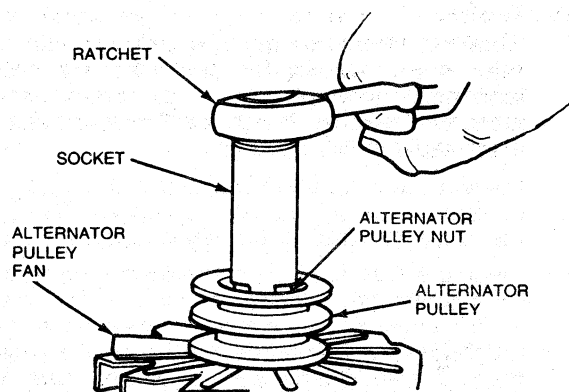
## DISASSEMBLY AND ASSEMBLY (Continued)

**Assembly**

Refer to the following illustration for Alternator/Regulator Assembly.



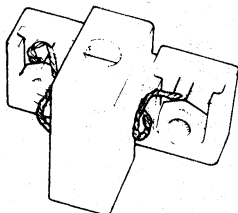
1. Install the bearing in the front housing. Press on the outer race only.
2. Position the bearing retainer on the front housing and install the attaching screws. Tighten the screws to 2.8-4.8 N·m (24-42 lb-in).
3. If the stop ring was removed from the rotor shaft, install a new ring by sliding it over the end of the shaft and into the groove furthest from the pole piece. Do not open the ring with snap ring pliers as permanent deformation of the ring will result.
4. Install the rotor stop on the rotor shaft with the recessed side against the stop ring.
5. Install the rotor in the front housing and clamp the rotor in a vise equipped with protective jaws.
6. Install the fan spacer, fan, drive pulley, flatwasher and nut on the rotor shaft. Tighten the nut to 82-135 N·m (60-100 lb-ft) with a socket wrench.



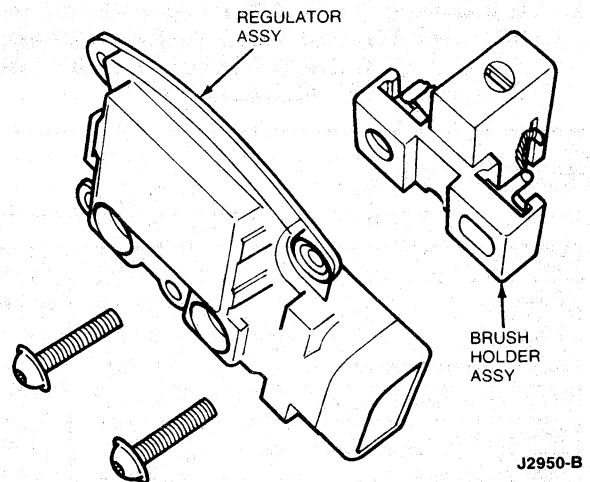
J3482-A

## DISASSEMBLY AND ASSEMBLY (Continued)

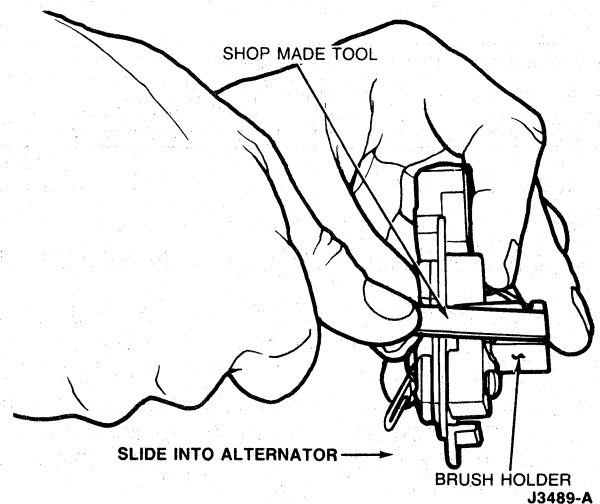
7. Remove the rotor and housing assembly from the vise and check for free rotation of the rotor in the housing.
  8. Support the rear housing close to the bearing boss to prevent damage to the housing and install the bearing using a suitable arbor press. Press the bearing into the bore until it is flush with the outside rear surface of the housing.
  9. Wipe the rectifier assembly base plate with a clean cloth. Apply a 2.0mm (3/32-inch) wide by 20mm (3/4-inch) long strip of Ford Heat Sink Compound ESF-M99G138-A or equivalent, lengthwise across the rectifier assembly base plate.
  10. Wipe the rectifier mounting surface of the rear housing with a clean cloth and seat the rectifier into the recessed mounting area.
- CAUTION: The rectifier assembly is cooled by conducting rectifier heat directly into the rear housing. Failure to remove foreign material from the mounting surfaces or failure to apply heat sink compound may cause rectifier overheating.**
11. Install the four rectifier assembly attaching screws. Tighten the screws to 2.8-4.0 N·m (25-35 lb-in).
  12. Position the stator assembly in the rear housing and align the scribe marks made during disassembly. Push the three stator terminals onto the rectifier blade terminals. Solder securely using resin core electrical solder if the terminals were previously soldered. Work quickly to prevent overheating the rectifier.
  13. Wipe the rear end bearing surface of the rotor shaft with a clean, lint-free cloth.
  14. Position the rear housing and stator assembly over the rotor and align the scribe marks made during disassembly.
  15. Seat the machined portion of the stator core into the stop in both end housings and install the housing through bolts. Tighten the bolts to 4.1-6.7 N·m (35-60 lb-in). Spin the rotor to check for free movement.
  16. Position the two nut and washer assemblies into the retaining slots in the brush holder. Tip the holder back slightly so that the nut and washer assemblies fall to the nut side of the slots. Insert the brush terminals past the washers and into the slots.



J2949-A



17. Wipe the regulator base plate with a clean cloth. Position the regulator against the brush holder and install the regulator to brush holder attaching screws. Tighten the screws to 2.3-3.4 N·m (20-30 lb-in). Loop the brush leads toward the brush end of the brush holder.
18. Install the adhesive-backed insulator onto the A terminal screw head.
19. Place brush springs in brush holder. Locate brushes in brush holder and hold in place with a thin, flat piece of steel (retaining tool). Loop the brush leads toward the brush end of the brush holder.



20. Wipe the regulator mounting surface of the alternator rear housing with a clean cloth. Position the regulator and brush holder assembly in the alternator rear housing and pull the retaining tool.
21. Install the regulator attaching screws. Tighten the screws to 2.8-4.0 N·m (25-35 lb-in).

**DISASSEMBLY AND ASSEMBLY (Continued)**

22. Remove the wire holding the brushes.

**WARNING: THIS STEP IS IMPORTANT. FAILURE TO REMOVE A BARE WIRE WILL RESULT IN A SHORT CIRCUIT THAT WILL DESTROY THE REGULATOR.**

23. Place a daub of waterproof sealer over the brush pin to prevent water entry.

**NOTE:** Do not use silicone sealer on brush pin hole.

**SPECIFICATIONS**

Description	N·m	Lb·In
Pulley Nut	81-135	60-100①
Through Bolt	4.1-6.7	35-60
Rectifier Assembly Mounting Screw	2.8-4	25-35
Brush Holder Mounting Screw	2.3-3.4	20-30
Regulator Mounting Screw	2-4	25-35
Bearing Retainer Screw	2.8-4.5	24-42

① Lb·Ft

CK7398-C

Supplier	Stamp Color	Rating		Slip-Ring Turning				Brush Length				Pulley Nut	
		Amperes (@ 15V)	Watts (@ 15V)	Diameter		Runout		New		Wear Limit		N·m	Lb·Ft
				mm	inches	mm	inches	mm	inches	mm	inches		
Ford	Orange	40A	600W	31	1.22	.013	0.0005	12.19	.480	6.35	.25	82-135	60-100
Ford	Red	40A HE	600W	31	1.22	.013	0.0005	12.19	.480	6.35	.25	82-135	60-100
Ford	Green	60A	900W	31	1.22	.013	0.0005	12.19	.480	6.35	.25	82-135	60-100
Ford	Black	65A	975W	31	1.22	.013	0.0005	12.19	.480	6.35	.25	82-135	60-100

CK7396-B

**SPECIAL SERVICE TOOLS**

Tool Number	Description
T63L-8620-A	Belt Tension Gauge
T65P-10300-B	Alternator Pulley Remover

CK7397-B

**ROTUNDA EQUIPMENT**

Model	Description
021-00019	Belt Tension Gauge
021-00028	Belt Tension Gauge — Offset
059-00010	Dwell-Tach-Volt-Ohmmeter

CJ2814-A



# SECTION 31-20 Ignition Switch

SUBJECT	PAGE	SUBJECT	PAGE
DESCRIPTION AND OPERATION		SPECIFICATIONS .....	31-20-7
Switch, Blade-Type .....	31-20-1	TESTING .....	31-20-2
REMOVAL AND INSTALLATION .....	31-20-2	VEHICLE APPLICATION .....	31-20-1

## VEHICLE APPLICATION

Taurus/Sable.

## DESCRIPTION AND OPERATION

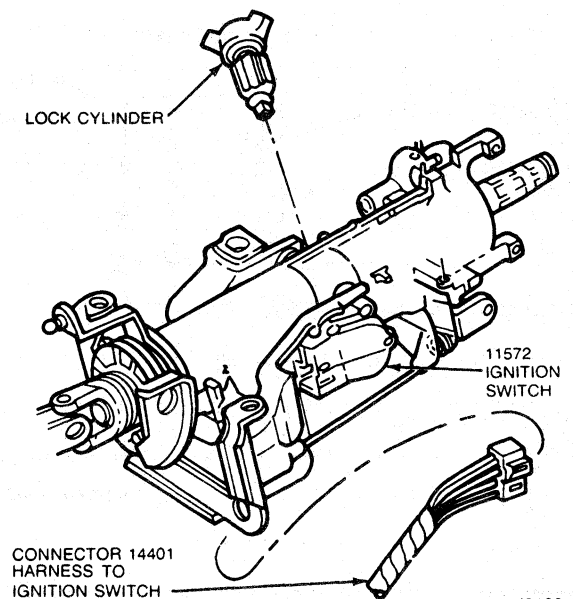
The ignition switch is mounted on the lock cylinder housing and is controlled by the lock cylinder through a direct coupling drive shaft.

The lock cylinder also controls the mechanism which provides a positive lock for the steering system. The locking mechanism is located in the lock cylinder housing in the middle of the steering column.

The lock cylinder positions are ACC, LOCK, OFF, RUN and START. The ACC position operates while the steering and transmission systems remain locked. Turning the key to OFF position shuts off the engine without locking the steering.

### Switch, Blade-Type

The switch has blade-type terminals that engage with one multiple connector. The multiple connector is secured to the switch by integral locking fingers.

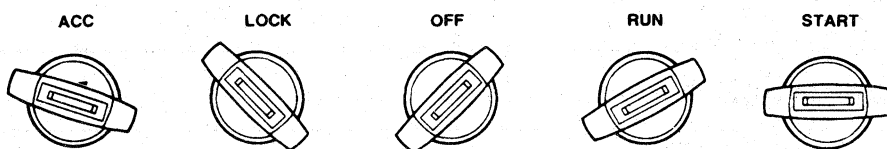


## TESTING

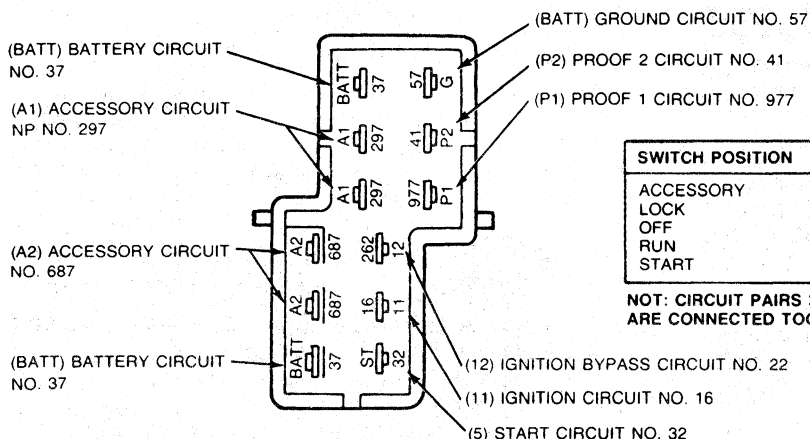
### Continuity Test

Disconnect the multiple connector by spreading apart the locking fingers on each end of the connector shell while pulling to disengage from the ignition switch. Test the switch continuity as described in the following illustration. Connect a self-powered test lamp or ohmmeter between the blade terminals indicated on the chart. No continuity between any blade and the ground terminal should exist in any switch position except the proof and ground circuit (41, 977 and 57) in the START position only.

For an "engine won't crank" condition, determine if the condition exists with the shift lever in both PARK and NEUTRAL positions before performing the ignition switch continuity test. If the "no-crank" condition occurs in one shift lever position but not the other, a more probable cause is the neutral start switch located on the transmission.



CONTINUITY TEST



SWITCH POSITION	CONTINUITY SHOULD EXIST ONLY BETWEEN:
ACCESSORY	37 AND 297
LOCK	NO CONTINUITY
OFF	NO CONTINUITY
RUN	37-16-687-297
START	41-977-57, 37-32-262-16

NOT: CIRCUIT PAIRS 37, 687 AND 297 ARE CONNECTED TOGETHER INTERNALLY

J3103-A

### Mechanical Test

Test the steering column ignition system mechanical operation by rotating the lock cylinder/key through all switch positions. The movement should feel smooth with no sticking or binding. The ignition system should return from the START position back to the RUN position without assistance (spring return). If sticking or binding is encountered, check for the following:

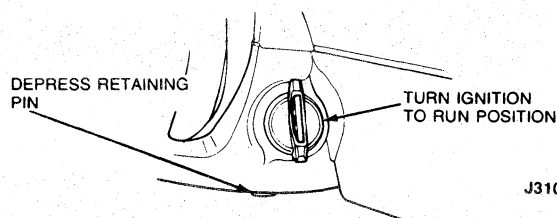
- Burrs on the lock cylinder key.
- Binding lock cylinder.
- Shroud rubbing against lock cylinder.
- Burrs or foreign material around rack-and-pinion actuator in lock cylinder housing.
- Insufficient lube on actuator.
- Binding ignition switch.

NOTE: Do not apply lubricant to the inside of the ignition switch.

## REMOVAL AND INSTALLATION

### Removal

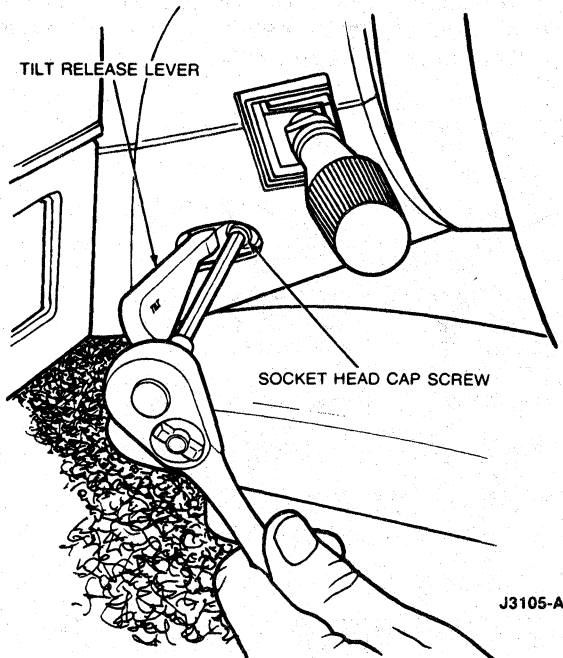
1. Disconnect battery ground cable.
2. Rotate ignition lock cylinder to RUN position and depress lock cylinder retaining pin through access hole in shroud with a 1/8-inch diameter punch.



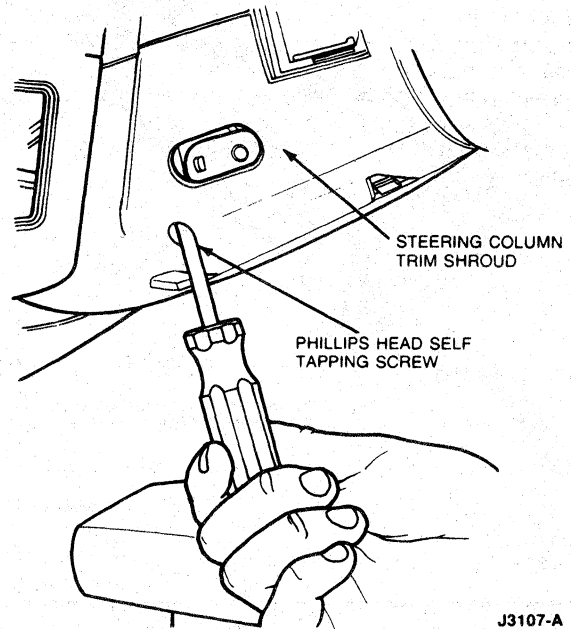
J3104-A

**REMOVAL AND INSTALLATION (Continued)**

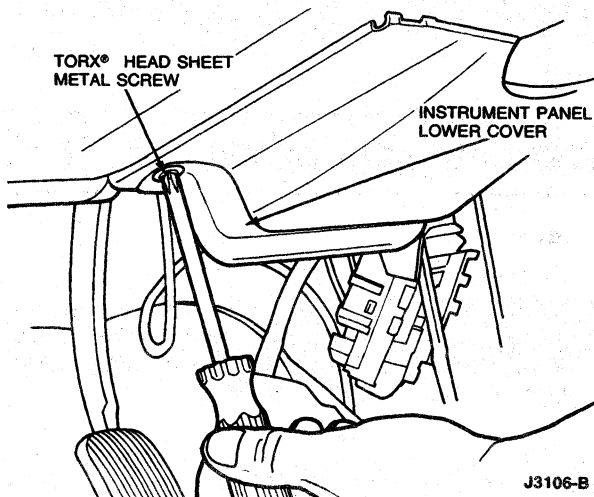
3. Remove lock cylinder.
4. On tilt columns, remove tilt release lever by removing one socket head capscrew.



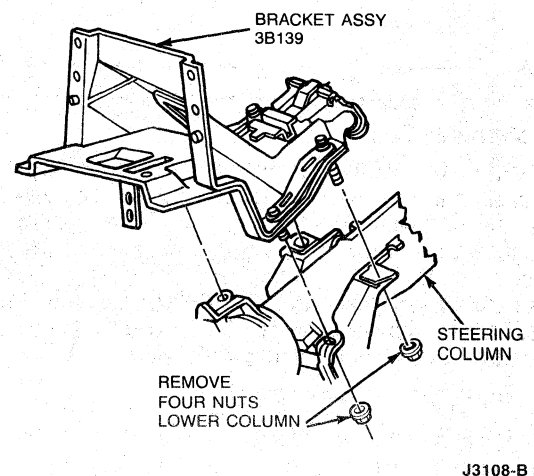
6. Remove steering column shroud by removing three Phillips head self-tapping screws.



5. Remove instrument panel lower cover by removing four Torx head sheet metal screws.

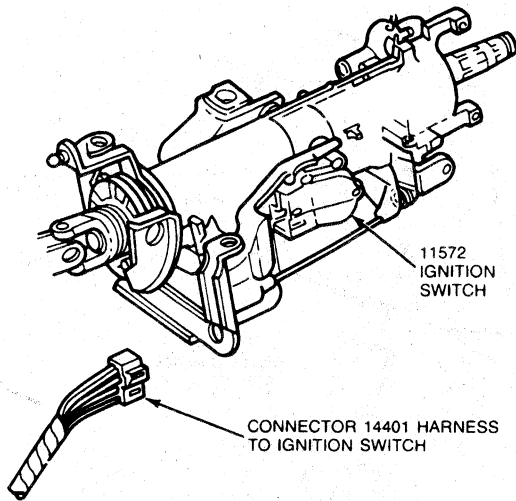


7. Remove four nuts attaching steering column to support bracket and lower column.



**REMOVAL AND INSTALLATION (Continued)**

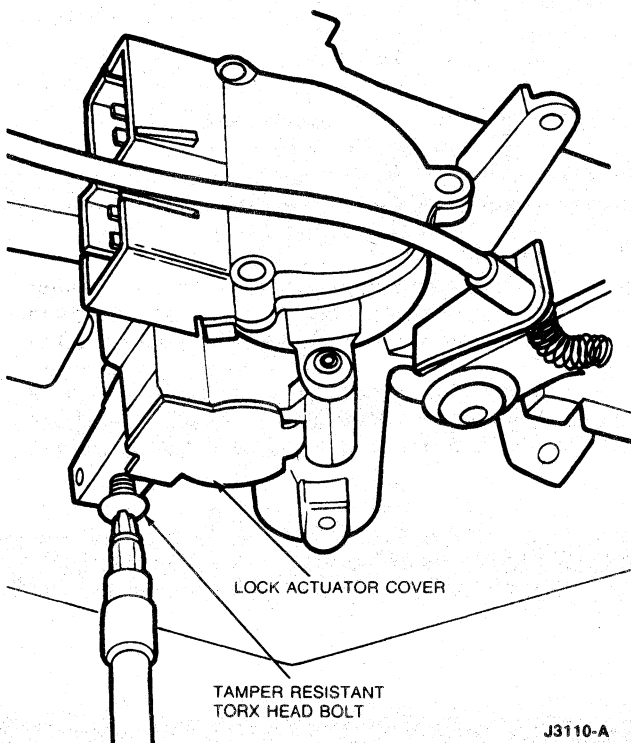
8. Disconnect ignition switch electrical connector.



J3109-A

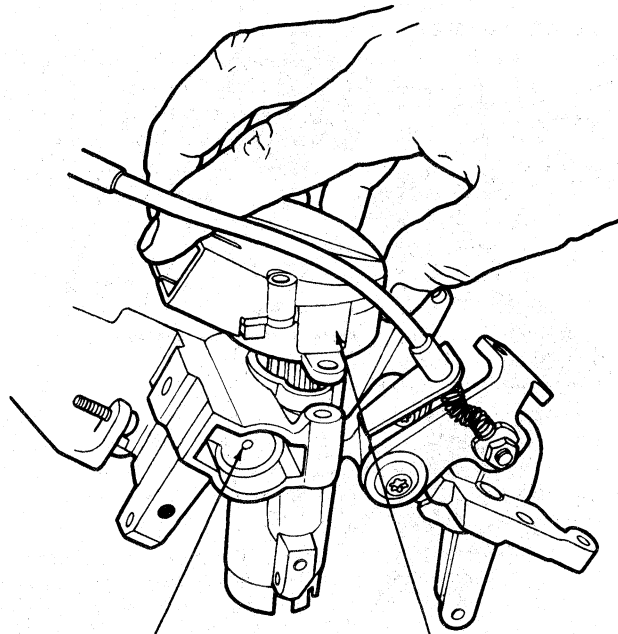
9. Remove lock actuator cover plate by removing one tamper-resistant Torx head bolt.

NOTE: Lock actuator assembly will slide freely out of lock cylinder housing when ignition switch is removed.



J3110-A

10. Remove ignition switch and cover by removing two tamper-resistant Torx head bolts with Torx Driver D83L-2100-A or equivalent.



NOTE: LOCK ACTUATOR ASSY WILL SLIDE OUT WHEN IGNITION SWITCH IS REMOVED

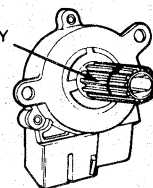
REMOVE IGNITION SWITCH AND COVER

J3111-A

**Installation**

1. Ensure ignition switch is in RUN position by rotating drive shaft fully clockwise to START position and releasing.

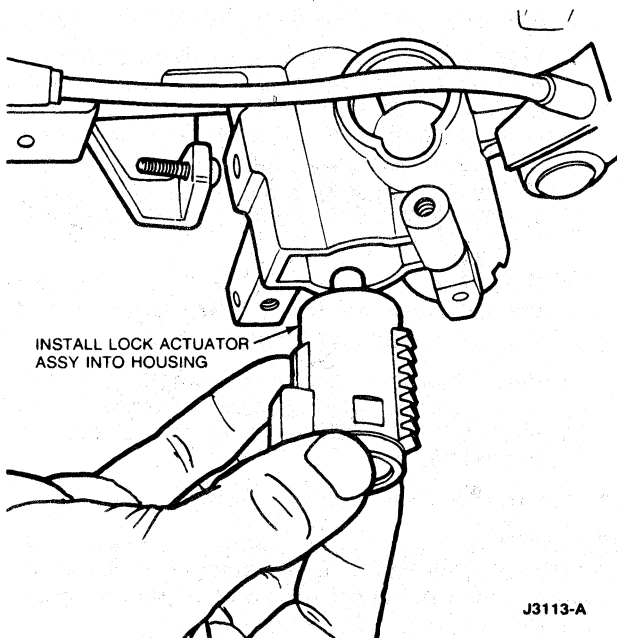
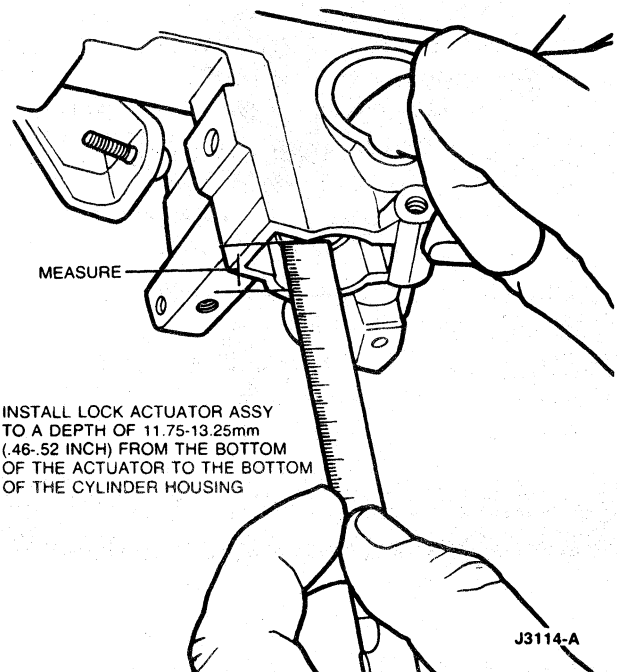
ROTATE SHAFT CLOCKWISE UNTIL IT STOPS AND SLOWLY RELEASE TO POSITION SWITCH IN RUN



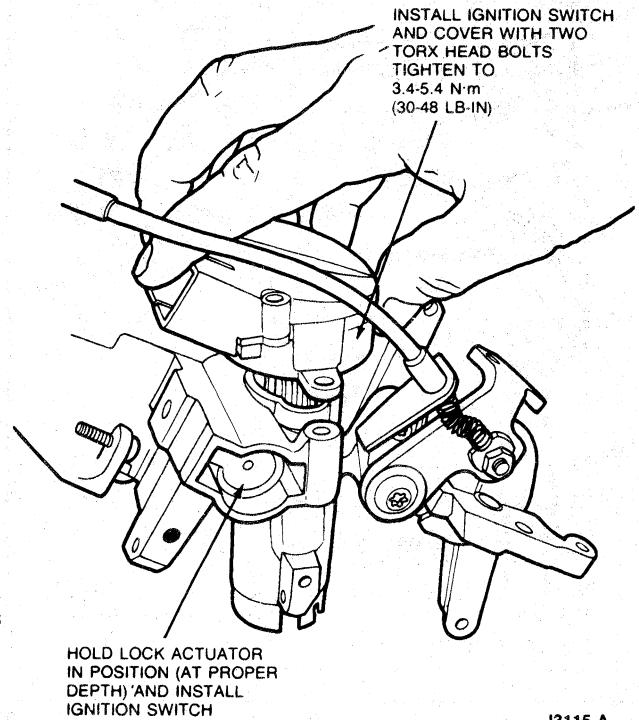
J3112-A

**REMOVAL AND INSTALLATION (Continued)**

2. Install lock actuator assembly to a depth of 11.75-13.25mm (.46-.54 inch) from the bottom of actuator assembly to bottom of lock cylinder housing.

**Lock Cylinder Installation****Depth Measurement**

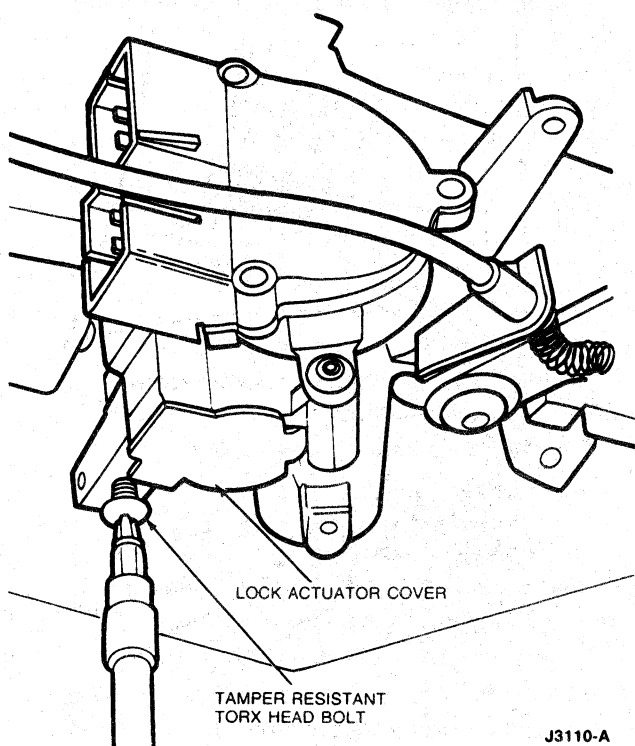
3. While holding actuator assembly at proper depth, install ignition switch.
4. Install ignition switch and cover and attach to housing with two tamper-resistant Torx head bolts. Tighten to 3.4-5.4 N·m (30-48 lb-in).



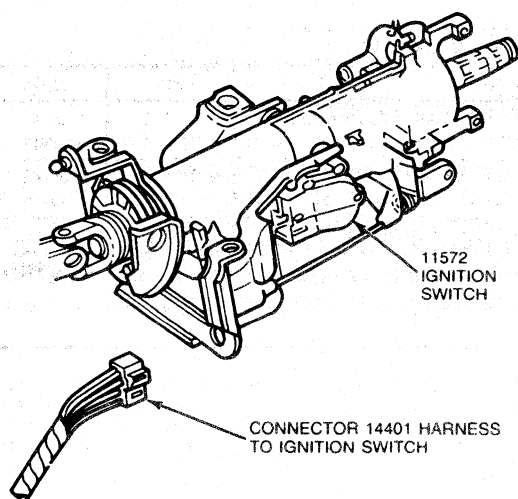
5. Install lock cylinder.
6. Rotate ignition lock cylinder to LOCK position and measure depth of actuator assembly as in Step 2. The actuator assembly must be 23.5-25.5mm (.92-1.00 inch) inside lock cylinder housing. If depth measured does not meet specification, actuator assembly must be removed and installed per steps outline above.

## REMOVAL AND INSTALLATION (Continued)

7. Install lock actuator cover plate with a tamper-resistant Torx head bolt tightened to 3.4-5.4 N·m (30-48 lb-in).



8. Install ignition switch electrical connector.



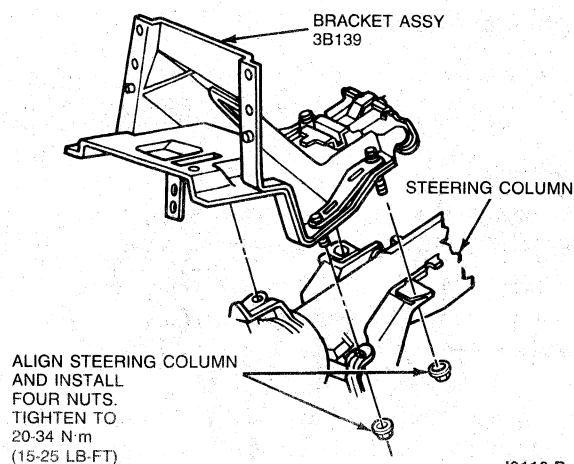
9. Connect negative battery terminal. Check ignition switch for proper function in all positions including START and ACC.

10. Check column functions as follows:

- With column shift lever in PARK position or with floor shift key release button depressed, and with ignition lock cylinder in LOCK position; make sure steering column locks.
- With column shift lever in DRIVE position or with floor shift key release button extended, and with ignition lock cylinder in RUN position; rotate ignition lock cylinder toward LOCK position until it stops. In this position, make sure that engine electrical off has been achieved and that steering shaft **does not** lock.
- Rotate ignition lock cylinder counterclockwise to the ACC position and check that the radio is energized.
- Place the shift lever in PARK position and rotate ignition lock cylinder clockwise to the start position. Check that the starter is energized.

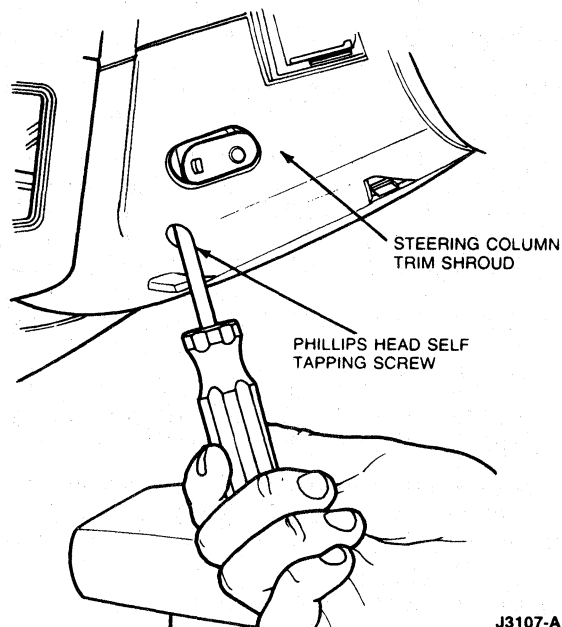
11. Remove ignition lock cylinder.

12. Align steering column mounting holes with support bracket, center steering column in instrument panel opening and install four nuts. Tighten to 20-34 N·m (15-25 lb-ft).



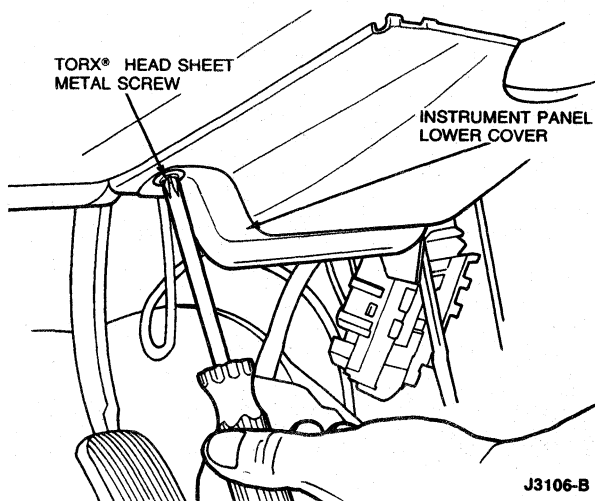
**REMOVAL AND INSTALLATION (Continued)**

13. Install three Phillips head self-tapping screws and install column trim shrouds. Tighten to 7-11 N·m (6-10 lb-in).



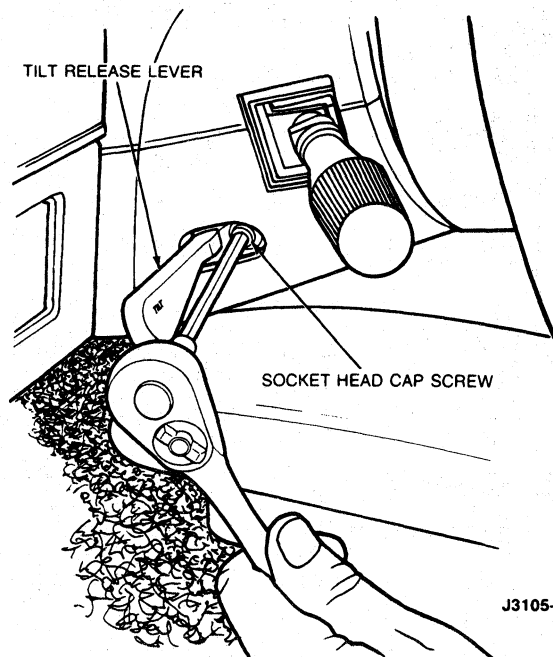
J3107-A

14. Install instrument panel lower cover and four Torx head sheet metal screws.



J3106-B

15. On tilt columns, install tilt release lever and socket head cup screw. Tighten to 9-11 N·m (6.5-8.5 lb-ft).



J3105-A

16. Install ignition lock cylinder.  
17. For tilt columns, check column tilt travel through its entire range to ensure there is no interference between column and instrument panel.

**SPECIFICATIONS****TORQUE SPECIFICATIONS**

Description	N·m	Lb·Ft
Ignition Switch Cover Attaching Bolt	3.4-5.4	30-48 Lb-In
Lock Actuator Cover Plate Attaching Bolt	3.4-5.4	30-48 Lb-In
Steering Column Attaching Nuts	20-34	15-25

CJ3117-B





# GROUP LIGHTING SYSTEM 32

(13000)

SECTION TITLE	PAGE	SECTION TITLE	PAGE
HEADLAMP SYSTEM .....	32-02-1	LAMPS—PARKING, REAR AND MARKER .....	32-20-1
ILLUMINATED ENTRY .....	32-80-1	LIGHTING SYSTEM—SERVICE .....	32-01-1
LAMPS, INTERIOR .....	32-60-1	MULTI-FUNCTION SWITCH .....	32-42-1

## SECTION 32-01 Lighting System—Service

SUBJECT	PAGE	SUBJECT	PAGE
DIAGNOSIS .....	32-01-1	VEHICLE APPLICATION .....	32-01-1
TESTING .....	32-01-5		

### VEHICLE APPLICATION

Taurus/Sable.

### DIAGNOSIS

To ensure accurate electrical service, it is important to follow a logical diagnosis procedure.

These charts suggest possible conditions, causes and actions for typical electrical problems.

## DIAGNOSIS (Continued)

## ELECTRICAL — LAMPS

CONDITION	POSSIBLE CAUSE	ACTION
<b>Headlamps</b>		
<ul style="list-style-type: none"> <li>• All exterior lamps do not light</li> </ul>	<ul style="list-style-type: none"> <li>• Loose wiring connections.</li> <li>• Open wiring.</li> <li>• Damaged headlamp switch.</li> </ul>	<ul style="list-style-type: none"> <li>• Check and secure connection at headlamp switch and dash panel connector.</li> <li>• Check power to and from headlamp switch. Service as necessary.</li> <li>• Replace headlamp switch.</li> </ul>
<ul style="list-style-type: none"> <li>• One headlamp does not work</li> </ul>	<ul style="list-style-type: none"> <li>• Loose connection.</li> <li>• Bad ground.</li> <li>• Bulb burned out.</li> <li>• Corroded or damaged connector.</li> </ul>	<ul style="list-style-type: none"> <li>• Secure connection at headlamp.</li> <li>• Check ground at headlamp.</li> <li>• Replace bulb.</li> <li>• Replace as required.</li> </ul>
<ul style="list-style-type: none"> <li>• All headlamps out. Park and tail lamps OK</li> </ul>	<ul style="list-style-type: none"> <li>• Loose connections.</li> <li>• Damaged dimmer switch.</li> <li>• Damaged headlamp switch.</li> <li>• Open wiring or poor ground.</li> </ul>	<ul style="list-style-type: none"> <li>• Check and secure connections at dimmer switch and headlamp switch.</li> <li>• Check dimmer switch operation. Inspect for corroded connector. Replace if necessary.</li> <li>• Replace if necessary.</li> <li>• Service as necessary.</li> </ul>
<b>Tail Lamps</b>		
<ul style="list-style-type: none"> <li>• One tail lamp out</li> </ul>	<ul style="list-style-type: none"> <li>• Bulb burned out.</li> <li>• Open wiring or poor ground.</li> <li>• Corroded bulb socket.</li> </ul>	<ul style="list-style-type: none"> <li>• Replace bulb.</li> <li>• Service as necessary.</li> <li>• Service or replace socket.</li> </ul>
<ul style="list-style-type: none"> <li>• All tail lamps, park lamps, and instrument panel lamps out — headlamps OK</li> </ul>	<ul style="list-style-type: none"> <li>• Blown fuse in fuse panel.</li> <li>• Loose connections.</li> <li>• Open wiring.</li> <li>• Damaged headlamp switch.</li> </ul>	<ul style="list-style-type: none"> <li>• Service as necessary.</li> <li>• Secure wiring connections where accessible.</li> <li>• Service as necessary.</li> <li>• Service headlamp switch.</li> </ul>
<b>Backup Lamps</b>		
<ul style="list-style-type: none"> <li>• Backup lamps — one does not function</li> </ul>	<ul style="list-style-type: none"> <li>• Blown fuse in fuse panel.</li> <li>• Bulb burned out.</li> <li>• Loose connection.</li> <li>• Open wiring.</li> </ul>	<ul style="list-style-type: none"> <li>• Replace fuse.</li> <li>• Replace bulb.</li> <li>• Tighten connectors.</li> <li>• Service as necessary.</li> </ul>

CK6057-F

## DIAGNOSIS (Continued)

## ELECTRICAL — LAMPS

CONDITION	POSSIBLE SOURCE	ACTION
<b>Backup Lamps</b>		
<ul style="list-style-type: none"> <li>• Backup lamps — both lamps do not function</li> </ul>	<ul style="list-style-type: none"> <li>• Fuse burned out.</li> <li>• Backup lamp switch out of adjustment.</li> <li>• Damaged backup lamp switch.</li> <li>• Loose connections.</li> <li>• Open wiring.</li> </ul>	<ul style="list-style-type: none"> <li>• Check a circuit that shares the same fuse. Replace fuse.</li> <li>• Adjust switch.</li> <li>• Replace switch.</li> <li>• Tighten connectors.</li> <li>• Service as required.</li> </ul>
<b>Parking Lamps</b>		
<ul style="list-style-type: none"> <li>• One parking lamp does not light</li> </ul>	<ul style="list-style-type: none"> <li>• Loose connections.</li> <li>• Bulb burned out.</li> <li>• Open wiring or poor ground.</li> </ul>	<ul style="list-style-type: none"> <li>• Tighten connections.</li> <li>• Replace bulb.</li> <li>• Check for corroded socket. Service as required.</li> </ul>
<ul style="list-style-type: none"> <li>• Both parking lamps do not light</li> </ul>	<ul style="list-style-type: none"> <li>• Loose connections.</li> <li>• Open wiring.</li> <li>• Bulbs burned out.</li> </ul>	<ul style="list-style-type: none"> <li>• Tighten connections.</li> <li>• Check for corroded socket. Service as required.</li> <li>• Replace bulbs.</li> </ul>
<b>Front Side Marker Lamps</b>		
<ul style="list-style-type: none"> <li>• Front side marker lamp does not light — tail lamps OK</li> </ul>	<ul style="list-style-type: none"> <li>• Loose connections.</li> <li>• Bulb burned out.</li> <li>• Open wiring.</li> </ul>	<ul style="list-style-type: none"> <li>• Tighten connections.</li> <li>• Replace bulb.</li> <li>• Check socket for corrosion. Service as required.</li> </ul>

CK6434-D

## DIAGNOSIS (Continued)

## ELECTRICAL — LAMPS

CONDITION	POSSIBLE SOURCE	ACTION
<b>Stoplamps</b>		
<ul style="list-style-type: none"> <li>• Stoplamps do not light</li> </ul>	<ul style="list-style-type: none"> <li>• Fuse burned out.</li> <li>• Problem in turn signal circuit or switch.</li> <li>• Loose connections.</li> <li>• Stoplamp switch inoperative.</li> <li>• Open wiring.</li> </ul>	<ul style="list-style-type: none"> <li>• Replace fuse or CB. If device blows again, check for short circuit.</li> <li>• Service turn signal circuit or replace turn signal.</li> <li>• Secure connections at stoplamp switch.</li> <li>• Replace stoplamp switch.</li> <li>• Service as required.</li> </ul>
<ul style="list-style-type: none"> <li>• Hi-mount stoplamp out</li> </ul>	<ul style="list-style-type: none"> <li>• Bulb burned out.</li> <li>• Open wiring or poor ground.</li> <li>• Corroded bulb socket.</li> </ul>	<ul style="list-style-type: none"> <li>• Replace bulb.</li> <li>• Service as necessary.</li> <li>• Service or replace socket.</li> </ul>
<b>Turn Signal Lamps</b>		
<ul style="list-style-type: none"> <li>• Turn signal lamps — one or more inoperative</li> </ul>	<ul style="list-style-type: none"> <li>• Bulb burned out.</li> <li>• Loose connections.</li> <li>• Open wiring.</li> <li>• Turn signal switch inoperative.</li> </ul>	<ul style="list-style-type: none"> <li>• Replace bulb.</li> <li>• Secure connections.</li> <li>• Service as required.</li> <li>• Replace turn signal switch.</li> </ul>
<ul style="list-style-type: none"> <li>• Turn signal lamps — all lamps inoperative</li> </ul>	<ul style="list-style-type: none"> <li>• Fuse burned out.</li> <li>• Turn signal flasher inoperative.</li> <li>• Loose connections.</li> <li>• Open wiring.</li> <li>• Turn signal switch inoperative.</li> </ul>	<ul style="list-style-type: none"> <li>• Replace fuse or CB. If device blows again, check for short circuit.</li> <li>• Replace flasher.</li> <li>• Tighten connections.</li> <li>• Service as required.</li> <li>• Replace turn signal switch.</li> </ul>
<b>Hazard Flasher Lamps</b>		
<ul style="list-style-type: none"> <li>• Hazard flasher lamps — do not flash</li> </ul>	<ul style="list-style-type: none"> <li>• Turn signal operation improper.</li> <li>• Fuse burned out.</li> <li>• Hazard flasher inoperative.</li> <li>• Open wiring.</li> <li>• Hazard flasher switch inoperative.</li> </ul>	<ul style="list-style-type: none"> <li>• Service turn signal system.</li> <li>• Replace fuse. If fuse blows again, check for a short circuit.</li> <li>• Replace flasher.</li> <li>• Service as required.</li> <li>• Service or replace the turn signal switch assembly, which includes the hazard flasher switch.</li> </ul>

NOTE: Combination turn signal and hazard warning electronic flasher is used on Taurus/Sable

CK8566-B

## TESTING

**COURTESY LAMPS DO NOT TURN ON WHEN ONE DOOR  
IS OPENED — OK WHEN OTHER DOORS ARE OPENED**

TEST STEP		RESULT	ACTION TO TAKE
<b>A0</b>	VERIFY THE CONDITION		
			▶ GO to <b>A1</b> .
<b>A1</b>	CHECK POWER		
	<ul style="list-style-type: none"> <li>• Check for power at door switch.</li> </ul>	<del>OK</del> ▶ OK ▶	SERVICE the power circuit back to the fuse. GO to <b>A2</b> .
<b>A2</b>	CHECK THE DOOR SWITCH		
	<ul style="list-style-type: none"> <li>• Check the door switch for proper operation.</li> </ul>	<del>OK</del> ▶ OK ▶	REPLACE the switch. SERVICE the circuit from the switch to the lamp(s).

CK5998-A

**COURTESY LAMP(S) DOES NOT COME ON WHEN  
HEADLAMP SWITCH IS TURNED COUNTERCLOCKWISE TO STOP**

TEST STEP		RESULT	ACTION TO TAKE
<b>B0</b>	VERIFY CONDITION		
			▶ GO to <b>B1</b> .
<b>B1</b>	CHECK OPERATION OF DOOR SWITCHES		
	<ul style="list-style-type: none"> <li>• Check to see if courtesy lamps operate from door switches.</li> </ul>	<del>OK</del> ▶ OK ▶	GO to Diagnostic Chart <b>C</b> — Courtesy Lamp(s) Does Not Come on When All Doors are open. GO to <b>B2</b> .
<b>B2</b>	CHECK FOR POWER		
	<ul style="list-style-type: none"> <li>• Check for power at headlamp switch.</li> </ul>	<del>OK</del> ▶ OK ▶	SERVICE circuits back to fuse panel. GO to <b>B3</b> .
<b>B3</b>	CHECK FOR CONTINUITY		
	<ul style="list-style-type: none"> <li>• Check continuity of headlamp switch.</li> </ul>	<del>OK</del> ▶ OK ▶	REPLACE headlamp switch. SERVICE circuit from switch to lamps.

CK5999-C

## TESTING (Continued)

COURTESY LAMP(S) DOES NOT COME ON  
WHEN ALL DOORS ARE OPEN

TEST STEP		RESULT	ACTION TO TAKE
<b>C0</b>	VERIFY THE CONDITION		
		Vehicles with only one courtesy lamp	GO to <b>C1</b> .
		Vehicles with more than one courtesy lamp	GO to <b>C4</b> .
<b>C1</b>	CHECK OPERATION OF FUSE CIRCUIT		
	<ul style="list-style-type: none"> <li>Check operation of other circuits that share the same fuse.</li> </ul>	<del>OK</del>	GO to <b>C4</b> .
		OK	GO to <b>C2</b> .
<b>C2</b>	CHECK FOR POWER		
	<ul style="list-style-type: none"> <li>Check for power to bulb.</li> </ul>	<del>OK</del>	SERVICE circuit between fuse and common point with other circuits.
		OK	GO to <b>C3</b> .
<b>C3</b>	CHECK CONTINUITY		
	<ul style="list-style-type: none"> <li>Check continuity of bulb.</li> </ul>	<del>OK</del>	REPLACE bulb.
		OK	SERVICE bulb ground.
<b>C4</b>	CHECK FUSE		
	<ul style="list-style-type: none"> <li>Check courtesy lamp fuse.</li> </ul>	<del>OK</del>	REPLACE fuse. If fuse blows again, CHECK for shorted circuit(s).
		OK	GO to <b>C5</b> .
<b>C5</b>	CHECK FOR POWER		
	<ul style="list-style-type: none"> <li>Check for power through the fuse.</li> </ul>	<del>OK</del>	SERVICE power feed circuit.
		OK	SERVICE open circuit between fuse and common point in courtesy lamp power circuit.

CK6000-A

# SECTION 32-02 Headlamp System

SUBJECT	PAGE	SUBJECT	PAGE
<b>ADJUSTMENTS</b>		<b>REMOVAL AND INSTALLATION (Cont'd.)</b>	
Headlamp Aim .....	32-02-3	Headlamp Switch .....	32-02-6
<b>CLEANING</b> .....	32-02-10	Rheostat and Dimmer Switch—	
<b>DESCRIPTION AND OPERATION</b>		Instrument Panel .....	32-02-6
Headlamp and Dimmer Switch .....	32-02-1	<b>SPECIAL SERVICE TOOLS</b> .....	32-02-10
Headlamps ON Warning Buzzer .....	32-02-1	<b>TESTING</b> .....	32-02-6
<b>DIAGNOSIS</b> .....	32-02-7	<b>VEHICLE APPLICATION</b> .....	32-02-1
<b>REMOVAL AND INSTALLATION</b>			
Headlamp Assembly .....	32-02-4		
Bulb Replacement .....	32-02-5		

## VEHICLE APPLICATION

Taurus/Sable.

## DESCRIPTION AND OPERATION

The aerodynamically styled headlamp system uses halogen replaceable bulbs. A burned out bulb may be replaced without removing the headlamp body.

Refer to the headlamp switch diagnosis procedure before attempting to replace the headlamp switch.

### Headlamp and Dimmer Switch

A combination three-position lighting switch, mounted in the instrument panel, controls circuits to the headlamps, parking lamps/marker lamps, tail lamps, license plate lamp, courtesy lamp, instrument panel lamps and ash receptacle lamps. A fuse panel protects all lamps described above except headlamps. A separate circuit breaker in the switch protects the headlamps. Refer to Section 34-50 for location of fuse and circuit breaker.

The instrument panel lamp circuit is routed through a rheostat, which is controlled by rotating the thumbwheel.

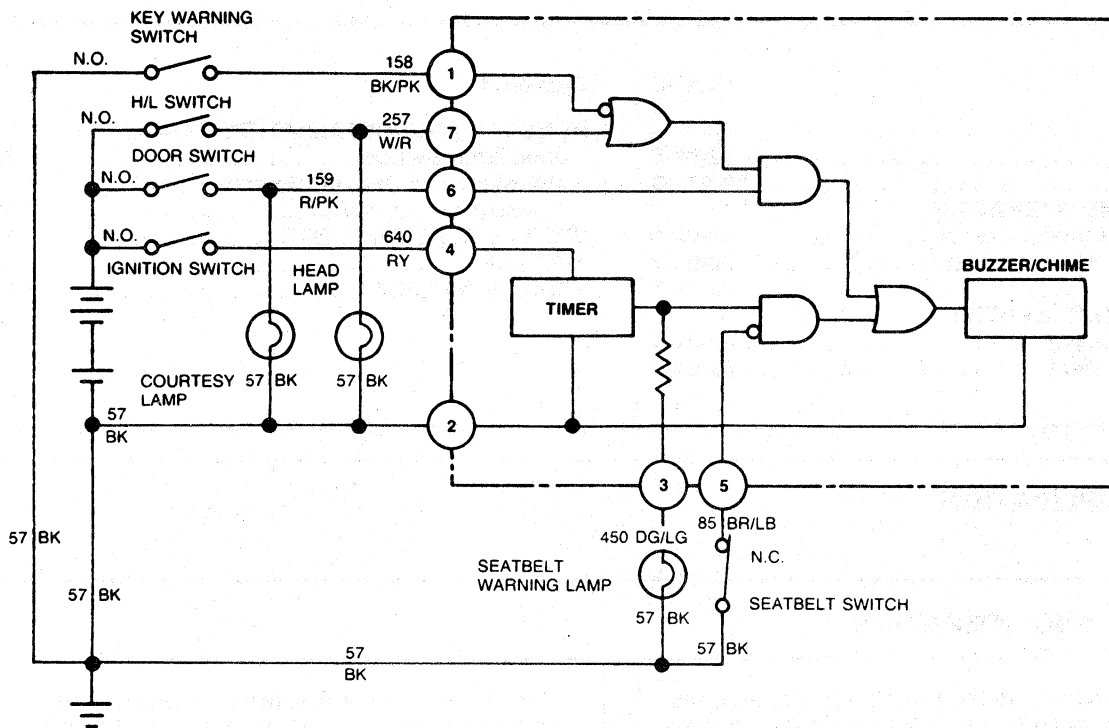
A dome lamp switch is also a part of the rheostat switch. It is actuated by rotating the thumbwheel to the extreme up position. The courtesy lamps are also illuminated by the switch in the pillar when the doors are opened.

### Headlamps ON Warning Buzzer

With optional headlamps ON warning, a seven-terminal buzzer replaces the six-terminal buzzer used with the key warning. This buzzer allows dual function of the key warning and headlamps ON warning buzzers.

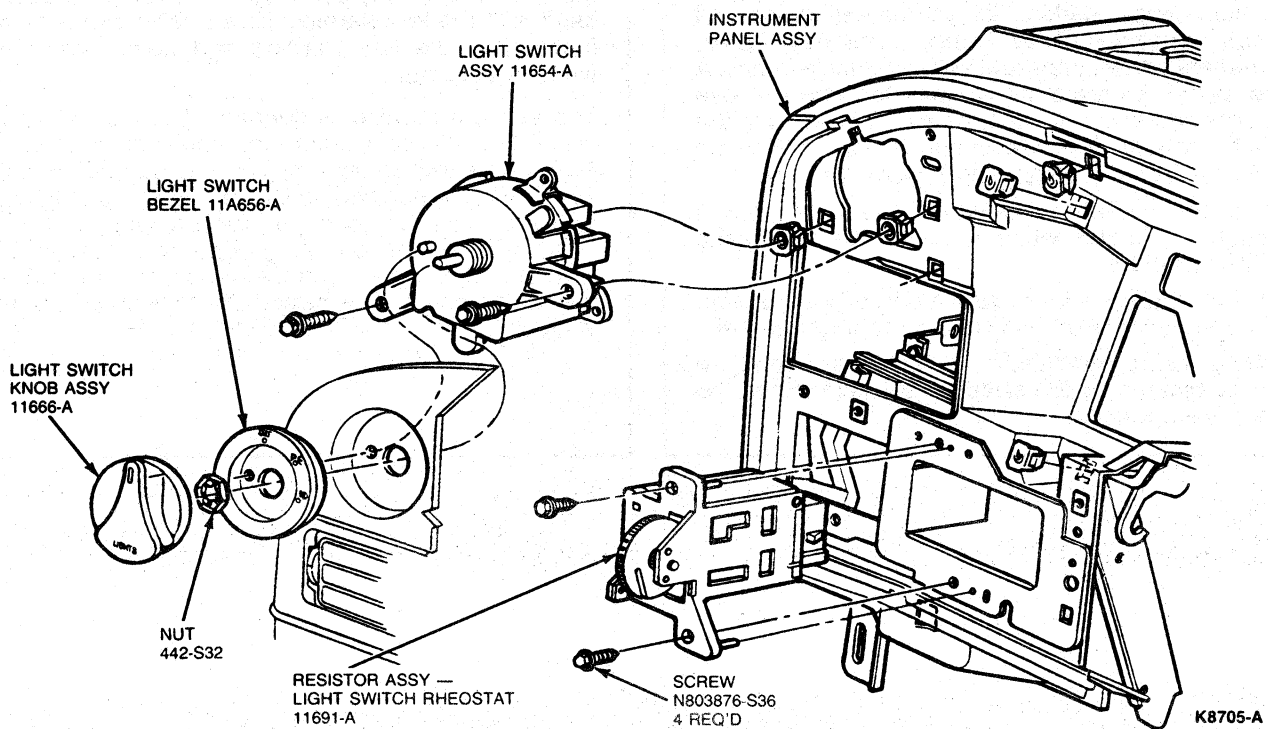
The seventh terminal is connected to the tail lamp circuit (14 BR); otherwise the circuits are identical. As in key warning, when the door is opened, circuit 159 R/PK is energized and if the headlamp switch is operated, a transistor is turned on to allow completion of the buzzer ground path (circuit 57 BK). The buzzer will continue to operate until either the headlamp switch is turned off or the driver's door is closed.

### DESCRIPTION AND OPERATION (Continued)



**K8693-A**

## Taurus

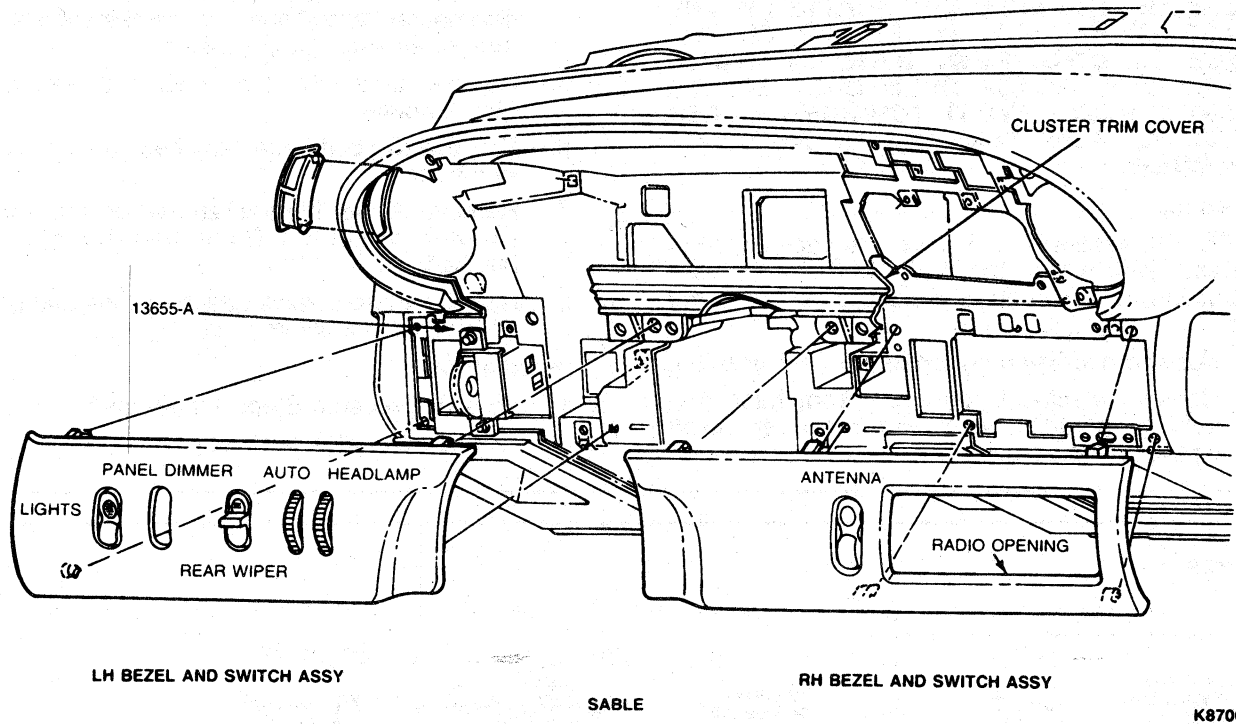


**K8705-A**



## DESCRIPTION AND OPERATION (Continued)

## Sable



Refer to Headlamp Switch Diagnosis before attempting to replace the headlamp switch.

## ADJUSTMENTS

## Headlamp Aim

All headlamp adjustments should be made with a half tank of gas, luggage compartment empty, except for the spare tire and jack equipment and correct tire pressures.

To aim the aerodynamically styled headlamps, use Rotunda Aiming Kit 107-00001 with Adapter Kit 107-00011 or equivalent. The equipment in the

aiming kit can be calibrated to accommodate a slight floor slope, however, it should be reasonably flat. The adjusted adapter positions are moulded into the lower face of the headlamp lens.

Set and lock the adjustable adapter. Attach each adapter to its mechanical aimer, and aim headlamps per latest instructions in Rotunda Kit.

## REMOVAL AND INSTALLATION

## Headlamp Assembly

**WARNING: THE REPLACEABLE HALOGEN HEADLAMP BULB CONTAINS GAS UNDER PRESSURE. THE BULB MAY SHATTER IF THE GLASS ENVELOPE IS SCRATCHED OR THE BULB IS DROPPED. HANDLE BULB CAREFULLY. GRASP BULB ONLY BY ITS PLASTIC BASE. AVOID TOUCHING GLASS ENVELOPE. KEEP BULB OUT OF REACH OF CHILDREN.**

## Removal

NOTE: The headlamp on this vehicle does not need replacement when the bulb burns out. See instructions for removal and installation of headlamp bulb.

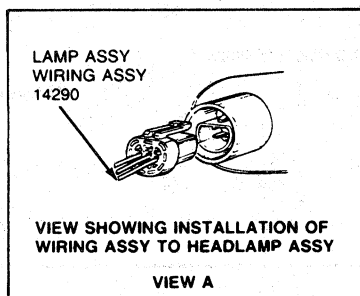
1. Position headlamp switch in the OFF position.
2. Remove electrical connector from headlamp bulb by grasping wires firmly and snapping connector rearward.

3. Remove grille (Taurus) or lighted grille (Sable).
4. Remove lamp just outboard of headlamp; sidemarker lamp (Taurus) or combination park/turn/sidemarker lamp (Sable).
5. Remove park/turn lamp bulb and connector (Taurus only).
6. Remove two bolts attaching headlamp housing to fender.
7. Remove three bolts (Taurus) or four bolts (Sable) attaching headlamp housing to brackets.
8. Remove three screws attaching lens and body assembly to headlamp housing.

## Installation

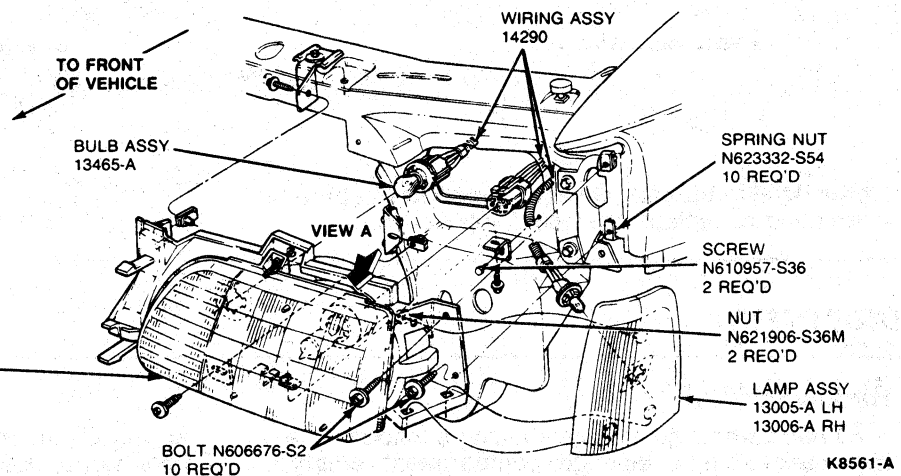
1. To install reverse Steps 1 through 8.
2. Aim headlamp as outlined.

## Taurus



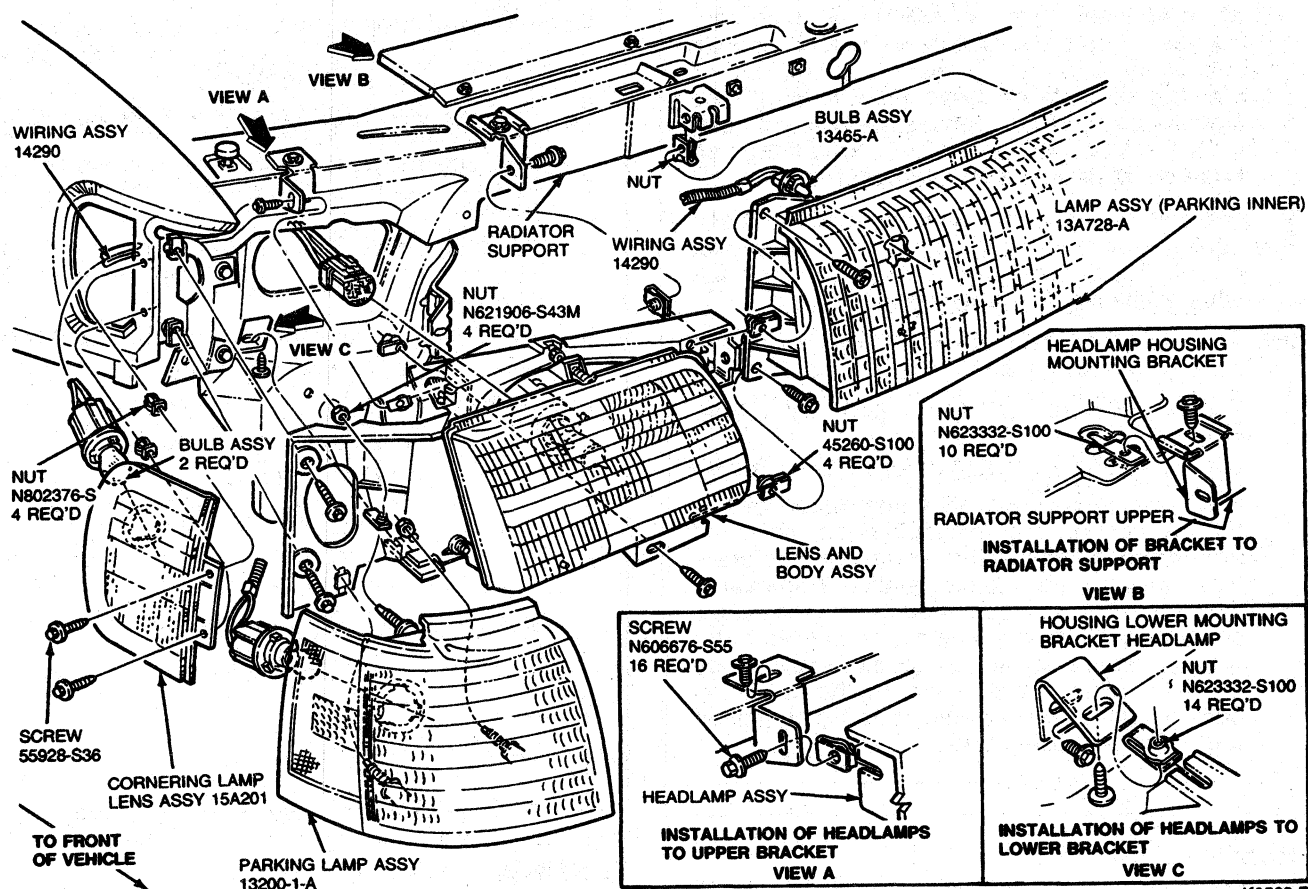
LH HEADLAMP SHOWN RH TYPICAL

LENS AND BODY ASSY  
13005-A LH  
13006-A RH



## REMOVAL AND INSTALLATION (Continued)

## Sable

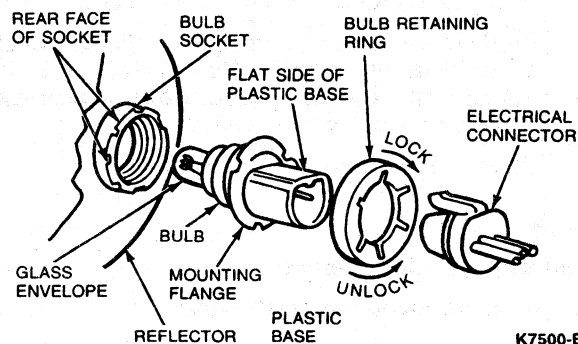


K8562-B

## Bulb Replacement

## Removal

1. Check that headlamp switch is in OFF position.
2. Lift hood and locate bulb installed in rear of headlamp body.
3. Remove electrical connector from bulb by grasping wires firmly and snapping connector rearward.
4. Remove bulb retaining ring by rotating counterclockwise (when viewed from rear) about one-eighth turn and sliding ring off plastic base. Keep ring as it may be used again to retain new bulb.
5. Carefully remove headlamp bulb from socket in reflector by gently pulling straight backward out of socket. Do not rotate bulb during removal.



K7500-B

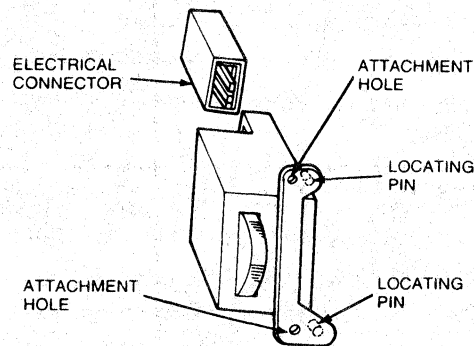
**REMOVAL AND INSTALLATION (Continued)****Installation**

1. With flat side of plastic base of bulb facing upward, insert glass envelope of bulb into socket. Turn base slightly to left or right, if necessary, to align grooves in forward part of plastic base with corresponding locating tabs inside socket. When grooves are aligned, push bulb firmly into socket until mounting flange on base contacts rear face of socket.
2. Slip bulb retaining ring over rear of plastic base against mounting flange. Lock ring into socket by rotating ring clockwise. A stop will be felt when retaining ring is fully engaged.
3. Push electrical connector into rear of plastic base until it snaps and locks into position.
4. Turn headlamps on and check for proper operation.

**NOTE:** A properly aimed headlamp normally need not be reaimed after installation of this bulb. A burned out bulb should not be removed from the headlamp reflector until just before a replacement bulb is to be installed. Removal of a bulb for an extended period of time may allow contaminants (dust, moisture, smoke) to enter the headlamp body and affect the performance of the headlamp. When servicing the headlamp bulb, energize the bulb only while it is contained within the headlamp body.

**Rheostat and Dimmer Switch—Instrument Panel Illumination and Interior Lamps****Removal and Installation**

1. Remove lower left finish panel.
2. Remove two screws retaining rheostat switch to instrument panel. Pull switch out of instrument panel, disconnect electrical connector and remove switch.
3. To install, reverse Steps 1 and 2.

**Headlamp Switch****Taurus****Removal and Installation**

1. Pull off headlamp switch knob.
2. Remove bezel retaining nut and remove bezel.
3. Remove instrument cluster finish panel.
4. Remove two screws retaining headlamp switch to instrument panel. Pull switch out of instrument panel, disconnect electrical connector and remove switch.
5. To install, reverse Steps 1 through 4.

**Sable****Removal and Installation**

1. Remove lower left finish panel.
2. Remove two screws retaining the headlamp switch to the finish panel.
3. Disconnect electrical connector and remove switch.
4. To install, reverse Steps 1, 2 and 3.

**TESTING**

Before performing any lighting systems test, check that the battery is fully charged and all battery cable connections are clean and tight.

Visual inspection is an important part of the lighting system test. Check for wires with frayed or damaged insulation, loose connections and improper harness routing. Any problems found by visual inspection should be corrected before performing lighting system tests.

**DIAGNOSIS**

Use the following diagnosis charts to diagnose the headlamp system.

**HEADLAMP SWITCH**

**NOTE:** Replace burned out bulbs or fuses before proceeding.

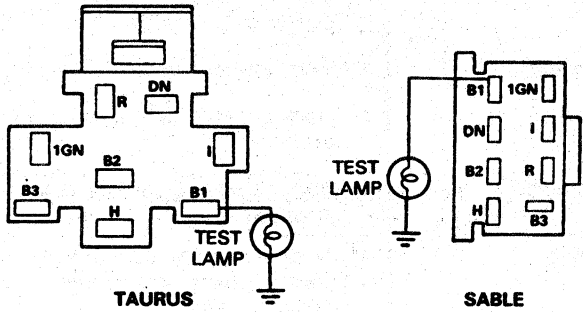
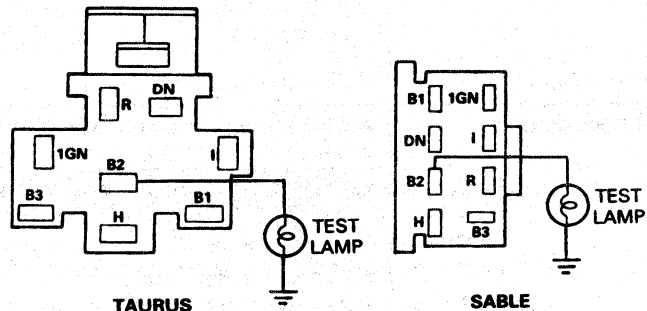
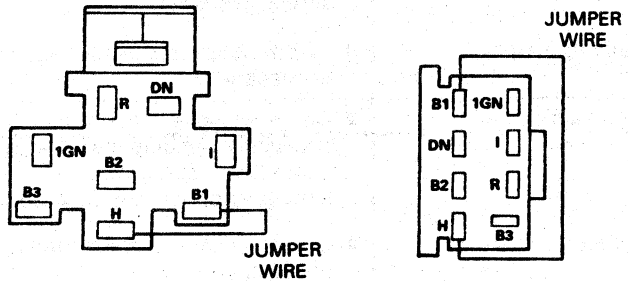
CONDITION	POSSIBLE SOURCE	ACTION
Headlamps do not work. Park and taillamps OK.	<ul style="list-style-type: none"> <li>• Open or shorted wiring</li> <li>• Poor ground connections</li> <li>• Damaged dimmer switch</li> <li>• Damaged headlamp switch</li> </ul>	<ul style="list-style-type: none"> <li>• Check wiring and connections between power source and headlamp switch, and between headlamp switch and lamps. Service as necessary.</li> <li>• Check and service as necessary.</li> <li>• Check dimmer switch; replace if necessary.</li> <li>• Check headlamp switch; replace if necessary.</li> </ul>
All exterior lamps do not work.	<ul style="list-style-type: none"> <li>• Open or shorted wiring</li> <li>• Damaged headlamp switch</li> </ul>	<ul style="list-style-type: none"> <li>• Check wiring and connections between power source and headlamp switch.</li> <li>• Check headlamp switch; replace if necessary.</li> </ul>
Headlamps flash on and off.	<ul style="list-style-type: none"> <li>• Shorted circuit</li> <li>• Damaged headlamp switch</li> </ul>	<ul style="list-style-type: none"> <li>• Check wiring and connections between headlamp switch and headlamps.</li> <li>• Replace headlamp switch.</li> </ul>
Park and taillamps do not work. Headlamps OK.	<ul style="list-style-type: none"> <li>• Open wiring or poor ground</li> <li>• Blown Fuse</li> <li>• Damaged headlamp switch</li> </ul>	<ul style="list-style-type: none"> <li>• Check wiring and connections between power source and headlamp switch, and between headlamp switch and lamps. Service as necessary.</li> <li>• Service as necessary.</li> <li>• Check headlamp switch; replace if necessary.</li> </ul>
Instrument panel lamps do not work, or will not dim.	<ul style="list-style-type: none"> <li>• Open or shorted wiring</li> <li>• Damaged headlamp switch</li> </ul>	<ul style="list-style-type: none"> <li>• Check wiring between headlamp switch and lamps.</li> <li>• Check headlamp switch; replace if necessary.</li> </ul>
Dome lamps will not work.	<ul style="list-style-type: none"> <li>• Open or shorted wiring</li> <li>• Damaged headlamp switch</li> </ul>	<ul style="list-style-type: none"> <li>• Check wiring and connections between headlamp switch and dome lamp, and between headlamp switch and fuse panel.</li> <li>• Check headlamp switch; replace if necessary.</li> </ul>

CK7412-B

## DIAGNOSIS (Continued)

## HEADLAMP SWITCH CONNECTOR CHECKOUT

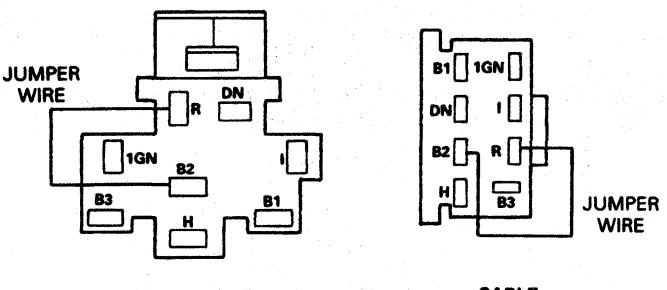
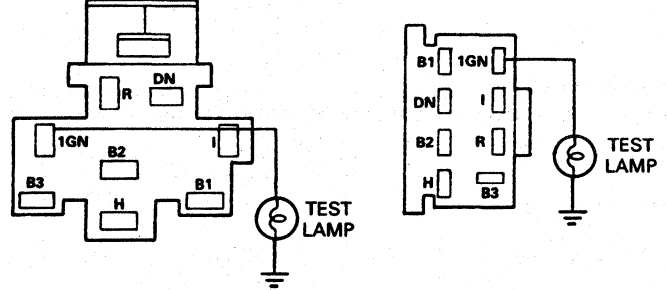
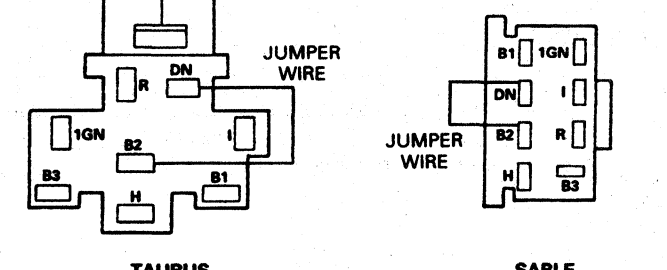
1. Replace burned out bulbs and fuses before proceeding.
2. A 12-volt test lamp and jumper wire will be required.
3. When necessary to trace and/or service the various circuits, refer to the respective vehicle wiring diagrams.
4. Terminal identification used on connector checkout procedure corresponds with actual identification on headlamp switch.
5. Perform checks in sequence as shown.

OPERATION	RESULT
<p><b>1</b> Connect a 12-volt test lamp between Terminal B1 and a good ground.</p>  <p>TAURUS                      SABLE</p>	<p>Test lamp should light. If not, trace circuit back to fuse link and service as necessary.</p>
<p><b>2</b> Connect a 12-Volt test lamp between Terminal B2 and a good ground.</p>  <p>TAURUS                      SABLE</p>	<p>Test lamp should light. If not, trace circuit back to fuse panel and service as necessary.</p>
<p><b>3</b> Connect a jumper wire between Terminals B1 and H.</p>  <p>TAURUS                      SABLE</p>	<p>Headlamps should light. If not, trace Circuit H back to headlamps and service. If circuit is OK, check ground circuit from headlamps to ground.</p>

CK8709-B

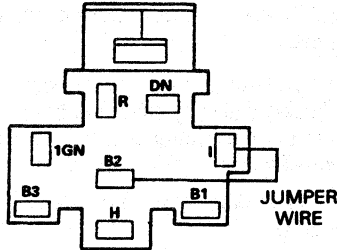
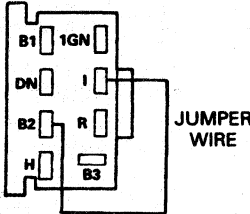
## DIAGNOSIS (Continued)

## HEADLAMP SWITCH CONNECTOR CHECKOUT — Continued

OPERATION	RESULT
<p><b>4</b> Connect a jumper wire between Terminals B2 and R.</p>  <p><b>TAURUS</b> <b>SABLE</b></p>	<p>A. Parking lamps, rear lamps, and marker lamps should light. If not, trace Circuit R and service as necessary. If Circuit R is OK, check ground circuit from lamps to ground.</p> <p>B. Slowly rotate panel dimmer control. Instrument panel illumination lamps will vary from full bright to dim. If not, trace Circuit R to panel dimmer control and service as necessary.</p> <p>NOTE: The liquid crystal display will not come on during this test.</p>
<p><b>5</b> Connect a 12-volt test lamp between Terminal IGN and a good ground.</p>  <p><b>TAURUS</b> <b>SABLE</b></p>	<p>With ignition switch in the RUN position, the test lamp should light. If not, trace circuit back to ignition and service as necessary.</p>
<p><b>6</b> Connect a jumper wire between Terminals B2 and DN.</p>  <p><b>TAURUS</b> <b>SABLE</b></p>	<p>Liquid crystal display lamps only, should come on, full bright. If cluster lamps do not light, trace Circuit DN back to lamps and service as necessary. If Circuit is OK, check ground circuit from lamps to ground.</p> <p>NOTE: No other instrument panel lamps will light during this test.</p>

## DIAGNOSIS (Continued)

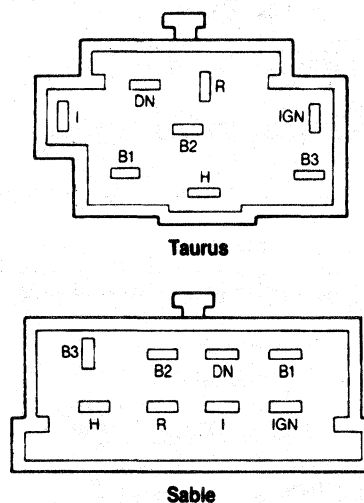
## HEADLAMP SWITCH CONNECTOR CHECKOUT — Continued

OPERATION	RESULT
<p><b>7</b> Connect a jumper wire between Terminals B2 and I.</p> <div style="display: flex; justify-content: space-around; align-items: center;">   </div> <p style="text-align: center;"><b>TAURUS</b>                      <b>SABLE</b></p>	<p>Instrument panel illumination lamps only, should come on, full bright. If panel lamps do not light, trace I circuit back to lamps and service as necessary. If circuit is OK, check ground circuit from lamps to ground.</p> <p><b>NOTE:</b> The liquid crystal displays will not light during this test.</p>

CK8711-B

**NOTE:** A self-powered test lamp or ohmmeter will be required. Terminal identification used in test procedure corresponds to that on headlamp switch.

Switch Terminals	Switch Positions		
	Off	Park	Headlamp
B1 to H	No Cont.	No Cont.	Continuity
B2 to R	No Cont.	Continuity	Continuity
DN to IGN	Continuity	No Cont.	No Cont.
DN to I	No Cont.	Continuity	Continuity
B1 to B3	Continuity	Continuity	Continuity
All Other Terminals	No Cont.	No Cont.	No Cont.



CK7422-A

## CLEANING

Clean headlamps by spraying with Ford Glass Cleaner, E4AZ-19C507-A or equivalent and wiping with a soft, clean cloth.

## SPECIAL SERVICE TOOLS

## ROTUNDA EQUIPMENT

Model	Description
107-00001	Headlamp Aimer Kit
107-00011	Aero-Dynamic Headlamp Aiming Adapters

CK6685-C



# SECTION 32-20 Lamps—Parking, Rear and Marker

SUBJECT	PAGE	SUBJECT	PAGE
DESCRIPTION AND OPERATION .....	32-20-1	REMOVAL AND INSTALLATION (Cont'd.)	
REMOVAL AND INSTALLATION		Lamp Replacement, License Plate .....	32-20-5
Cornering Lamp .....	32-20-3	Lamps, Parking/Turn Signal Combination ....	32-20-1
Hi-Mount Stoplamp .....	32-20-6	Lens or Lamp Assembly Replacement .....	32-20-6
Lamp Assembly Replacement, Rear .....	32-20-4	Side Marker Lamp, Front .....	32-20-2
Lamp Lens/Ornament Reflex		Side Marker Lamp Replacement, Rear .....	32-20-5
Replacement, Rear .....	32-20-4	Switch, Stoplamp (Mechanical) .....	32-20-7
Lamp Replacement, Backup .....	32-20-6	VEHICLE APPLICATION .....	32-20-1

## VEHICLE APPLICATION

Taurus/Sable.

## DESCRIPTION AND OPERATION

Parking/marker lamps, tail lamps and license lamp circuits are controlled by the headlamp switch. When the headlamp switch is pushed to the first detent, only the parking/marker lamps, tail lamps and license lamp are activated.

When the headlamp switch is pushed to the second detent, the parking/marker lamps, tail lamps and license lamp remain on, but the headlamps are also illuminated.

## REMOVAL AND INSTALLATION

### Lamps, Parking/Turn Signal Combination

#### Taurus

The parking and turn signal lamps share the same dual filament bulb.

#### Removal and Installation

1. Using access hole in radiator support, rotate bulb socket counterclockwise to disengage from lamp housing and remove bulb.
2. To install, reverse the removal procedure. Rotate bulb socket clockwise to engage in lamp housing.

### Sable

Marker lamp and parking lamp units share the same bulb.

#### Removal

1. Remove two screws attaching parking lamp assembly and pull forward.
2. Remove bulb socket by twisting and remove bulb, if necessary.

#### Installation

1. Install bulb, if removed, and install socket in lamp assembly by twisting.
2. Position parking lamp assembly in place. Install screws.

## REMOVAL AND INSTALLATION (Continued)

## Side Marker Lamp, Front

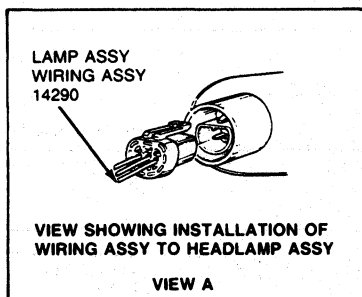
## Taurus

## Removal

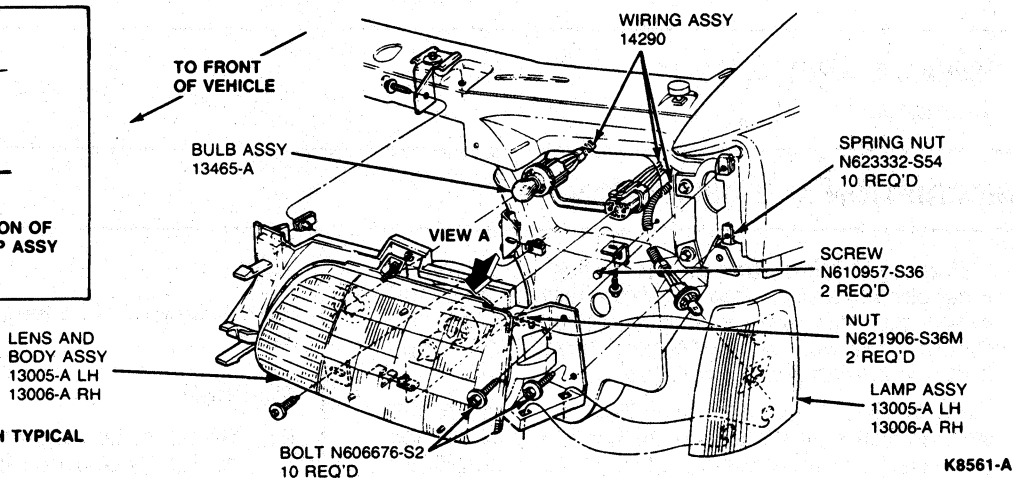
1. Remove one nut and washer from attaching stud at top of lamp assembly.
2. Rotate top of outboard until stud tip has cleared slot in housing.
3. Lift lamp to clear two lower tabs (on headlamp) from headlamp housing.
4. Remove bulb socket by twisting counterclockwise and remove bulb by pulling.

## Installation

1. Install bulb, if removed, and install bulb socket by twisting clockwise.
2. Position lamp in place by lowering two tabs on lamp into two slots on headlamp housing.
3. Rotate lamp inboard to allow stud to enter upper slot in housing.
4. Install nut and washer to attaching stud, and secure.



LH HEADLAMP SHOWN RH TYPICAL



## REMOVAL AND INSTALLATION (Continued)

## Cornering Lamp

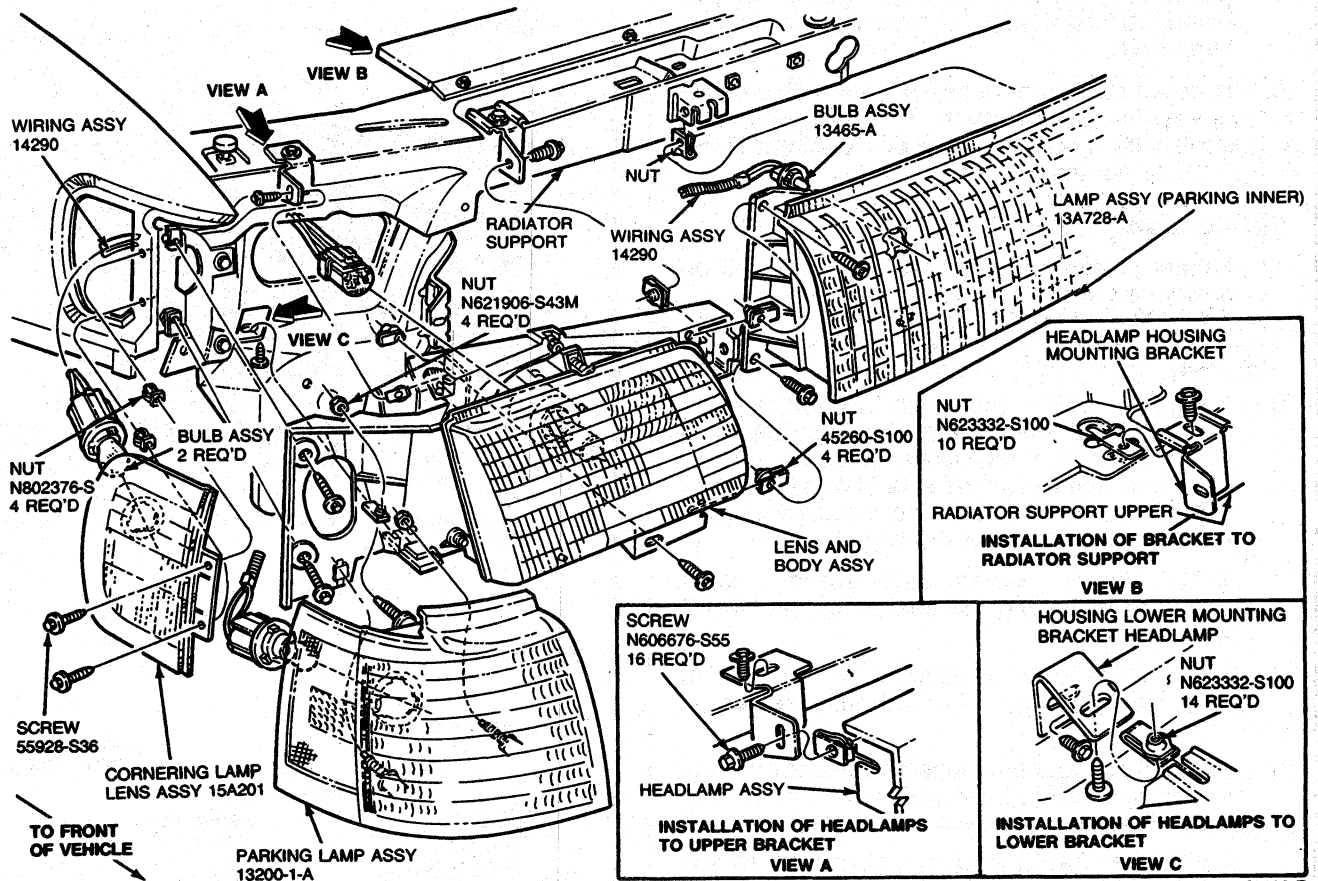
## Sable

## Removal

1. Perform Steps 1 and 2 of Parking Lamp Removal.
2. Remove two screws attaching cornering lamp assembly, and lift out.
3. Remove bulb by twisting counterclockwise.

## Installation

1. Install bulb, if removed, and install socket into lamp assembly by twisting clockwise.
2. Position cornering lamp in place, and install two screws.
3. Perform Steps 1 and 2 of Parking Lamp Installation.



K8562-B

**REMOVAL AND INSTALLATION (Continued)****Lamp Lens/Ornament Reflex Replacement, Rear****Removal**

1. The lamp assembly will not have to be removed from vehicle to replace lens.
2. From inside luggage compartment, remove lamp sockets and bulbs.
3. On Sable right rear lamp, remove lens by prying off with a screwdriver on edge of lens and body.
4. Using a hammer, break out large portions of damaged lens which is ultrasonically welded to lamp body.
5. Remove remainder of broken lens with a chisel or sharpened screwdriver. The entire perimeter should be smoothed to within 0.40mm (1/64 inch) of normal surface.

**Installation**

1. Locate position of water drainage notches on bottom edge of new lens assembly.
2. Mark position of drainage notches on lamp body.
3. Starting at a drainage notch location, apply a strip of Ford Windshield and Backlite Seal D9AZ-19562-A or equivalent, around perimeter of lamp assembly. Leave a 12.70mm (1/2-inch) gap between ends of seal, centered about each notch in lens for water drainage.

NOTE: Special care should be taken to avoid bunching or tearing the seal when applying it around corners.

4. Firmly press clips supplied with replacement lens into butyl so they are fully seated in channel.
5. Firmly press and hold lens into position for ten seconds, ensuring butyl tape seals lens to body around entire perimeter.

**CAUTION: Avoid applying pressure to the middle of the lens to keep from breaking the new part.**

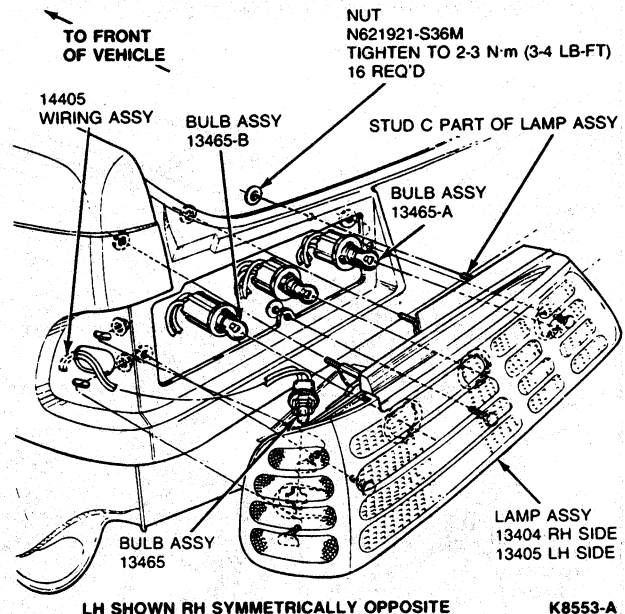
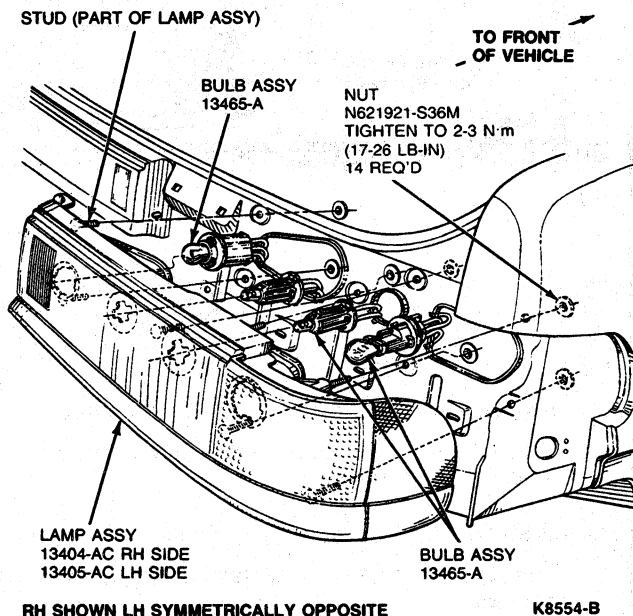
6. Install lamp sockets and bulbs.
7. Test tail lamps, turn signals, and backup lamp for proper operation.

**Lamp Assembly Replacement, Rear****Sedan****Removal**

1. From inside luggage compartment, remove lower back panel trim cover, if so equipped.
2. Remove lamp sockets from lamp body.
3. Remove nuts retaining lamp body to lower back panel. Remove lamp assembly.

**Installation**

1. Position lamp assembly to rear panel. Install retaining nuts.
2. Install lamp sockets in lamp body.
3. Install trim panel cover.

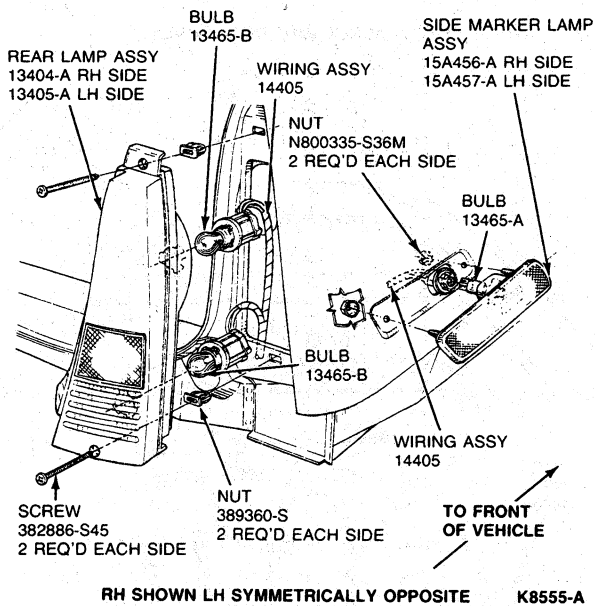
**Taurus****Sable**

**REMOVAL AND INSTALLATION (Continued)****Wagon****Removal**

1. Remove two screws retaining lamp assembly to quarter panel.
2. Remove lamp assembly.

**Installation**

1. Position new lamp assembly to quarter panel.
2. Install two screws retaining lamp assembly to quarter panel.

**Wagon**

Refer to illustration under Lamp Assembly Replacement, Rear—Wagon.

**Removal**

1. Remove two nuts retaining lamp assembly to quarter panel.
2. Remove lamp assembly.

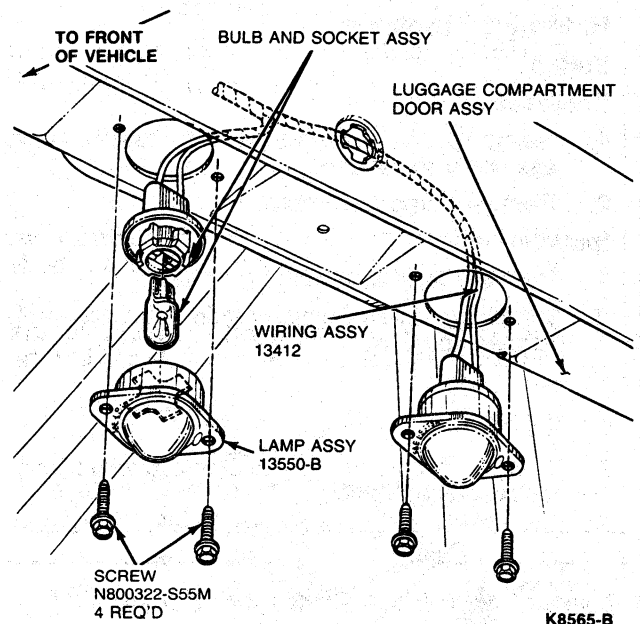
**Installation**

1. Position lamp assembly to quarter panel.
2. Install two nuts retaining lamp assembly to quarter panel.

**Lamp Replacement, License Plate****Removal and Installation**

NOTE: License plate lamp bulbs are located under rear lip of two luggage compartment doors.

To replace license plate lamp assembly or bulb, remove two lamp body retaining screws. Remove the lamp assembly. Remove socket and bulb from back of lamp body to replace bulb.

**Sedan****Side Marker Lamp Replacement, Rear****Sable****Sedan**

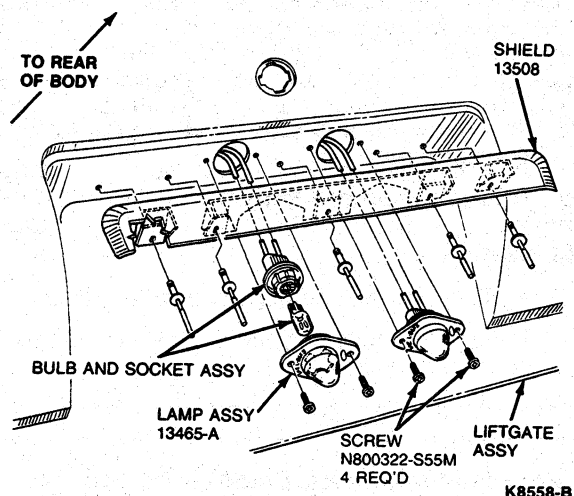
NOTE: Taurus side marker lamp assembly is an integral part of the rear lamp assembly.

**Removal**

1. Remove rear lamp assembly as outlined.
2. Remove three side marker lens retaining screws and remove lens.

**Installation**

1. Install side marker lens and three attaching screws.
2. Install new rear lamp assembly as outlined.

**REMOVAL AND INSTALLATION (Continued)****Wagon****Lamp Replacement, Backup Removal and Installation**

To replace a bulb or lens, perform the Rear Lamp Assembly Replacement procedure.

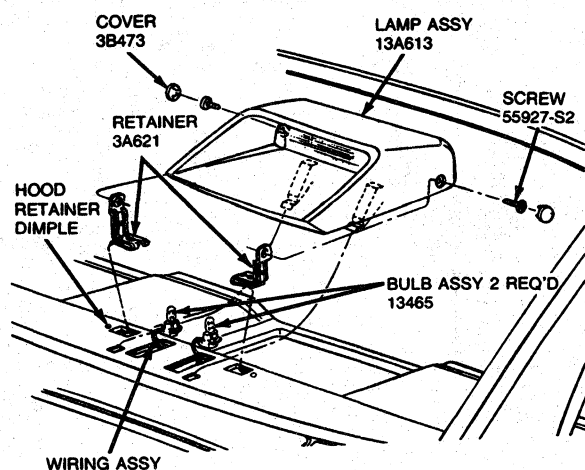
NOTE: Sable backup lamp is part of rear lamp assembly.

**Hi-Mount Stoplamp****Sedan****Removal**

1. Remove two screws which retain lamp assembly to retainer.
2. Remove lamp assembly.

**Installation**

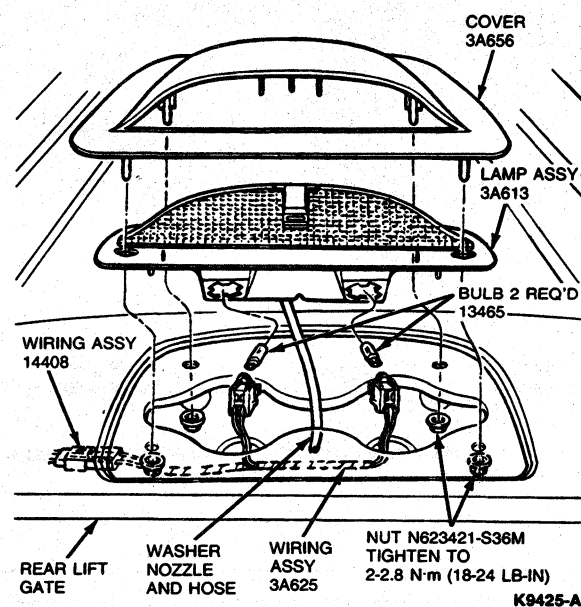
1. Position lamp assembly to retainer.
2. Install two screws which retain lamp assembly to package tray.

**Wagon****Removal**

1. Remove lamp assembly trim cover, located at top of liftgate frame.
2. Remove four nuts attached to lamp mounting studs.
3. Remove lamp assembly.

**Installation**

1. Position lamp assembly on four mounting studs.
2. Install four attaching nuts which retain lamp assembly.
3. Install lamp assembly trim cover.

**Lens or Lamp Assembly Replacement****Removal and Installation**

1. To replace lens or lamp assembly, complete Backup Lamp Replacement procedure. Then, remove one lamp retaining screw and remove backup lamp assembly from housing and bracket assembly.
2. To install, reverse Step 1.

## REMOVAL AND INSTALLATION (Continued)

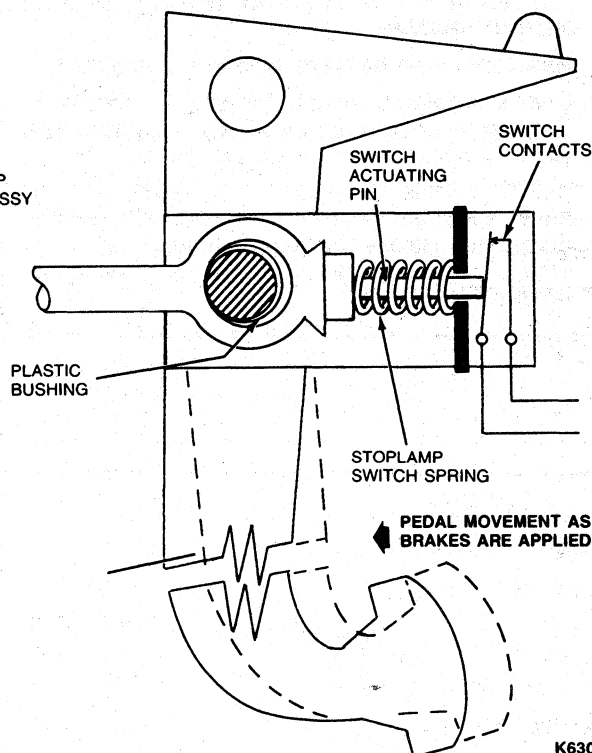
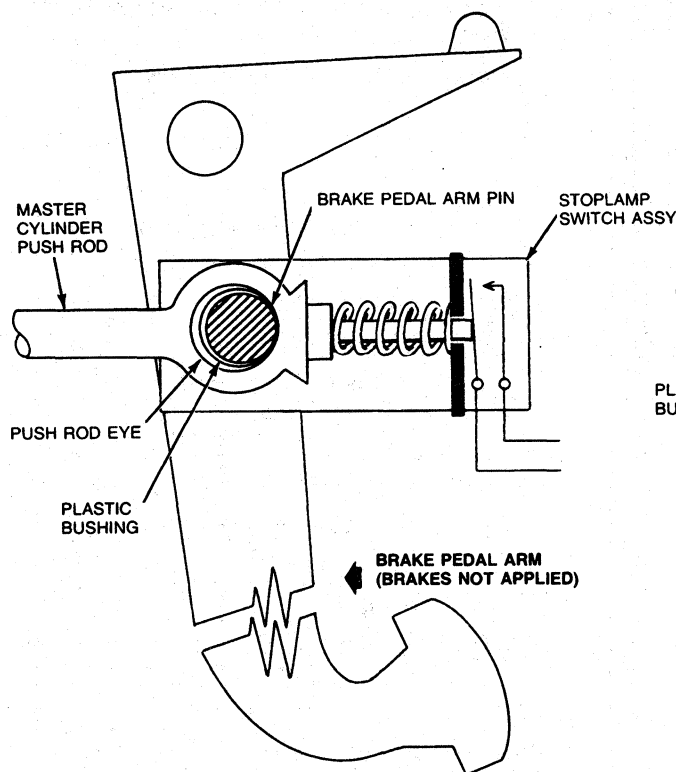
**Switch, Stoplamp (Mechanical)**

The mechanical stoplamp switch assembly is installed on the pin of the brake pedal arm, so that it straddles the master cylinder push rod. The switch assembly is slip fit on the pedal arm pin, and the switch pressure plate mates with the flat on the master cylinder push rod. The switch assembly travels with the pedal arm but maintains alignment with the flat on the push rod at all times.

The brake pedal arm pin and plastic bushing have a designed-in clearance with the eye of the master cylinder push rod. Because of this clearance,

whenever the brake pedal is pushed forward, the stoplamp switch frame moves forward, pulling the whole assembly forward. During that movement, the push rod flat pushes the switch pressure plate and actuating pin rearward, closing the switch contacts. This completes the circuit to the stoplamps.

When the brake pedal is released, the spring in the stoplamp switch returns the actuating pin to its normal position and the circuit to the stoplamp opens.

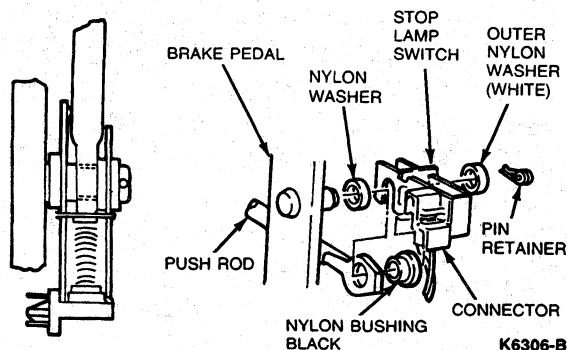
**Removal**

1. Disconnect the wire harness at connector from switch.

NOTE: Locking tab must be lifted before connector can be removed.

2. Remove hairpin retainer and white nylon washer. Slide stoplamp switch and push rod away from pedal. Remove switch by sliding switch up/down.

NOTE: Since the switch side plate nearest the brake pedal is slotted, it is not necessary to remove the brake master cylinder push rod black bushing and one white spacer washer nearest the pedal arm from the brake pedal pin.



**REMOVAL AND INSTALLATION (Continued)****Installation**

1. Position switch so that U-shaped side is nearest pedal and directly over/under pin. The black bushing must be in position in push rod eyelet with washer face on side away from brake pedal arm.
2. Slide switch up/down trapping master cylinder push rod and black bushing between switch side plates. Push switch and push rod assembly firmly toward brake pedal arm. Assemble outside white plastic washer to pin. Install hairpin retainer to trap whole assembly.

**CAUTION: Do not substitute other types of pin retainer. Replace only with production hairpin retainer.**

3. Assemble wire harness connector to switch.
4. Check stoplamp switch for proper operation. Stoplamps should illuminate with less than 27N (6 lbs) applied to brake pedal at pad.

**NOTE:** Stoplamp switch wire harness must have sufficient length to travel with switch during full stroke at pedal. If wire length is insufficient, reroute harness or service as required.



# SECTION 32-42 Multi-Function Switch

SUBJECT	PAGE	SUBJECT	PAGE
<b>DESCRIPTION AND OPERATION</b>		<b>DIAGNOSIS AND TESTING</b> .....	32-42-3
Cornering Lamp Switching .....	32-42-2	<b>REMOVAL AND INSTALLATION</b>	
Hazard Flasher Switching .....	32-42-1	Flasher Unit .....	32-42-3
Headlamp Dimmer/Flash-to-Pass Switching .....	32-42-1	Multi-Function Switch .....	32-42-2
Turn Signal Switching .....	32-42-1	<b>SPECIAL SERVICE TOOLS</b> .....	32-42-7
Windshield Washer Switching .....	32-42-2	<b>VEHICLE APPLICATION</b> .....	32-42-1
Windshield Wiper Switching .....	32-42-2		

## VEHICLE APPLICATION

Taurus/Sable.

## DESCRIPTION AND OPERATION

The Multi-Function Switch provides electrical switching for the turn signal, headlamp dimmer, headlamp flash-to-pass, hazard warning, cornering lamps (optional), windshield washer and windshield wiper. The integrated switch assembly is mounted to the steering column.

### Turn Signal Switching

The turn signal lever is located on the LH side of the upper steering column. To operate the turn signal(s), the key lock cylinder must be in the RUN position. To indicate a normal full turn, move the turn signal lever to the end-of-travel position for the turn desired. The lever will remain in position without effort until the turn is completed, at which time the steering wheel motion will automatically cancel the turn signal. The steering wheel contains a cancel cam for the turn signal.

The turn signal system also has a lane change feature. To operate the lane change feature, move and hold the turn signal lever to the first stop position when changing lanes. When the lane maneuver is completed, release the lever and it will return to normal.

### Headlamp Dimmer/Flash-to-Pass Switching

The turn signal lever also operates the headlamp dimmer switch and the flash-to-pass feature. High beam is selected by moving the turn signal lever forward in vehicle or away from the steering wheel to the stop. Release of the lever will maintain high beams. Low beam is selected by moving the turn signal lever rearward in vehicle or toward the steering wheel from high beam. Release of the lever will maintain low beams.

To operate the flash-to-pass feature, pull the lever gently toward the steering wheel. Release of the lever will return the lever to the LO beam position. If driving without headlamps on, use of the flash-to-pass feature will turn on the high beams until the turn signal lever is released. If the headlamps are turned on, the low and high beams will be on until the turn signal lever is released. NOTE: Excessive force used to hold the turn signal lever in the flash-to-pass function followed by quick release may result in incorrect headlamp dimmer selection of high beam. The operator must be cautioned to avoid this condition.

### Hazard Flasher Switching

The hazard flasher system is operated independent of the key lock cylinder. The actuator for the hazard flasher system is located at the top of the steering column just forward of the steering wheel and is identified with a "double triangle" symbol. All turn signal lamps can be made to flash in unison by first pushing in the actuator and then releasing the actuator.

The actuator will move out or away from the steering column to the ON position. The hazard flasher system is turned off by first pushing in the actuator and then releasing the actuator. The actuator should remain in or toward the steering column in the OFF position. NOTE: The turn signal system is deactivated when the hazard flasher system is on and turn signal lever motion does not affect the hazard flasher system.

One flasher unit is used for both the turn signal and the hazard flasher system. Refer to the Wiring and Vacuum Diagram manual.

## DESCRIPTION AND OPERATION (Continued)

**Cornering Lamp Switching**

The cornering lamp switch is coordinated with the turn signal function. In order to operate the cornering lamp function the headlamps must be turned on.

**Windshield Washer Switching**

The washer switch is located at the end of the turn signal lever. To operate the washer, the key lock cylinder must be in the RUN position. To actuate the washer push the end of the turn signal lever in toward the center of the steering column. Release of the turn signal lever will then turn off the washer. If equipped with interval wipers, the wiper blades will continue to operate for a few wipes and then automatically return to the wiper speed setting (OFF, LO, or INT) previously selected after a few wiper cycles. If equipped with standard wipers, the wash function is selected while in the "O" or OFF position. The wipers will then "cam-to-lo" when wash is selected. Actuator and wipers must be turned off ("O") by the operator. Wash operation is available in all positions of wiper operation.

**Windshield Wiper Switching****Standard**

The wiper switch is located in the knob at the end of the turn signal lever. To operate the wiper the key lock cylinder must be in the RUN position. In addition to OFF, there are two wiper speeds that are selected by rotating the wiper actuator (knob) relative to the turn signal lever: LO and HI speed wiper speed.

**Interval**

The wiper switch is located in the knob at the end of the turn signal lever. To operate the wiper the key lock cylinder must be in the RUN position. In addition to "O" there are two fixed speed wiper positions (LO, low; HI, high) and an interval position. The positions are selected by rotating the knob actuator relative to the turn signal lever. If interval is selected, the time between wiper cycles will increase as the knob is rotated away from OFF position and the time interval will decrease as the knob is rotated toward OFF position. The time interval between wipes will vary depending on the knob's position from OFF position. The wiper speed for interval wiper operation is fixed at the LO speed setting.

## REMOVAL AND INSTALLATION

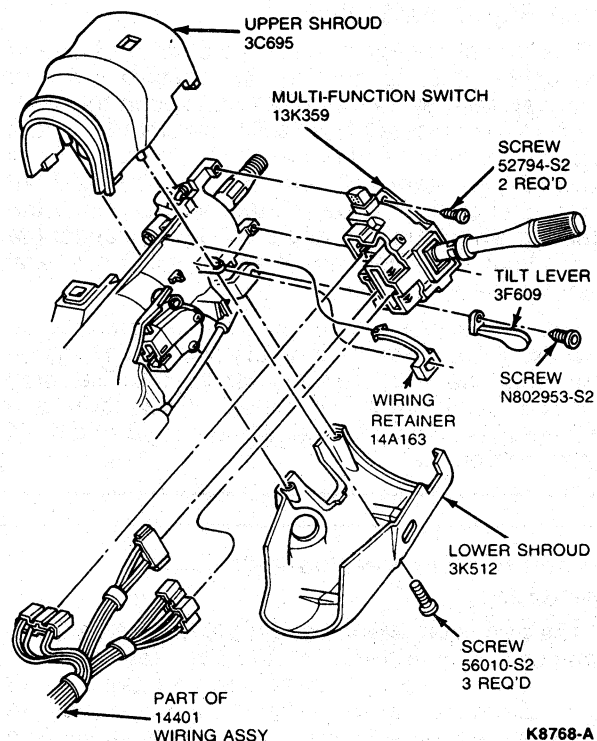
**Multi-Function Switch****Removal**

1. Disconnect battery ground cable.
2. If so equipped, tilt column to lowest position and remove tilt lever.

3. Remove ignition lock cylinder.
4. Remove three shroud screws and remove upper and lower shroud.
5. Remove wiring harness retainer and disconnect three electrical connectors.
6. Remove two self-tapping screws that attach multi-function switch to steering column casting. Disengage switch from casting.

**Installation**

1. Align multi-function switch mounting holes with corresponding holes in the steering column casting. Install two self-tapping screws ensuring to start the screws in the previously tapped holes. Tighten to 2-3 N·m (18-27 lb-in).
2. Install three electrical connectors to full engagement.
3. Install wiring harness retainer.
4. Install upper and lower steering column trim shroud with three screws. Tighten to .7-1.1 N·m (6-10 lb-in).
5. Install ignition lock cylinder.
6. Attach tilt lever, if so equipped, with one screw. Tighten to .7-1.0 N·m (6-8.5 lb-in).
7. Connect battery ground cable.
8. Check steering column and switch for proper operation.



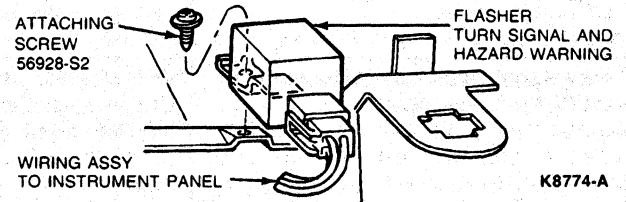
K8768-A

**REMOVAL AND INSTALLATION (Continued)****Flasher Unit****Removal and Installation**

The turn signal flasher is located on the LH side of the instrument panel, and is attached by one screw to the lower instrument panel reinforcement.

The combination turn signal and hazard flasher can be removed by pressing the plastic retaining clip (attached to the flasher housing) and pulling straight rearward. Installation of a new flasher can be made by removing the bracket from the new unit, then aligning the existing bracket to the instrument panel with the track on the flasher housing. Then push the flasher forward until it snaps into the bracket.

**NOTE:** The electrical wiring connector can be removed prior to installing a new unit and engaged into the new unit prior to snapping it into the bracket.

**DIAGNOSIS AND TESTING**

Refer to the diagnosis charts and the illustration for diagnosis and testing procedures. Testing for electrical malfunctions can be accomplished using a continuity tester and an ohmmeter, such as Rotunda Digital Volt-Ohm Meter 007-00001, or equivalent.

## DIAGNOSIS AND TESTING (Continued)

## MECHANICAL MULTI-FUNCTION SWITCH DIAGNOSIS

CONDITION	TEST STEP	ACTION
Hazard warning switch will not turn on warning lamps.	With hazard warning switch in the OFF position, fully depress knob and release.	If knob does not pop up to the ON position, the switch is damaged or worn; replace switch.
Hazard warning switch will not turn off warning lamps.	With hazard warning switch in the ON position, fully depress knob and release.	If knob does not pop up to the OFF position, the switch is damaged or worn. Replace switch.
Turn signal lever will not stay in the LH/RH turn positions.	With steering wheel locked in the straight ahead position, move lever to the RH and LH turn positions.	If lever does not stay in either turn position, the switch is damaged or worn. Replace switch.  NOTE: If lever stays in the turn position, verify that there is an effort required to manually move the lever from either the LH or RH turn position to the neutral position. If effort required to move the lever from the LH turn position to the neutral position is greater than the RH turn position to the neutral position, the switch is operating properly.
Turn signal lever cancels before steering wheel returns from the desired turn position.	Road test vehicle to verify condition.	If lever cancels before steering wheel return, the switch is damaged or worn; replace switch.
Turn signal lever will not cancel when steering wheel returns from the desired turn position.	Check effort to switch from high beam to low beam and the effort to manually cancel turn signal lever from a turn position.	If effort required to switch from HIGHBEAM to LOWBEAM is less than manually cancelling turn signal lever from a turn position, switch is damaged or worn. Replace switch.
Headlamp dimmer switch does not stop in LOWBEAM position after the flash-to-pass function is operated.	Gently pull turn signal lever to the FLASH-TO-PASS position and release.	If lever stops in the LOWBEAM position, switch is good. If lever travels beyond LOWBEAM position, the switch is damaged or worn — replace switch.
Headlamp dimmer switch does not return to LOWBEAM position after the flash-to-pass function is operated.	Gently pull turn signal lever to the FLASH-TO-PASS position and release.	If lever does not return to the LOWBEAM position, the switch is damaged or worn — replace switch.
Turn signal lever is loose.	Move turn signal lever from LOWBEAM to HIGHBEAM and back to LOWBEAM.	If looseness is felt in the lever, the switch is damaged or worn; replace switch.
Windshield washer switch knob does not return from the WASH position.	With ignition lock cylinder in the OFF position, push the washer switch knob to the ON position and release.	If washer switch knob does not return to the OFF position, the switch is damaged or worn; replace switch.
Windshield washer switch knob does not rotate from OFF to LO when the washer function is operated (standard wipers only)	With key lock cylinder in the RUN position, push the washer switch knob to the WASH position and observe knob rotation.	If washer switch knob rotates to LO (Note: graphics may not line up.) and wipers turn on to low speed, switch is good.  If washer switch knob rotates, but wipers do not turn on, switch is damaged or worn; replace switch.
Windshield wiper switch knob rotates past the OFF and/or HI stops.	Slowly turn knob in both directions, observe and feel where the switch knob stops.	If knob rotates past OFF and/or HI, switch is damaged or worn; replace switch.

CK8769-A

**DIAGNOSIS AND TESTING (Continued)****MECHANICAL MULTI-FUNCTION SWITCH DIAGNOSIS — Continued**

CONDITION	TEST STEP	ACTION
Windshield wiper switch knob rotates easily from OFF, LO, HI or the INTERVAL position during turn signal or headlamp dimmer operation.	Position finger on top of knob parallel to steering column. Gently pull finger back toward steering wheel and push down on lever toward LH turn position. Check each position, HI, LO, OFF and INTERVAL positions.	If knob rotates from any of the positions, switch is damaged or worn; replace switch.
Windshield wiper switch knob rotates past the HI and MAX. interval stop.	Slowly turn knob to the HI stop and then to MAX. interval stop. Observe and feel where knob stops.	If knob rotates past the HI position without a noticeable stop and/or past the MAX. interval stop, the switch is damaged or worn; replace switch.

**CK8770-B**

## DIAGNOSIS AND TESTING (Continued)

## MULTIFUNCTION SWITCH — BENCH CHECK CONTINUITY

SWITCH ACTUATOR POSITION	CONTINUITY BY CIRCUIT NUMBER
<p><b>Turn Signal Lever in Neutral</b> Hazard OFF.</p> <p><b>Turn Signal Lever in Left Turn.</b> Hazard OFF.</p> <p><b>Turn Signal Lever in Right Turn.</b> Hazard OFF.</p>	<p><b>Turn Signal:</b> Closed No. 511 to 5 and 9 Open No. 511 to 2, 3, 44 and 385; No. 44 to 2, 3, 5, 9 and 385; No. 385 to 2 and 3.</p> <p><b>Cornering Lamp:</b> Open No. 15 to 379 and 380; No. 379 to 380.</p> <p><b>Turn Signal:</b> Closed No. 511 to 5; No. 44 to 3 and 9 Open No. 511 to 3, 9, 44 and 385; No. 44 to 2, 5 and 385; No. 385 to 2.</p> <p><b>Cornering Lamp:</b> Closed No. 15 to 380. Open No. 15 to 379; No. 379 to 380.</p> <p><b>Turn Signal:</b> Closed No. 511 to 9; No. 44 to 2 and 5 Open No. 511 to 2, 5, 44 and 385; No. 44 to 3, 9 and 385; No. 385 to 2.</p> <p><b>Cornering Lamp:</b> Closed No. 15 to 380. Open No. 15 to 379; No. 379 to 380</p>
<p><b>Hazard ON.</b></p> <p><b>Hazard OFF</b> and Turn Signal Lever, Right Turn.</p>	<p>Closed No. 385 to 2, 3, 5 and 9. Open No. 385 to 44, 379 and 380; No. 44 to 2, 3, 5, 9 and 511.</p> <p>Closed No. 511 to 9; No. 44 to 2 and 5; No. 15 to 379. Open No. 511 to 2, 5, 44 and 385; No. 44 to 3, 9, and 385; No. 385 to 2.</p>
<p><b>Headlamp Beam Switching;</b></p> <ul style="list-style-type: none"> <li>● Lever at <b>High beam:</b></li> <li>● Lever at <b>Low beam.</b></li> <li>● Lever at <b>FLASH-TO-PASS.</b></li> </ul>	<p>Closed No. 15 to 12. Open No. 15 to 13 and 196; No. 196 to 12.</p> <p>Closed No. 15 to 13. Open No. 15 to 12 and 196; No. 196 to 13.</p> <p>Closed No. 15 to 13; No. 196 to 12. Open No. 15 to 12 and 196.</p>
<p><b>Standard Wiper/Washer Switching;</b></p> <ul style="list-style-type: none"> <li>● Wash OFF.</li> <li>● Wash ON.</li> <li>● Wiper <b>ON</b> or OFF. Wash OFF.</li> <li>● Wiper <b>LO</b> or low speed. Wash OFF.</li> <li>● Wiper <b>HI</b> or high speed. Wash OFF.</li> </ul>	<p>Open No. 65 (i.e. Terminal No. 590/65) to 941.</p> <p>Closed No. 65 (i.e. Terminal No. 590/65) to 941.</p> <p>Closed No. 61 to 63 (i.e. Terminal No. 589/63); No. 56 to 28 (i.e. Terminal No. 993/28)</p> <p>Open No. 57 to 56 and 58; No. 65 (i.e. Terminal No. 590/65) to 61 and 941.</p> <p>Closed No. 57 to 56; No. 65 (i.e. Terminal No. 590/65) to 61. Open No. 57 to 58; No. 56 to 28 (i.e. Terminal no. 993/28); No. 61 to 63 (i.e. Terminal No. 589/63).</p> <p>Closed No. 57 to 58; No. 65 (i.e. Terminal No. 590/65) to 61. Open No. 57 to 56; No. 56 to 28 (i.e. Terminal No. 993/28); No. 61 to 63 (i.e. Terminal No. 589/63).</p>

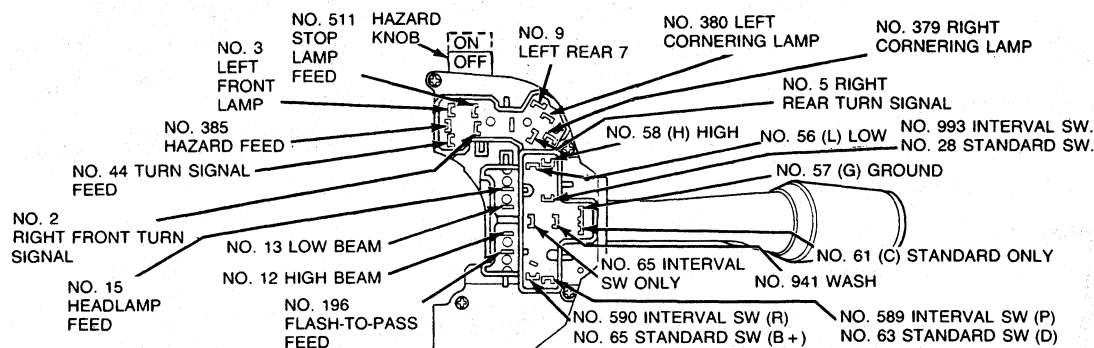
CK8772-B

## DIAGNOSIS AND TESTING (Continued)

## MULTIFUNCTION SWITCH — BENCH CHECK CONTINUITY — Continued

SWITCH ACTUATOR POSITION	CONTINUITY BY CIRCUIT NUMBER
<b>Interval Wiper/Washer Switching;</b> • Wash OFF.  • Wash ON.  • Wiper <b>ON</b> or OFF. Wash OFF.  • Wiper <b>LO</b> or low speed. Wash OFF  • Wiper <b>HI</b> or high speed.  • <b>Wiper Interval</b> at maximum knob travel or maximum time between wipe cycles. Wash <b>OFF</b> .	Open No. 65 to 941.  Closed No. 65 to 941.  Closed No. 56 to 993 (i.e. Terminal No. 993/28); No. 57 to 589 (i.e. Terminal No. 589/63). Open No. 57 to 56 and 58; No. 65 to 941. Resistance No. 57 to 590 (Terminal No. 590/65) greater than 420 ohms but less than 880 ohms  Closed No. 57 to 56 and 590 (Terminal No. 590/65). Open No. 57 to 58 and 589 (i.e. Terminal No. 589/63); No. 56 to 993 (i.e. Terminal No. 993/28); No. 65 to 941.  Closed No. 57 to 58 and 590 (Terminal No. 590/65). Open No. 57 to 56 and 589 (i.e. Terminal No. 589/63); No. 56 to 993 (i.e. Terminal No. 993/28); No. 65 to 941.  Closed No. 57 to 56. Open No. 57 to 58 and 589 i.e. Terminal No. 589/63; No. 56 to 993 (i.e. Terminal No. 993/28); No. 65 to 941. Resistance No. 57 to 590 (Terminal No. 590/65) greater than 7000 ohms but less than 13,000 ohms. <b>Note;</b> If knob is then rotated toward the OFF or minimum time between wipe cycles, then the resistance should decrease to less than 880 ohms but greater than 420 ohms.

CK8771-B



K8773-B

## SPECIAL SERVICE TOOLS

## ROTUNDA EQUIPMENT

Model	Description
007-00001	Digital Volt — Ohmmeter

CJ2820-B

# SECTION 32-60 Lamps, Interior

SUBJECT	PAGE	SUBJECT	PAGE
DESCRIPTION AND OPERATION .....	32-60-1	REMOVAL AND INSTALLATION (Cont'd.)	
REMOVAL AND INSTALLATION		Lamp Switch, Courtesy/Dome .....	32-60-2
Lamp, Dome .....	32-60-2	Lamp Switch, Glove Compartment .....	32-60-3
Lamp, Map .....	32-60-2	VEHICLE APPLICATION .....	32-60-1
Lamp, Transmission Control Selector .....	32-60-3		

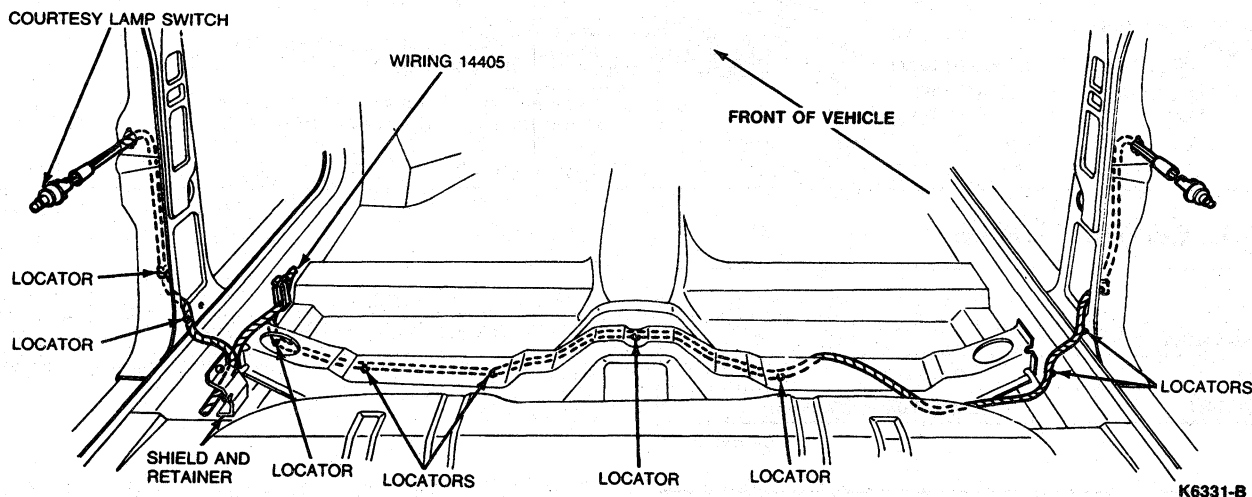
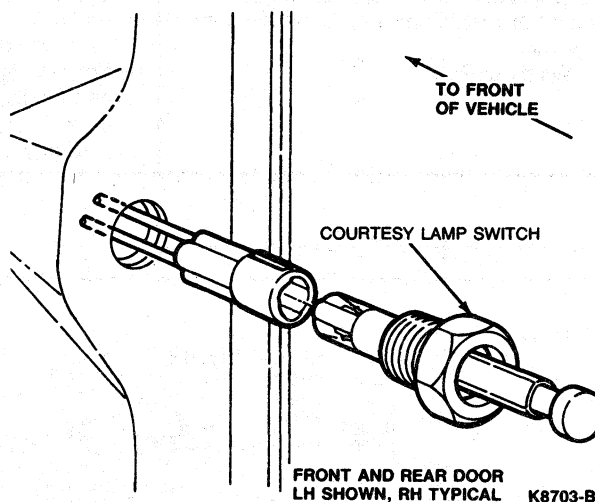
## VEHICLE APPLICATION

Taurus/Sable.

## DESCRIPTION AND OPERATION

Interior lamps include a PRNDL lamp and glove compartment lamp.

The dome lamp is located on the center roof support panel. It is illuminated by turning the thumbwheel rheostat to the detented UP position. It is also illuminated by switches located in the door pillars when any of the doors are opened. Refer to the following illustrations for switch locations.

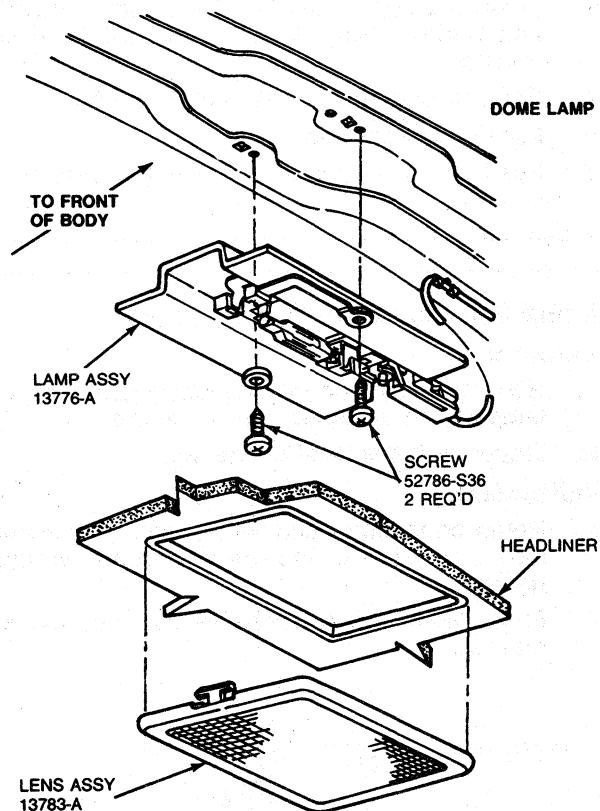




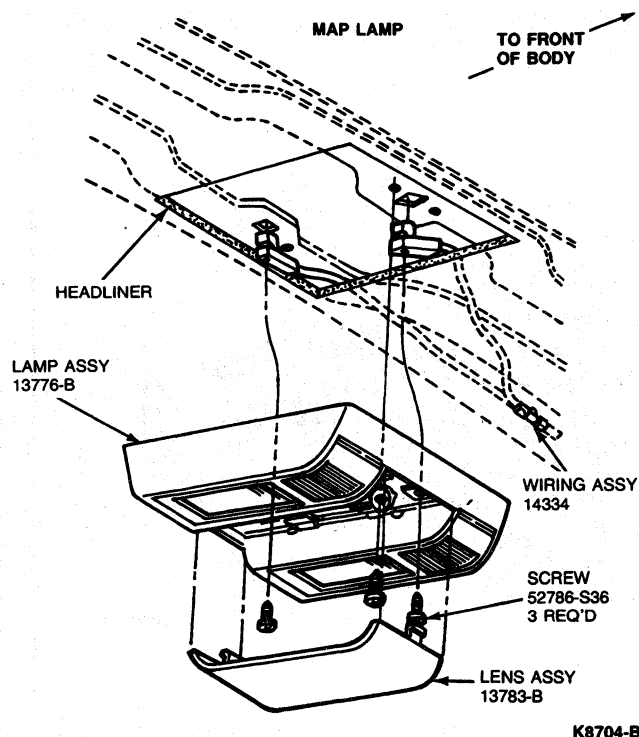
## REMOVAL AND INSTALLATION

**Lamp, Dome**

To replace bulb, carefully remove dome lamp lens from lamp housing. The entire lamp assembly may be removed by removing attaching screws.

**Lamp, Map**

Carefully remove center lens. Remove three screws and lower lamp. To remove map lamp bulbs, carefully pull bulb from lamp.

**Lamp Switch, Courtesy/Dome**

Refer to the illustrations under Description and Operation.

**CAUTION:** Retention of courtesy lamp switch to the wiring connector is by one of three tabs positioned 120 degrees apart on the switch. If, when the switch is disconnected from the wiring connector, the engaged locking tab breaks off, the switch must be rotated 120 degrees to engage a new tab. When all three tabs have been broken, replace the switch.

**Removal**

1. Disconnect battery ground cable.
2. Open door.

3. Using a deep well socket, remove switch from door pillar.

4. Disengage electrical connector.

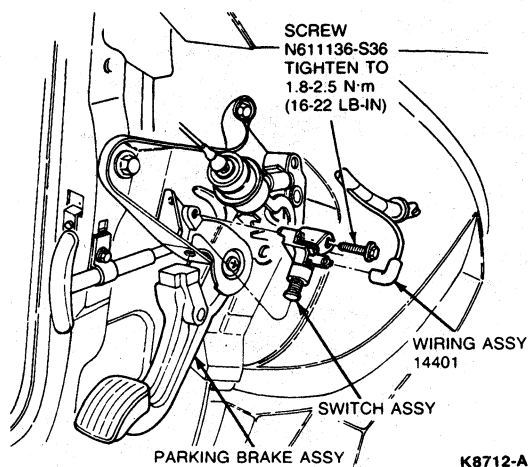
NOTE: Hold connector so it cannot slip back into A-pillar.

**Installation**

1. Engage electrical connector to switch and twist wiring and switch six turns counterclockwise.
2. Install switch in door pillar. Tighten to 14-19 N·m (10-14 lb-ft).
3. Connect battery ground cable.
4. Check operation of switch.

**REMOVAL AND INSTALLATION (Continued)****Lamp, Transmission Control Selector****Floor Mounted****Removal and Installation**

1. Remove four retaining screws from selector lever cover and dial indicator on floor.
2. Lift lever cover assembly and replace bulb.
3. Position cover to floor. Install four cover retaining screws.



K8712-A

**Console Mounted****Removal and Installation**

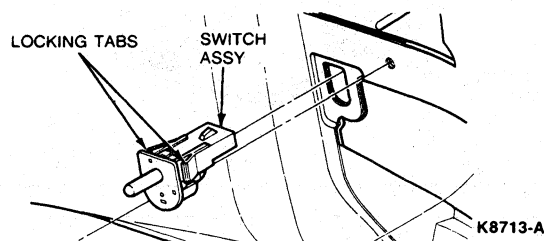
1. Remove finish panel from the console.
2. Remove quadrant bezel.
3. Position selector lever in first position (LOW) and remove lamp socket and bulb from its retainer.
4. Replace bulb and install socket in retainer.
5. Install quadrant bezel.
6. Position finish panel and install retaining screws.

**Lamp Switch, Glove Compartment****Removal**

1. Squeeze inward on switch locking tabs and pry lamp switch assembly out of vehicle.
2. Disconnect electrical connector.

**Installation**

1. Route connectors and wiring through bracket and connect to instrument panel wiring harness.
2. Press lamp switch assembly into position in bracket.



K8713-A

# SECTION 32-80 Illuminated Entry

SUBJECT	PAGE	SUBJECT	PAGE
DESCRIPTION .....	32-80-1	REMOVAL AND INSTALLATION .....	32-80-2
DIAGNOSIS AND TESTING		VEHICLE APPLICATION .....	32-80-1
Check-Out Procedure .....	32-80-3		
Quick Checks .....	32-80-3		

## VEHICLE APPLICATION

Taurus/Sable.

## DESCRIPTION

The illuminated entry system assists vehicle entry during the hours of darkness by illuminating the door lock cylinder, so it may be easily located for key insertion. The vehicle interior will also be illuminated by the courtesy lamps.

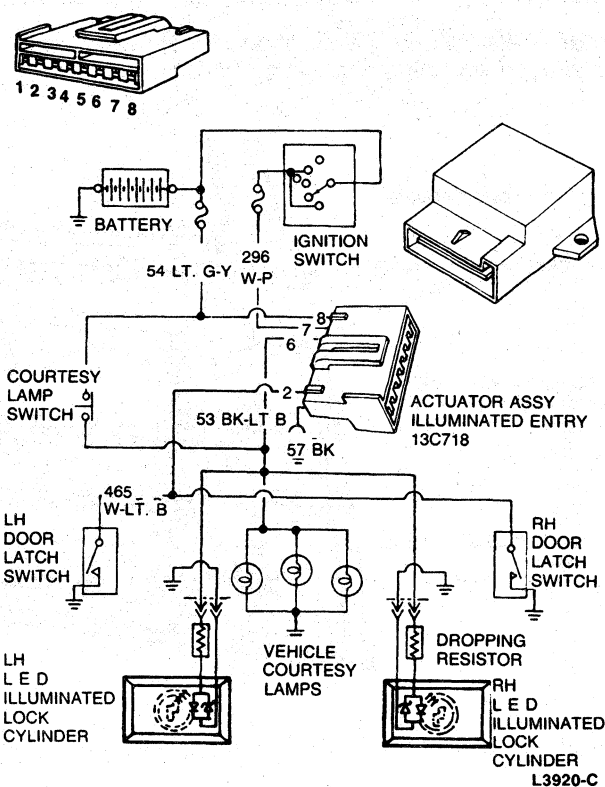
Activation of the system is accomplished by raising the outside door handle.

This action momentarily closes a switch mounted on the door latch mechanism, which completes the ground circuit of the electronic actuator module and switches the system on. The vehicle interior lamps turn on, and both front door lock cylinders are illuminated by a ring of light around the area where the key enters. This illumination will remain on for approximately 25 seconds, then automatically turn off. During this 25 second period, the system can be manually deactivated by turning the ignition switch to either RUN or ACC position.

The system will be activated every time the outside front door handles are operated, whether the vehicle is locked or not. Opening the doors from the inside of the vehicle will not activate the system.

If the outside door handle is held up indefinitely so that the latch switch is continuously closed, the system will operate as normal and turn off after 25 seconds. At the completion of this cycle, if the door handle is still in the raised position, the system will remain off, and it will be impossible to activate the system from the other front door handle until the raised handle is returned to its normal position. This function is built into the logic circuitry of the system to prevent battery discharge, should the outside door handle be intentionally propped up or become jammed in any way.

The system consists of four main components: electronic actuator module, illuminated door lock cylinder, door latch switch, and wiring harness.



The module is attached to the package tray on sedans and the LH quarter panel on wagons.

Housed within the module is a printed circuit board, the logic circuitry, and a relay to switch B+ to the various circuits. The normal operating voltage is 9 to 16 volts, but the unit will withstand voltage up to 24 volts for a period of 15 minutes. It cannot be damaged by reverse voltages and is unaffected by vehicle transients.

**DESCRIPTION (Continued)**

The rectangular door lock cylinder is unique to this system. A light-emitting diode (LED) provides the light source to a lens system built into the cylinder. Normal operating voltage for the LED is 3 volts. A resistor built into the harness protects the LED. It is important when checking the lock cylinder illumination that 12 volts is applied only to the connector terminals. If the resistor is bypassed and 12 volts is applied to the wires between the resistor and the lock cylinder by the use of needle-type probes, the LED will be instantly destroyed. Correct polarity must be observed by applying B+ to the red wire; otherwise the LED will not light. If leads are reversed, however, no damage will be done to the assembly.

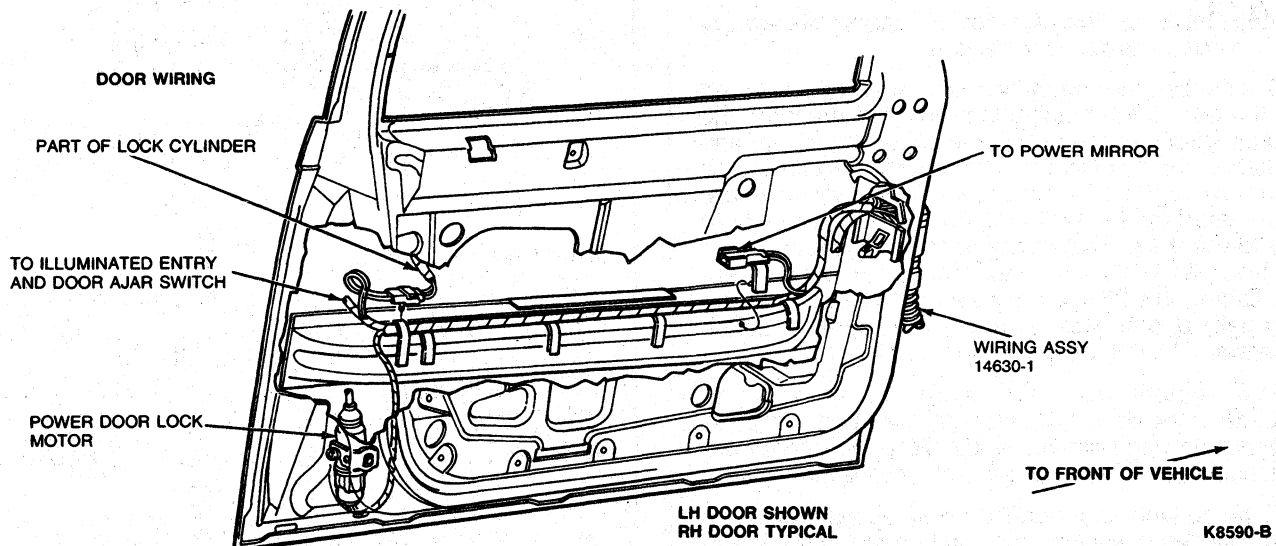
The lens system built into the cylinder is made of acrylic resin with a highly polished lustrous surface

and will retain its fine appearance if given proper care. A mild soap and water solution is all that is usually required to keep the lens in its original condition. Should the lens become contaminated with oil or grease, clean with approved solvents such as hexane, dry cleaning naphtha, kerosene or methanol. Since these solvents are flammable as well as toxic, use with adequate ventilation and away from open flames. Solvents such as benzene, gasoline, acetone, carbon tetrachloride or denatured alcohol should **never** be used, as they will soften and deteriorate the lens surface, causing a permanent loss in light output.

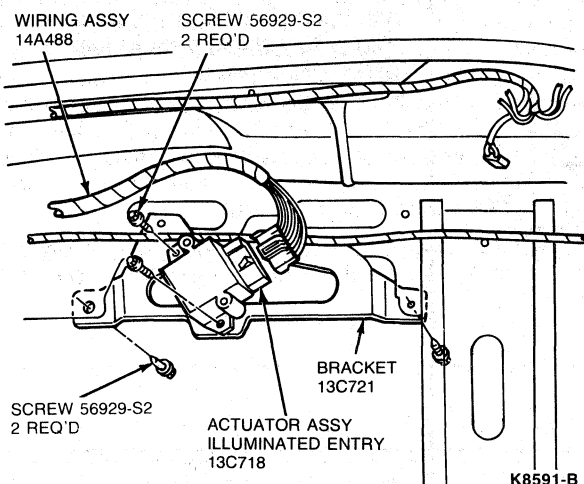
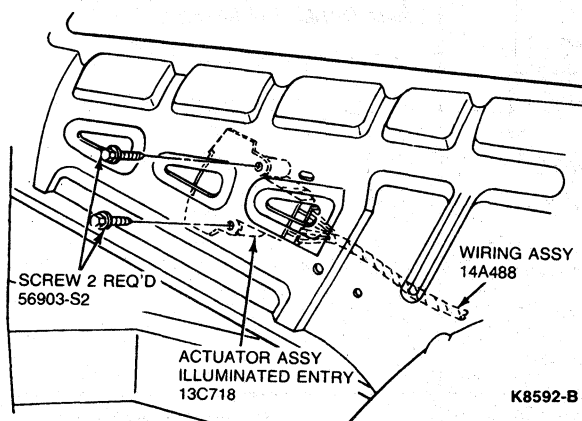
The latch switch is a grounding-type leaf switch and is attached to the latch mechanism by one screw.

**REMOVAL AND INSTALLATION**

Refer to the following illustrations for Removal and Installation and electrical disconnect points.



## REMOVAL AND INSTALLATION (Continued)

**Actuator Module****Sedan****Wagon**

## DIAGNOSIS AND TESTING

**NOTE:** Before performing diagnosis, verify that the system is malfunctioning. The illuminated entry module will not turn off the courtesy lamp if the lamp is turned on by the headlamp rheostat or if the door is open.

**Quick Checks**

1. Verify that courtesy lamp circuit is working properly. If not, check fuse.
2. With ignition switch in ACC or RUN position, verify that other systems which share same accessory fuse are functional. If not, check fuse.
3. If any above systems are not working properly, service inoperative circuit and check operation of illuminated entry system before proceeding with following complete check-out procedure.

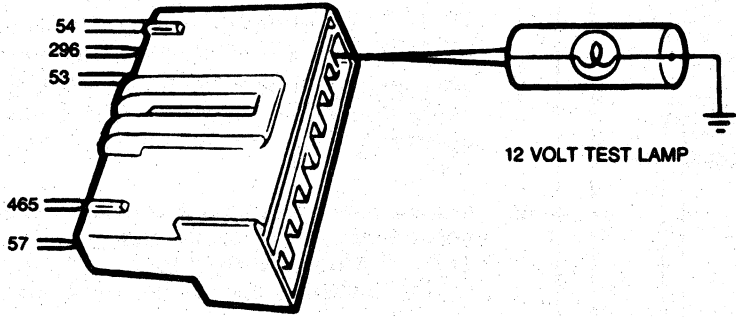
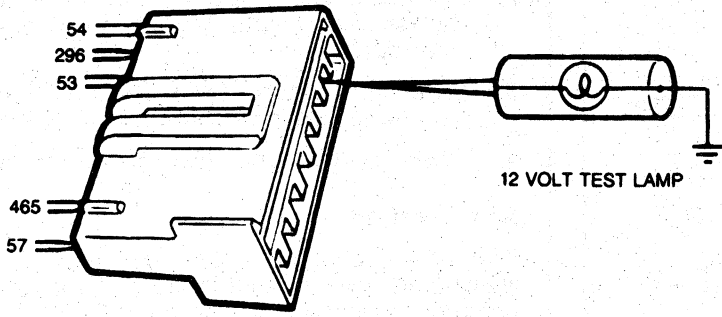
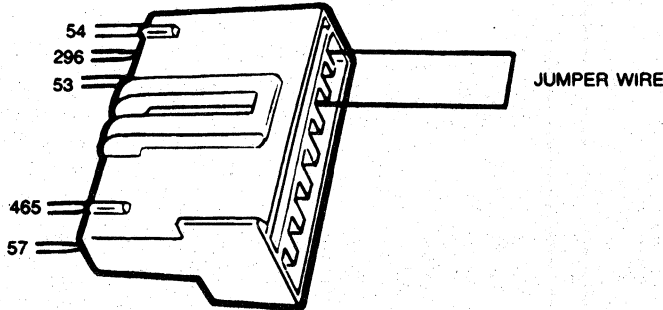
**Check-Out Procedure**

1. Terminal numbers referred to in the following procedure relate to wiring connector attached to illuminated entry actuator assembly. The terminals are numbered from left to right (when the connector is held as shown).
2. Any malfunctions diagnosed in Steps 4 and 5 in the following charts could be located in either front door.
3. When necessary to trace and/or service various circuits, refer to vehicle wiring diagrams.
4. Check system fuses (two) before proceeding.

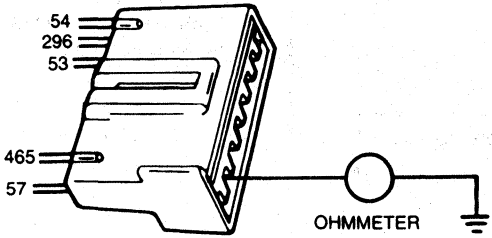
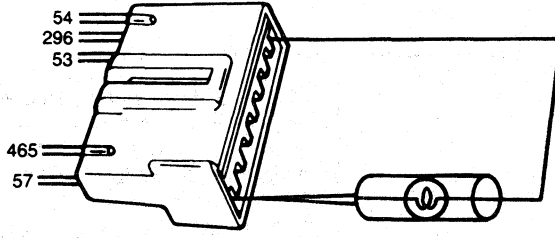
**After Testing**

If all of the following tests check out OK and the illuminated entry system is still malfunctioning, the actuator assembly is the cause of the problem and must be replaced.

## DIAGNOSIS AND TESTING (Continued)

OPERATION	RESULT
<p><b>Step 1</b> — Connect a 12 volt test lamp between Terminal No. 8 and a good ground.</p> 	<p>Whether ignition is ON or OFF, the test lamp should glow. If not, trace circuit 54 (light green with yellow stripe) back to fuse panel and service.</p>
<p><b>Step 2</b> — Connect a 12 volt test lamp between Terminal No. 7 and a good ground.</p> 	<p>The test lamp should glow when the ignition switch is in ACC or RUN and go out when the switch is turned to OFF or LOCK. If not, trace circuit 296 (white with purple stripe) back to fuse panel and service.</p>
<p><b>Step 3</b> — Connect a jumper wire between Terminals No. 6 and 8.</p> 	<p>With vehicle doors closed, interior courtesy and door lock cylinder lamps should be ON. If not, trace circuit 53 (black with light blue stripe) and service.</p>

## DIAGNOSIS AND TESTING (Continued)

OPERATION	RESULT
<p><b>Step 4</b> — Connect an ohmmeter between Terminal No. 2 and a good ground.</p>  <p>OHMMETER</p>	<p>The ohmmeter should show over 10,000 ohms (open). Then, operate each outside door handle in turn, ohmmeter should show not more than 50 ohms (closed). If either readings are incorrect, then trace circuit 465 (white with light blue stripe) back to latch switches and service. <b>Note: When operating door handle, hold in raised position.</b></p>
<p><b>Step 5</b> — Connect a 12 volt test lamp between Terminal No. 1 and Terminal No. 8</p>  <p>12 VOLT TEST LAMP</p>	<p>The test lamp should glow. If not, trace circuit 57 (black) back to ground and service.</p>

CK9613-A





# INSTRUMENTS, CLUSTERS, CONTROLS AND WARNING SYSTEMS

## GROUP 33 (10000 & 19000)

SECTION TITLE	PAGE	SECTION TITLE	PAGE
CHARGE INDICATOR—LAMP .....	33-30-1	INSTRUMENT CLUSTER—ELECTRONIC .....	33-05-1
CLOCK .....	33-15-1	OIL PRESSURE INDICATOR—LAMP .....	33-34-1
FUEL INDICATING SYSTEM—		SPEEDOMETER—MECHANICAL .....	33-10-1
CONVENTIONAL .....	33-20-1	TACHOMETER .....	33-11-1
INSTRUMENT CLUSTER—CONVENTIONAL .....	33-01-1	WARNING INDICATOR—LOW OIL LEVEL .....	33-40-1

## SECTION 33-01 Instrument Cluster—Conventional

SUBJECT	PAGE	SUBJECT	PAGE
DESCRIPTION		REMOVAL AND INSTALLATION (Cont'd.)	
Instrument Cluster .....	33-01-1	Illumination Bulb .....	33-01-5
Magnetic Gauges .....	33-01-2	Instrument Cluster .....	33-01-4
DIAGNOSIS .....	33-01-8	Speedometer/Odometer .....	33-01-6
REMOVAL AND INSTALLATION		SPECIAL SERVICE TOOLS .....	33-01-11
Electronic Low Fuel Warning Assembly .....	33-01-7	SPECIFICATIONS .....	33-01-11
Flexible Printed Circuit .....	33-01-7	VEHICLE APPLICATION .....	33-01-1
Gauges and Tachometer .....	33-01-6		

### VEHICLE APPLICATION

Taurus/Sable.

### DESCRIPTION

#### Instrument Cluster

##### Taurus

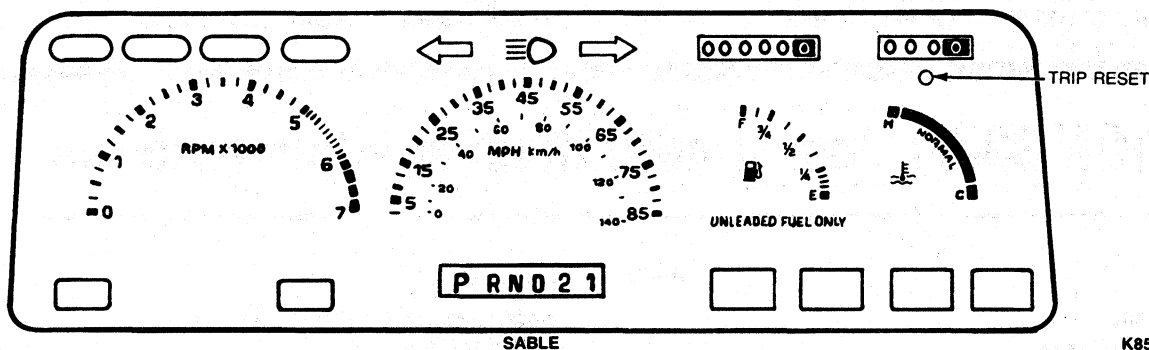
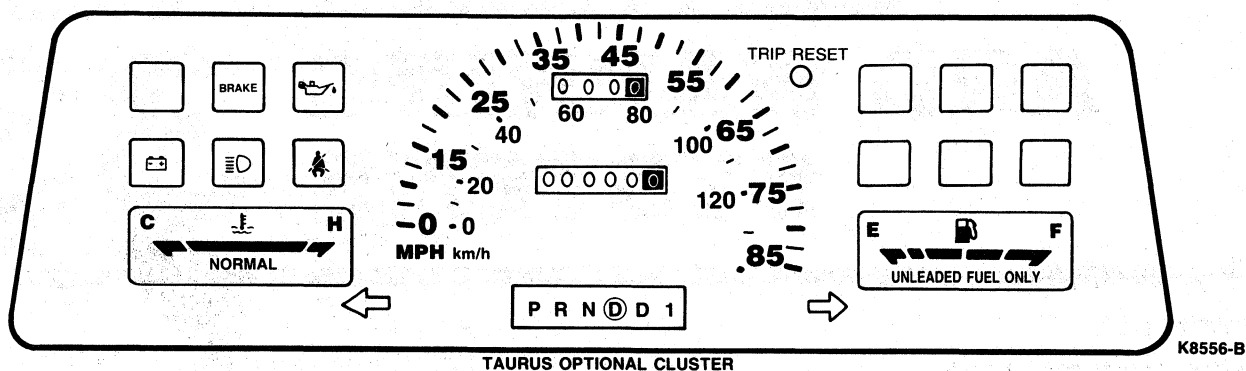
The standard instrument cluster contains a speedometer, a fuel gauge, a temperature gauge and tachometer (with manual transmission). It also contains high beam, fasten seat belts, brake, door

ajar, charge and oil pressure warning indicators. An optional cluster is also available with a trip odometer. There is also another cluster available with a trip odometer and diagnostic warning lamps.

## DESCRIPTION (Continued)

**Sable**

The instrument cluster contains a speedometer with trip odometer, fuel gauge, temperature gauge and tachometer. The cluster also contains a high beam, turn signals, fasten seat belts, brake, oil pressure, up-shift, lift gate ajar, and charge warning indicators. An optional cluster with diagnostic warning lamps is also available.



The cluster is designed to allow the removal and installation of all gauges and illumination bulbs without the need for removing the entire instrument cluster. However, the printed circuit and the Low Fuel Warning module require cluster removal.

NOTE: An optional electronic instrument cluster is available. Refer to Section 33-05.

**Magnetic Gauges****Fuel and Temperature**

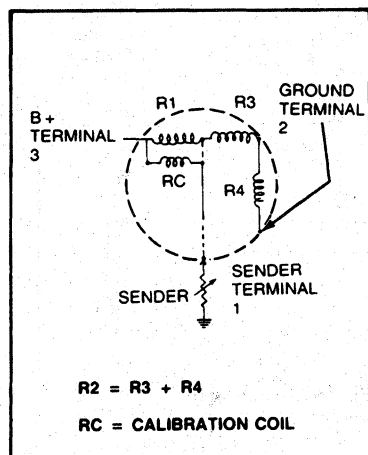
The magnetic gauge movement consists of three primary coils, one of which is wound at a 90 degree angle to the other two. The coils form a magnetic field which varies in direction according to the variable resistance of the sender unit which is connected between two of them. A primary magnet, to which a shaft and pointer are attached, rotates to

align to this primary field, resulting in pointer position. The bobbin/coil assembly is pressed into a metal housing which has two holes for dial mounting. There is no adjustment, calibration or maintenance required for these gauges.

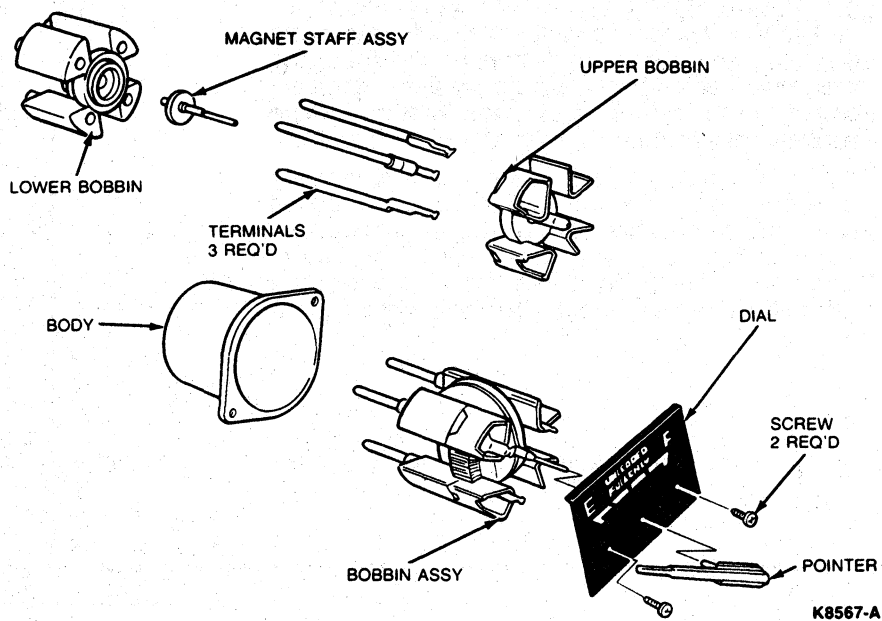
NOTE: An instrument voltage regulator (IVR) is not required for this system.

## DESCRIPTION (Continued)

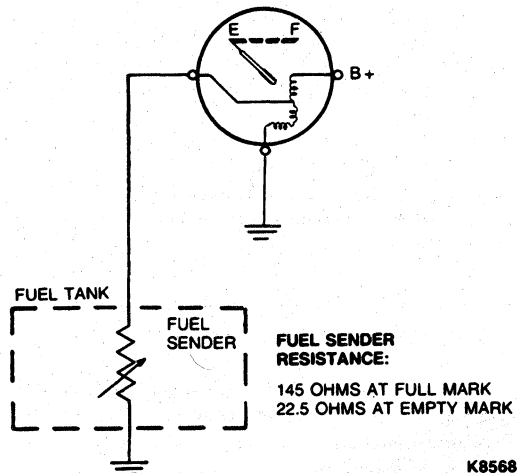
## Magnetic Gauge Exploded View



SCHEMATIC DIAGRAM



## Fuel Indicating System



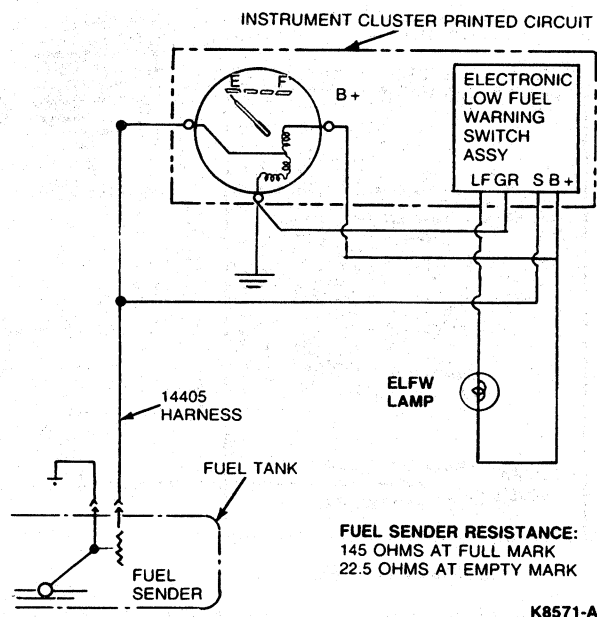
K8568-A

## DESCRIPTION (Continued)

**Electronic Low Fuel Warning Assembly**

The magnetic fuel gauge system uses an Electronic Low Fuel Level Warning Switch (ELFW) assembly. The ELFW assembly is solid state and requires no adjustment or calibration. It mounts directly to the instrument cluster backplate and makes electrical contact to the printed circuit pads through flexible terminals that scratch through any oxide buildup.

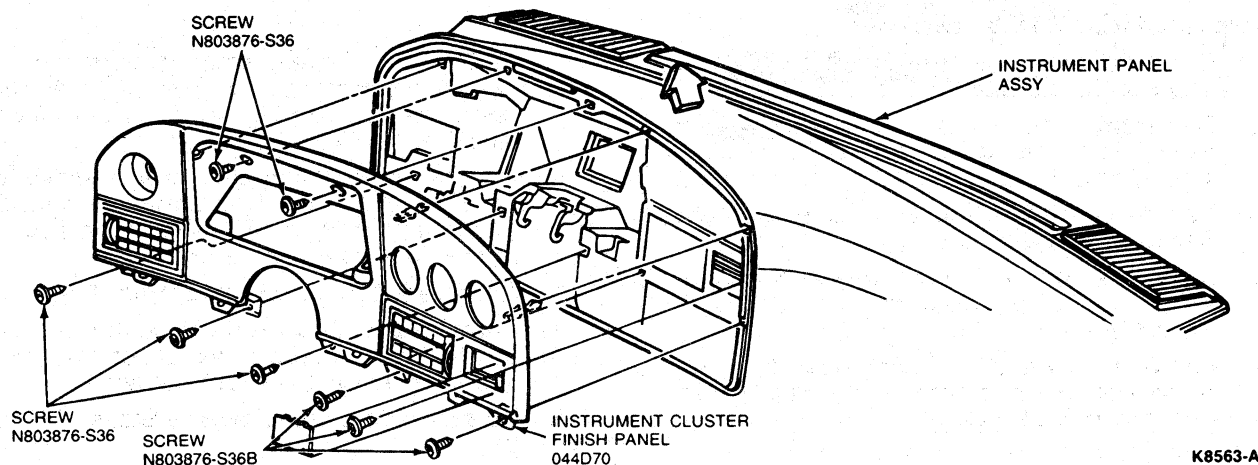
The ELFW is set to switch the low fuel warning indicator on when the fuel level in the tank reaches about one-eighth full. It contains a one-minute electronic filter to prevent erratic switching due to fuel movement in the tank. The filter also prevents a momentary lamp prove-out after initial engine start-up.

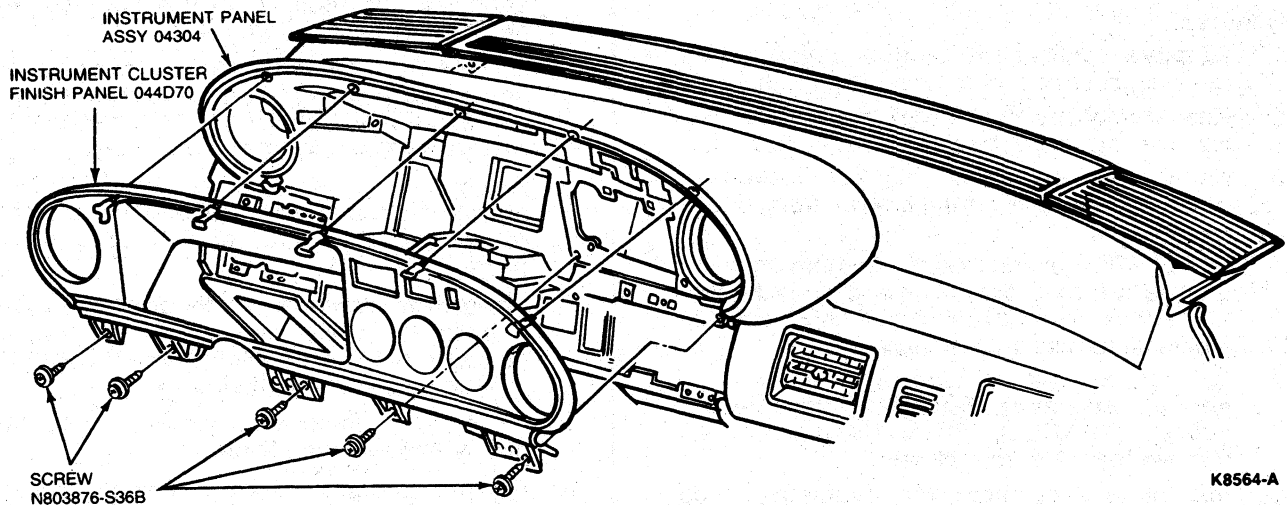
**Fuel Indicating System with ELFW**

## REMOVAL AND INSTALLATION

**Instrument Cluster****Removal and Installation**

1. Disconnect battery ground cable.
2. Remove ignition lock cylinder assembly, (refer to Section 13-04) to permit removal of steering column shrouds.
3. Remove steering column trim shrouds.

**Taurus**

**REMOVAL AND INSTALLATION (Continued)****Sable**

4. Remove screws retaining lower LH and radio finish panels (one screw each) and remove panels by snapping out.
5. On Taurus vehicles only, remove clock assembly (or clock cover), to gain access to finish panel screw behind clock. Refer to Section 33-15.
6. Remove seven cluster opening finish panel retaining screws, and one jamnut behind headlamp switch. Remove finish panel by rocking upper edge toward driver.
7. On column shift vehicles only, disconnect transmission selector indicator (PRNDL or PRNⓈD1) cable from column (one screw).
8. Disconnect speedometer cable at transaxle.
9. Remove four screws retaining cluster to instrument panel and pull cluster assembly forward.
10. Disconnect cluster electrical connector and speedometer cable. Press cable latch to disengage cable from speedometer head, while pulling cable away from cluster. Remove cluster.
11. To install, reverse Steps 1 through 10.

**Illumination Bulb****Removal and Installation**

1. Remove instrument cluster finish panel retaining screws and remove finish panel.
2. On Sable vehicles with tachometer cluster, remove lower trim panel attaching screws and remove trim panel.
3. Remove eight mask-and-lens mounting screws. Remove mask and lens.
4. On Sable vehicles with tachometer cluster, remove two lower floodlamp bulb and socket assemblies.
5. Remove entire main dial assembly from instrument cluster by carefully pulling it away from cluster backplate.

**NOTE:** The speedometer, tachometer and gauges are mounted to main dial, and some effort may be required to pull quick-connect electrical terminals from clips.

6. On column shift vehicles only, remove two screws attaching transmission selector indicator (PRNDL or PRN D D1) to main dial and remove indicator from cluster.
7. Remove bulb from socket and install new bulb.
8. Install main dial assembly to cluster backplate by aligning it on guides, then pressing carefully and firmly to seat all electrical terminals.
9. To assemble cluster, reverse Steps 1 through 8.

**REMOVAL AND INSTALLATION (Continued)****Speedometer/Odometer****Taurus****Removal**

1. Remove instrument cluster finish panel retaining screws and remove finish panel.
2. Remove eight mask-and-lens mounting screws. Remove mask and lens.
3. Remove entire dial assembly from instrument cluster by carefully pulling it away from cluster backplate.

NOTE: The speedometer, tachometer and gauges are mounted to main dial, and some effort may be required to pull quick-connect electrical terminals from clips.

4. On column shift vehicles only, remove two screws attaching transmission selector indicator (PRNDL or PRN D D1) to main dial and remove indicator from cluster.
5. Pull reset knob from trip odometer, if so equipped.
6. To remove speedometer/odometer from main dial, manually rotate speedometer pointer to align it with slot in dial. Remove mounting screws and carefully pull speedometer away from dial, guiding pointer through slot.

**Installation**

1. Carefully position pointer parallel to rectangular raised portion of speedometer dial.

**CAUTION: The speedometer is calibrated at the factory. Excessively rough handling could disturb the calibration.**

2. Guide the pointer carefully through slot in main dial. Rest speedometer on mounting bosses and install mounting screws. Tighten screws to 0.8-1.4 N·m (7-12 lb-in).
3. Attach trip odometer reset knob, if so equipped.
4. On column shift vehicles, install transmission selector indicator.
5. Install main dial assembly to cluster backplate by aligning it on guides, then pressing carefully and firmly to seat all electrical terminals.
6. Position mask-and-lens assembly. Install eight mask-and-lens attaching screws.
7. Install instrument cluster finish panel.

NOTE: The speedometer, tachometer and gauges are mounted to main dial, and some effort may be required to pull quick-connect electrical terminals from clips.

6. On column shift vehicles only, remove two screws attaching transmission selector indicator (PRNDL or PRN D D1) to main dial and remove indicator from cluster.
7. Remove odometer drive jack shaft. Remove attachment clip at odometer and slip jack shaft out of odometer bracket and speedometer bridge.
8. Manually rotate speedometer pointer to align it with slot in dial. Remove mounting screws and carefully pull speedometer away from dial, guiding pointer through slot.
9. To remove odometer assembly, if necessary, pull reset knob from lever.
10. Remove odometer drive jack shaft. Remove attachment clip at odometer and slip jack shaft out of odometer bracket and speedometer bridge.

**Installation**

1. Position odometer on mounting bosses and install mounting screws. Tighten screws to 0.8-1.4 N·m (7-12 lb-in).
2. Install trip odometer reset knob.
3. Carefully position speedometer pointer parallel to rectangular raised portion of speedometer dial.

**CAUTION: The speedometer is calibrated at the factory. Excessively rough handling could disturb the calibration.**

4. Guide the pointer carefully through slot in main dial. Position speedometer on mounting bosses and install mounting screws. Tighten screws to 0.8-1.4 N·m (7-12 lb-in).
5. On column shift vehicles, install transmission selector indicator.
6. Install main dial assembly to cluster backplate by aligning it on guides then pressing carefully and firmly to seat all electrical terminals.
7. Position mask-and-lens assembly. Install eight mask-and-lens attaching screws.
8. Install instrument cluster finish panel.

**Sable****Removal**

1. Remove instrument cluster finish panel retaining screws and remove finish panel.
2. Remove lower trim panel attaching screws. Remove trim panel.
3. Remove eight mask-and-lens mounting screws. Remove mask and lens.
4. Remove two lower floodlamp bulb and socket assemblies.
5. Remove entire main dial assembly from instrument cluster by carefully pulling it away from cluster backplate.

**Gauges and Tachometer****Removal**

1. Remove instrument cluster finish panel retaining screws and remove finish panel.
2. On Sable vehicles with tachometer cluster, remove lower trim panel attaching screws and remove trim panel.
3. Remove eight mask-and-lens mounting screws. Remove mask and lens.

**REMOVAL AND INSTALLATION (Continued)**

4. On Sable vehicles with tachometer cluster, remove two lower floodlamp bulb and socket assemblies.
5. Remove entire main dial assembly from instrument cluster by carefully pulling it away from cluster backplate.

NOTE: The speedometer, tachometer and gauges are mounted to main dial, and some effort may be required to pull quick-connect electrical terminals from clips.

6. On column shift vehicles only, remove two screws attaching transmission selector indicator (PRNDL or PRN D D1) to main dial and remove indicator from cluster.
7. Manually rotate pointer to align it with slot in dial. Remove mounting screws and carefully pull gauge or tachometer away from dial, guiding pointer through slot.

**Installation**

1. Carefully position pointer parallel to rectangular raised portion of speedometer dial.  
**CAUTION: The tachometer and gauges are calibrated at the factory. Excessively rough handling could disturb the calibration.**
2. Guide the pointer carefully through slot in main dial. Position tachometer or gauge on mounting bosses and install mounting screws. Tighten screws to 0.8-1.4 N·m (7-12 lb-in).
3. On column shift vehicles, install transmission selector indicator.
4. Install main dial assembly to cluster backplate by aligning it on guides, then pressing carefully and firmly to seat all electrical terminals.
5. On Sable vehicles with tachometer cluster, install two lower floodlamp bulb and socket assemblies.
6. Position mask-and-lens assembly. Install eight mask-and-lens attaching screws.
7. On Sable vehicles with tachometer cluster, install lower trim panel.
8. Install instrument cluster finish panel.

**Electronic Low Fuel Warning Assembly****Removal and Installation**

1. Remove instrument cluster as outlined.
2. Remove screw attaching assembly to cluster and remove assembly.
3. Position assembly on cluster and install attaching screw. Tighten screws to 0.8-1.4 N·m (7-12 lb-in).
4. Install instrument cluster as outlined.

**Flexible Printed Circuit****Removal**

1. Remove instrument cluster as outlined.
2. Remove low fuel warning assembly as outlined.
3. Remove all bulb and socket assemblies by twisting counterclockwise.
4. Remove instrument dial assembly from backplate. Refer to Instrument Cluster, Removal and Installation.
5. Remove clips using long nose pliers. Squeeze both ends of clip equally so that locking ears will slide through clip opening in backplate. Push clip through opening.  
**CAUTION: Do not overbend clips as they may break.**
6. After all clips are removed, printed circuit can be removed.

**Installation**

1. Position printed circuit on backplate and install clips by bending tabs on clips with fingers. Push clip into clip opening until locking ears are locked into backplate.  
**NOTE: An audible click will be heard when clips are locked into position.**
2. Install all bulb and socket assemblies into backplate by twisting clockwise.
3. Install low fuel warning assembly as outlined.
4. Install instrument cluster as outlined.

## DIAGNOSIS

Refer to the following charts for magnetic gauge diagnosis.

## FUEL GAUGE INOPERATIVE — POINTER DOES NOT MOVE — PINPOINT TEST A

TEST STEP		RESULT	ACTION TO TAKE
<b>A1</b>	VERIFY CONDITION		
	<ul style="list-style-type: none"> <li>Verify condition.</li> </ul>	Gauge pointer does not move Gauge pointer moves	GO to <b>A2</b> . GO to <b>B1</b> .
<b>A2</b>	CHECK OTHER GAUGES		
	<ul style="list-style-type: none"> <li>Check power to cluster. With ignition on, observe other gauges and warning lamps for proper operation. If necessary, use voltmeter or test lamp to verify voltage at B+ terminal of cluster connector.</li> </ul>	Other gauges and warning lamps operate properly; voltage present at cluster Other gauges and warning lamps do not operate properly; no voltage present at cluster	GO to <b>B1</b> . REPAIR power to cluster.

CK8572-A

## FUEL GAUGE INACCURATE — PINPOINT TEST B

TEST STEP		RESULT	ACTION TO TAKE
<b>B1</b>	TEST BOX CHECK		
	<ul style="list-style-type: none"> <li>Insert Instrument Gauge System Tester, Rotunda 021-00038 in sender circuit. Disconnect Circuit 14405 connector under instrument panel and connect tester to cluster side of connector. Set tester to LOW (22 ohms).</li> </ul>	Gauge reads E Pointer does not move	GO to <b>B2</b> . REPLACE gauge.
<b>B2</b>	TEST BOX CHECK		
	<ul style="list-style-type: none"> <li>Set tester to HIGH (145 ohms).</li> </ul>	Gauge reads F Gauge does not read F	GO to <b>B3</b> . REPLACE gauge.
<b>B3</b>	CHECK SENDER WIRING		
	<ul style="list-style-type: none"> <li>Check sender circuit wiring for shorts or open with ohmmeter.</li> </ul>	(OK) (X)	REPLACE sender. SERVICE wiring.

CK8573-B



## DIAGNOSIS (Continued)

**MAGNETIC TEMP/OIL GAUGE INOPERATIVE — POINTER DOES NOT MOVE  
PINPOINT TEST C**

TEST STEP		RESULT	ACTION TO TAKE
<b>C1</b>	<b>VERIFY CONDITION</b>		
<ul style="list-style-type: none"> <li>Verify Condition.</li> </ul>		Gauge pointer does not move	GO to <b>C2</b> .
		Gauge pointer moves	GO to <b>D1</b> .
<b>C2</b>	<b>CHECK OTHER GAUGES</b>		
<ul style="list-style-type: none"> <li>Check power to cluster. With ignition on, observe other gauges and warning lamps for proper operation. If necessary, use voltmeter or test lamp to verify voltage at B+ terminal of cluster connector.</li> </ul>		Other gauges and warning lamps operate correctly; voltage present at cluster	GO to <b>D1</b> .
		Other gauges and warning lamps do not operate correctly; no voltage present at cluster	SERVICE power to cluster.

CK8574-B

**TEMP/OIL GAUGE INACCURATE  
PINPOINT TEST D**

TEST STEP		RESULT	ACTION TO TAKE
<b>D1</b>	<b>TEST BOX CHECK</b>		
<ul style="list-style-type: none"> <li>Insert Instrument Gauge, System Tester, Rotunda 021-00038 or equivalent in sender circuit. Disconnect connector at sender and connect tester to cluster side of connector. Set tester to LOW (73 ohms).</li> </ul>		Gauge reads C or L	GO to <b>D2</b> .
		Pointer does not move	GO to <b>D3</b> .
<b>D2</b>	<b>TEST BOX CHECK</b>		
<ul style="list-style-type: none"> <li>Set tester to HIGH (10 ohms).</li> </ul>		Gauge reads H	REPLACE sender.
		Gauge does not read H	GO to <b>D3</b> .
<b>D3</b>	<b>CHECK SENDER WIRING</b>		
<ul style="list-style-type: none"> <li>Check sender circuit wiring for shorts or open with ohmmeter, using Rotunda Digital Volt-Ohmmeter, or equivalent.</li> </ul>		<div style="display: flex; align-items: center;"> <div style="border: 1px solid black; border-radius: 50%; padding: 2px 5px; margin-right: 5px;">OK</div> <div style="font-size: 2em;">▶</div> </div>	REPLACE gauge.
		<div style="display: flex; align-items: center;"> <div style="border: 1px solid black; border-radius: 50%; padding: 2px 5px; margin-right: 5px;"><del>OK</del></div> <div style="font-size: 2em;">▶</div> </div>	SERVICE wiring.

CK8575-B

## DIAGNOSIS (Continued)

**INDICATOR LAMP STAYS ON CONTINUALLY — MORE THAN 1/4 TANK OF FUEL  
PINPOINT TEST E**

TEST STEP		RESULT	ACTION TO TAKE
<b>E1</b>	VERIFY CONDITION		
	<ul style="list-style-type: none"> <li>Verify Condition.</li> </ul>	Indicator lamp stays on with more than 1/4 tank of fuel	GO to <b>E2</b> .
<b>E2</b>	CHECK LAMP		
	<ul style="list-style-type: none"> <li>Disconnect Circuit 14405 connector under instrument panel and connect a 33 ohm resistor between fuel sender feed to gauge and ground.</li> </ul>	Indicator lamp ON. Gauge pointer should indicate approximately 1/16 tank	GO to <b>E3</b> .
		Indicator lamp OFF	REPLACE ELFW module at instrument cluster.
<b>E3</b>	REPLACE RESISTOR		
	<ul style="list-style-type: none"> <li>Replace the resistor from Test E2 with a 56 ohm resistor.</li> </ul>	With ignition switch in ON/ACC, indicator lamp is off. Gauge pointer should indicate approximately 1/4 tank	
		Indicator lamp on	REPLACE ELFW module at instrument cluster.

CK8576-A

**INDICATOR LAMP STAYS OFF CONTINUALLY  
PINPOINT TEST F**

TEST STEP		RESULT	ACTION TO TAKE
<b>F1</b>	VERIFY CONDITION		
	<ul style="list-style-type: none"> <li>Verify Condition.</li> </ul>	Indicator lamp stays off	GO to <b>F2</b> .
<b>F2</b>	CHECK INDICATOR LAMP		
	<ul style="list-style-type: none"> <li>With ignition switch in the ON/ACC position, ground lamp circuit between lamp and Low Fuel Module.</li> </ul>	Indicator lamp on	GO to <b>E2</b> .
		Indicator lamp off	CHECK power circuit to lamp. REPLACE lamp.

CK8577-A

## SPECIFICATIONS

## GAUGES

Size (Less Terminals)	29mm Diameter x 25mm Length (1.14 in. Diameter x 1 in. Length)
Weight (Less Dial and Pointer)	40 Grams (1.4 Ounces)
Mounting	Flange on Steel Body
Operating Temperature	-30°C to 80°C (-22°F to 176°F)
Pointer Travel	85° (Fuel)
	90° (Temp. and Oil)
Electrical Connection	Three Pin Terminals
Operating Voltage	11-16 VDC

CK8578-B

## SPECIAL SERVICE TOOLS

## ROTUNDA EQUIPMENT

Model	Description
021-00038	Instrument Gauge System Tester

CK9685-A

# SECTION 33-05 Instrument Cluster—Electronic

SUBJECT	PAGE	SUBJECT	PAGE
DESCRIPTION		OPERATION (Cont'd.)	
Switch Module .....	33-05-2	System Scanner .....	33-05-4
DIAGNOSIS .....	33-05-6	Tachometer, Bargraph .....	33-05-3
OPERATION		REMOVAL AND INSTALLATION	
Digital Odometer .....	33-05-2	Cluster Assembly .....	33-05-5
Digital Speedometer .....	33-05-2	Fuel Computer Module .....	33-05-5
Fuel Computer .....	33-05-3	Gauges—Fuel and Temperature .....	33-05-5
Fuel Computer/System Scanner Module		Speedometer Module .....	33-05-6
Operation .....	33-05-3	Switch Module .....	33-05-6
Service Interval Reminder .....	33-05-3	SPECIAL SERVICE TOOLS .....	33-05-45
Speed Alarm .....	33-05-3	SPECIFICATIONS .....	33-05-45
Speedometer/Odometer/Tachometer		VEHICLE APPLICATION .....	33-05-1
Module .....	33-05-2		

## VEHICLE APPLICATION

Taurus/Sable.

## DESCRIPTION

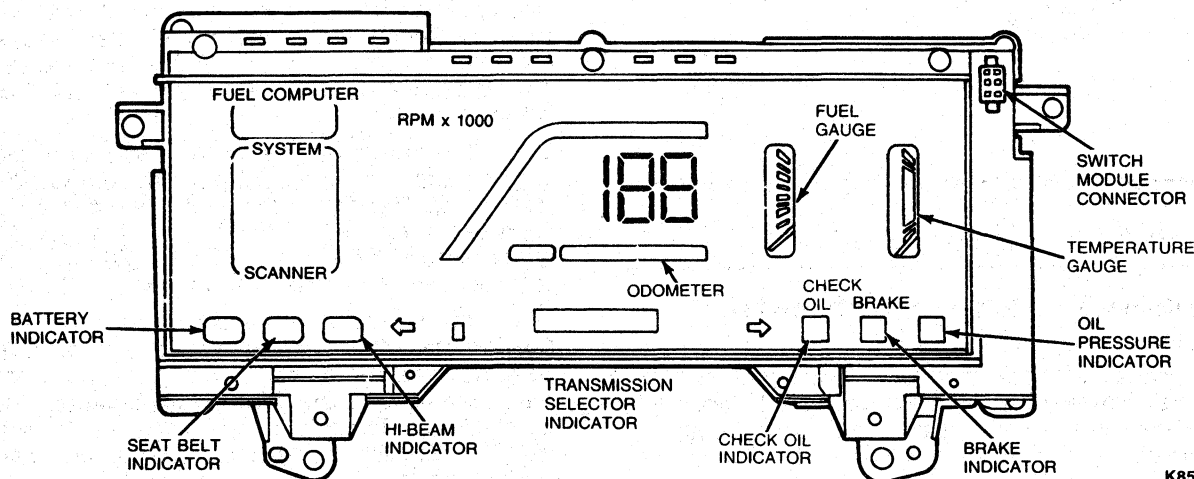
The all electronic instrument cluster consists of two electronic modules, a speedometer/odometer/tachometer module, and a fuel computer/scanner module. It also includes magnetic fuel and temperature gauges and the following warning lamps:

- Battery.
- Seat Belt.
- Brake.
- High Beam.
- Oil Pressure.
- Turn Signals.

### • Check Oil.

The electronic cluster is operational only when the ignition is in the RUN position. The electronic LCD displays are illuminated from bulbs. When the headlamps are turned on, the LCD lamp bulbs are switched over to the dimming rheostat through a relay.

Each time the ignition is first turned from OFF to RUN position, the electronic displays of the modules will prove out by momentarily lighting all of the display segments and then momentarily turning all display segments off. After the prove out, the modules return to normal operation.



K8534-B

## DESCRIPTION (Continued)

**Switch Module**

The **MPH/kmh** button switches the display from English to metric (MPH to km/h) or metric to English.

The **SPEED ALARM** button sets or clears the speed alert system.

The **DTE BUTTON** displays distance to empty.

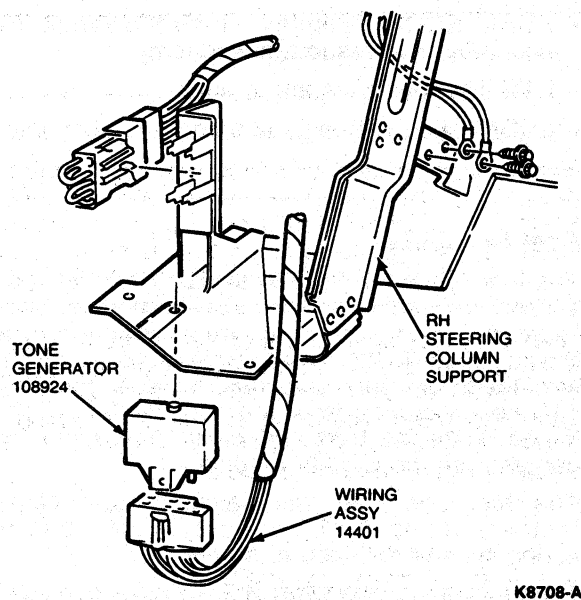
The **ODO SEL** button displays trip odometer, or the regular odometer.

The **TRIP RESET** button zeros out the trip odometer (when trip odometer is selected).

The **FUEL ECON** button displays instantaneous fuel economy or average fuel economy.

The **ECON RESET** button resets the average fuel economy (when average fuel economy is selected).

When a switch is pressed, a tone will sound to indicate that the switch has been recognized. Tones are sounded through a tone generator located on the RH steering column opening support.



K8708-A

- **MPH/km/h:** Displays in either English mode (MPH, MILES, MPG) or metric mode (km/h, km, L/100km). This switch controls both the speedometer module and the fuel computer module.
- **ODO SEL:** Displays trip odometer or regular odometer.
- **TRIP RESET:** Resets the trip odometer to zero, (when trip odometer is selected).
- **SPEED ALARM:** Sets or clears the speed alarm.

**Digital Speedometer**

The electronic speedometer gets a speed/distance signal from the cableless transmission-mounted speed sensor.

The speedometer portion of the display consists of 2-1/2 digits which indicate vehicle speed. The mode (English or metric) will also be indicated by displaying either the MPH or km/h legends. The display units (English or metric) will be consistent with the odometer and fuel computer, and will be the same at power up as they were at power down.

The maximum speed indicated will be limited to 136 km/h (85 mph). These readings will be displayed for all vehicle speeds exceeding 136 km/h (85 mph). It is normal for the speedometer to display consecutive numbers during slow acceleration or deceleration, and to skip consecutive numbers during quick starts and stops.

**Digital Odometer**

The digital odometer displays either miles or kilometers depending on the selection made with the **MPH/km/h** button. The total odometer or the trip odometer can be selected by activating the **ODO SEL** button, and the trip odometer can be reset by activating the **TRIP RESET** button while the trip odometer is being displayed. The display of the total odometer or the trip odometer, as well as the units (English or metric), will be the same at power up as at power down.

Accumulated mileage is stored in a non-volatile memory (NVM) every 16 Km (10 miles) and when the ignition switch is turned off. The NVM saves both the total odometer mileage as well as the trip odometer mileage.

When the total odometer is displayed it consists of 6-1/2 digits and a decimal point (leading zeros are displayed). The digit to the right of the decimal point represents tenths of a unit. The total odometer range is from 00000.0 to 199999.9. When 199999.9 is exceeded the display will roll over to 100000.0.

When the trip odometer is displayed, it consists of the legend **TRIP** five digits, and a decimal point (leading zeros are blanked). When the trip odometer has been reset using **TRIP RESET** button, 0.0 will be displayed. The trip odometer range is from 0.0 to 999.9 in English mode and from 0.0 to 1599.9 in metric mode. Regardless of which odometer is displayed (trip or total), the legend **km** will appear near the odometer when in metric mode.

## OPERATION

**Speedometer/Odometer/Tachometer Module**

The speedo/odo/tach module goes through prove out when powered up and then goes into normal operation, displaying speed and the regular odometer.

Four of the seven buttons on the switch module are used to operate speedometer functions. They are:

**OPERATION (Continued)**

**Service Alert:** If a condition exists where the speedo module cannot read a valid odometer memory value from the non-volatile memory, the words **ERROR** and **SERVICE** will be displayed.

**Replacement, Odometer/Service Speedo Module:** When the **S** is displayed it indicates that the odometer has been replaced. The **S** can only be displayed when a service speedo module, programmed to light the **S**, is installed. Previous accumulated mileage is recorded on a doorjamb sticker.

**Speed Alarm**

The speed alarm alerts the driver that he is going faster than the preset speed by blinking the word **SPEED** and giving three short audible beeps. The speed alarm can only be set when the vehicle speed is greater than 20 MPH in English mode, or 32 km/h in metric mode.

The speed alarm is set at the desired speed by driving 5 MPH below the desired speed (5 km/h in metric mode) and pressing the **SPEED ALARM** button. The word **SPEED** will appear to indicate that the alarm has been set. For example, to set the speed alarm at 55 MPH, drive 50 MPH and press the speed alarm button. When the vehicle speed is 55 MPH or faster the alarm will be given until the speed goes below 55 MPH.

The speed alarm can be cleared or turned off by again pressing the **SPEED ALARM** button. The word **SPEED** will disappear to show that the alarm is no longer set.

If a speed alarm is desired in metric (km/h), follow the same procedure in metric mode. When the English/metric mode changes after the alarm has been set, the alarm will be given at an equivalent speed in the new mode.

**Service Interval Reminder**

The service interval reminder alerts the driver of regular service interval time. The service reminder will light the word **SERVICE** on the display for a period of  $30 \pm 5$  seconds each time the vehicle is started or the module is powered up after achieving 11,520 km (7200 miles), to remind the driver that it is time for the regular service interval.

The reminder is reset for another interval by simultaneously pressing the **ODO SEL** button and the **TRIP RESET** button. The word **SERVICE** will disappear from the display and three short audible beeps will verify that the service reminder has been reset.

**Tachometer, Bargraph**

The tachometer gets its signal from the coil and displays engine rpm. The tachometer display consists of 36 bars and will indicate engine rpm from 0 to 7000 rpm. Engine rpm is indicated by the number of bars lit. Each bar represents 200 rpm.

For all engine speeds above 6600 rpm, the tach bargraph will indicate 7000 rpm.

A wire to the tachometer will indicate if it is a 6-cylinder or 4-cylinder engine.

**Fuel Computer/System Scanner Module Operation**

The fuel computer/system scanner module goes through prove out when powered up and then goes into normal mode by displaying distance to empty (DTE) and either the word **NORMAL** or an appropriate diagnostic message.

Three of the seven buttons on the switch module are used to operate the fuel computer functions. They are:

- **FUEL ECON:** Displays instantaneous fuel economy or average fuel economy.
- **DTE:** Displays distance to empty.
- **ECON RESET:** Resets average fuel economy.

**Fuel Computer**

The fuel computer takes in signals from the speed sensor, fuel sender and the EEC-IV module. Speed information comes from the transmission-mounted speed sensor to the speedometer module, which in turn feeds the fuel computer module. Fuel level information comes from the fuel sender which is located in the fuel tank, and the fuel flow information comes from the EEC-IV module.

The fuel computer will calculate and display instantaneous fuel economy, average fuel economy, and distance to empty.

The fuel computer portion of the display consists of three digits, a decimal point, and several legends (INST MPG, AVG MPG, MILES TO EMPTY, INST L/100 km, AVG L/100 km, and km TO EMPTY).

**Instantaneous Fuel Economy**

Instantaneous fuel economy is displayed by pressing the **FUEL ECON** button while displaying either distance to empty (DTE) or average fuel economy. The words **INST MPG** or **INST L/100 km** will be displayed to indicate the instantaneous fuel economy function has been selected. The range of fuel economy which can be displayed is from 0 to 99 MPG in English mode or 99 to 0 L/100 km in metric mode.

When the vehicle is not moving, instantaneous fuel economy will be displayed as 0 MPG or 99 L/100 km.

**OPERATION (Continued)****Average Fuel Economy**

Average fuel economy is displayed by pressing the **FUEL ECON** button while instantaneous fuel economy is being displayed. The words **AVG MPG** or **AVG L/100km** will be displayed to indicate the average fuel economy function has been selected. The range of fuel economy which can be displayed is from 0.0 to 99.9 MPG in English mode or 99.9 to 0 L/100 km in metric mode.

Average fuel economy can be reset by pressing the **ECON RESET** button while displaying average fuel economy.

Fuel economy, both average and instantaneous, are calculated using distance and fuel flow information.

**Distance to Empty**

**DTE** is displayed at ignition on, after the module goes through prove out, or by pressing the **DTE** button. The words **MILES TO EMPTY** or **km to EMPTY** will be displayed to indicate the **DTE** function has been selected. The range of **DTE** is from 0 to 999 miles or kilometers depending on mode.

**DTE** is calculated from the product of an internal fuel economy value and fuel level.

**Low DTE Alert**

When **DTE** is 80 km (50 miles) the fuel computer will override the current function and display a flashing numeric value of **DTE** for approximately five seconds. The display will continue to indicate **DTE** no longer flashing until another function is selected. This alert (flashing **DTE**) will reoccur at 40 km (25 miles) and at 16km (10 miles) to empty.

Low **DTE** alert (flashing **DTE**) is only active when **DTE** is less than or equal to 80 km (50 miles) to empty.

**System Scanner**

The system scanner takes in inputs from the lamp out module, washer fluid level, and door ajar sensors and displays the appropriate diagnostic message.

Based on the inputs from the various sensors, the system scanner will display the following messages:

- **NORMAL.**
- **DOOR AJAR.**
- **LIFT GATE AJAR.**
- **HEADLAMP OUT.**
- **TAIL LAMP OUT.**
- **BRAKELAMP OUT.**
- **WASHER LEVEL LOW.**

When a warning condition first occurs, the diagnostic message is displayed accompanied by a one-second tone. The message will remain on the display as long as it is active, but no further tones are issued.

If more than one warning condition occurs, one message will be displayed for approximately five seconds accompanied by a one-second tone, then the second message will be displayed for five seconds accompanied by a one-second tone, etc. Thereafter, the display will alternate between active warnings, but no further tones are issued.

On alternate level system scanners, if more than one warning condition occurs, each message will be displayed simultaneously. When the message first appears it will be accompanied by a one second tone.

**NORMAL**

If no system faults are present the display will indicate **NORMAL**.

**OIL LEVEL LOW**

Vehicles equipped with the electronic instrument cluster will have a **CHECK OIL** warning lamp at the lower RH side of the cluster in place of the **OIL LEVEL LOW** message.

**DOOR/LIFT GATE AJAR**

The door ajar signals come from switches located in the doorjamb. When any door or the lift gate is open, the appropriate wire to the system scanner will be grounded and the words **DOOR AJAR** or **LIFT GATE AJAR** will appear on the scanner display. The message will be cleared from the display when the warning condition is removed (the door is closed).

**HEAD/TAIL/BRAKELAMP OUT**

The signals which indicate headlamp out, tail lamp out, and brakelamp out all come from the lamp out module. Headlamp out and tail lamp out can only be sensed when the headlamp switch is in the ON position.

If one of the headlamps or tail lamps is out and the headlamp switch in ON, the appropriate wire to the system scanner will be grounded and the words **HEADLAMP OUT** or **TAIL LAMP OUT** will appear on the display. Once the message appears on the display it will remain on the display (possibly alternating with another warning) until the ignition switch is turned back off.

Brakelamp out can only be sensed when the brake pedal is depressed. If the brakelamp is out and the brake pedal is depressed, the brakelamp out wire to the system scanner will be grounded and the words **BRAKELAMP OUT** will appear on the display. Once the message appears on the display it will remain on the display (possibly alternating with another warning) until the ignition is switched back to the OFF position.

**OPERATION (Continued)****WASHER LEVEL LOW**

The low washer fluid level signal comes from a switch located in the washer fluid reservoir. When the washer fluid level is low and the washer/wiper switch is activated, the wire to the system scanner will be pulled high and the words **WASHER LEVEL LOW** will appear on the display. The message will leave the display approximately five seconds after the washer/wiper switch is deactivated.

**REMOVAL AND INSTALLATION****Cluster Assembly****Removal**

1. Disconnect battery ground cable.
2. Remove two lower trim covers.
3. Remove steering column cover and disconnect PRNDL cable from steering column.
4. Remove cluster trim panel. NOTE: Switch module must be disconnected from cluster to remove trim panel.
5. Remove four cluster mounting screws.
6. Pull bottom of cluster toward steering wheel.
7. Reaching behind and underneath cluster, disconnect three connectors.
8. Swing bottom of cluster out to clear top of cluster from crash pad and remove cluster.

**Installation**

1. Insert top of cluster under crash pad, leaving bottom out.
2. Connect three connectors.
3. Seat cluster and install four mounting screws.
4. Connect battery ground cable and check cluster operation.
5. Connect PRNDL. Check PRNDL dial alignment and adjust if necessary. Install steering column cover.
6. Connect switch module to cluster and install cluster trim panel.
7. Install two lower trim covers.

**Gauges—Fuel and Temperature****Removal**

1. Remove cluster assembly as outlined.
2. Using a clean cloth on bench, place cluster face down on cloth to protect lens from scratching.
3. Remove five screws attaching backplate to mask assembly.
4. Carefully remove speedometer and fuel computer flex circuits from their respective locating pins.
5. With even pressure on both sides of backplate, lift up on backplate to separate it from mask assembly.  
NOTE: Area near gauge clips will cause most resistance.
6. Remove three screws attaching gauge dial(s) to mask assembly and remove gauge(s).

**Installation**

1. Install gauge(s) into mask assembly.
2. Install three gauge dial(s) attaching screws.
3. Position backplate onto mask assembly making sure that speedometer and fuel computer flex circuits are fed through their respective holes.
4. With backplate properly aligned to the mask assembly, push down firmly on gauge clips to seat gauges properly into clips.
5. Carefully position speedometer and fuel computer flex circuits over their respective locating pins.
6. Install five backplate-to-mask assembly attaching screws.

**Fuel Computer Module****Removal**

1. Remove cluster assembly as outlined.
2. Using a clean cloth on bench, place cluster face down on cloth. NOTE: Cloth will protect lens from scratching.
3. Remove the five screws which hold backplate to mask assembly.
4. Carefully remove speedometer and fuel computer flex circuits from their respective locating pins.
5. With even pressure on both sides of backplate, lift up on backplate to separate it from mask assembly. NOTE: Area near gauge clips will cause most resistance.
6. Remove two screws securing fuel computer to mask assembly.

**Installation**

1. Install fuel computer module with flex circuit toward bottom of cluster.
2. Install two fuel computer module attaching screws.
3. Position backplate onto mask assembly ensuring that speedometer and fuel computer flex circuits are fed through their respective holes.
4. With backplate properly aligned to mask assembly, push down firmly on gauge clips to seat gauges properly into clips.
5. Carefully position speedometer and fuel computer flex circuits over their respective locating pins.
6. Install five backplate-to-mask assembly attaching screws.



**REMOVAL AND INSTALLATION (Continued)****Speedometer Module****Removal**

1. Remove cluster assembly as outlined.
2. Using a clean cloth on bench, place cluster face down on cloth. NOTE: Cloth will protect lens from scratching.
3. Remove five screws attaching backplate to mask assembly.
4. Carefully remove speedometer and fuel computer flex circuit from their respective locating pins.
5. With even pressure on both sides of backplate, lift up on backplate to separate it from mask assembly.  
  
NOTE: Area near gauge clips will cause most resistance.
6. Turn cluster assembly over and disconnect switch connector from mask assembly by squeezing in on retaining clips and pushing connector through hole in mask.
7. Remove four screws attaching speedometer to mask assembly.

**Installation**

1. Install speedometer module with flex circuit and switch connector toward gauge side of cluster.
2. Install four speedometer module attaching screws.
3. Push switch connector through hole in mask.  
  
**CAUTION: Ensure that wires are routed to top of mask, out of the way of gauges.**
4. Position backplate onto mask assembly ensuring that speedometer and fuel computer flex circuits are fed through their respective holes.

5. With backplate properly aligned to mask assembly, push down firmly on gauge clips to seat gauges properly into clips.
6. Carefully position speedometer and fuel computer flex circuits over their respective locating pins.
7. Install five backplate-to-mask assembly screws.

**Switch Module****Removal**

1. Remove two lower trim covers.
2. Remove cluster trim panel. NOTE: Switch module must be disconnected from cluster to remove trim panel.
3. Remove two switch module mounting screws and remove switch module.

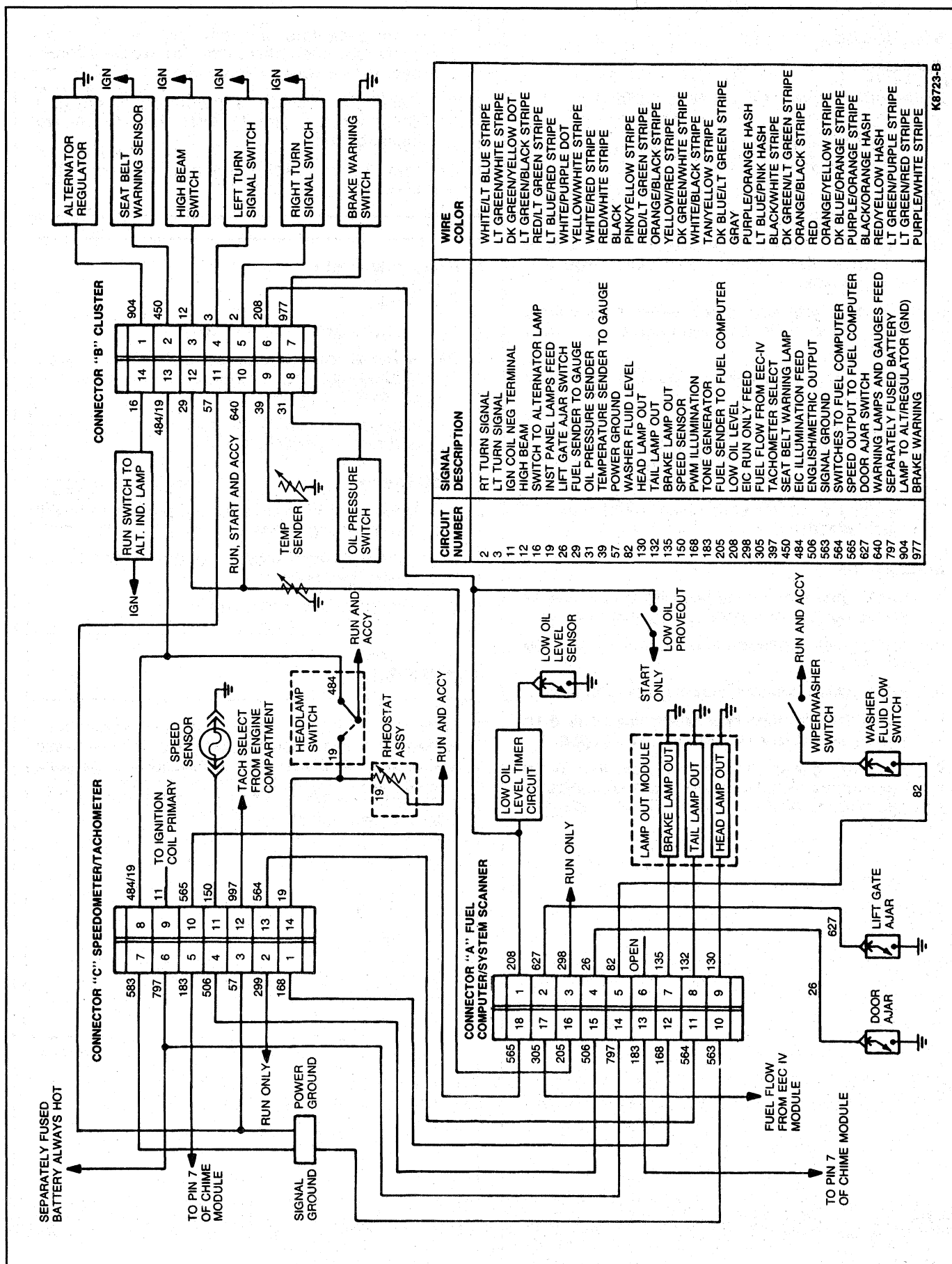
**Installation**

1. Mount switch module to trim panel and install two mounting screws.
2. Connect switch module to cluster and install cluster trim panel.
3. Install two lower trim covers.

**DIAGNOSIS**

Refer to the following diagnosis charts and electrical schematic to diagnose problems with the electronic instrument cluster and the mechanical gauges. Voltage and resistance measurements may be obtained using Rotunda Digital Volt/Ohmmeter 014-00407 or equivalent.

## DIAGNOSIS (Continued)



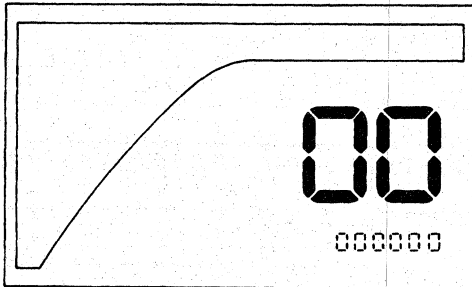
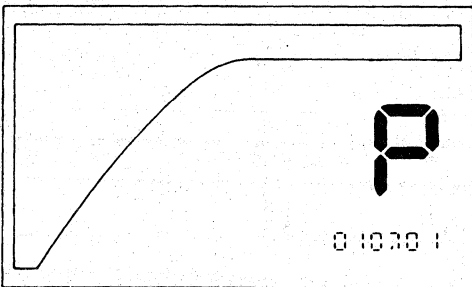
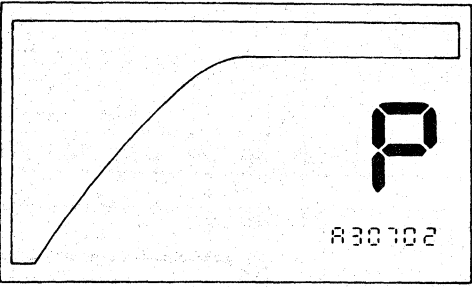
K8723-B

## DIAGNOSIS (Continued)

## SELF-TEST SPEEDO/ODO/TACH MODULE

Enter test mode by holding the TRIP RESET button in and turning the ignition from OFF to RUN. Zeros are displayed entering test mode. Advance through tests by successively pressing the TRIP RESET button. A tone and a P on the display indicate that the test passed. No tone and a F on the display indicate that the test failed. The test number is indicated in the ones and tenths digit of the odometer. Exit test mode by completing the last test (watch dog timer test) or by turning the ignition to OFF.

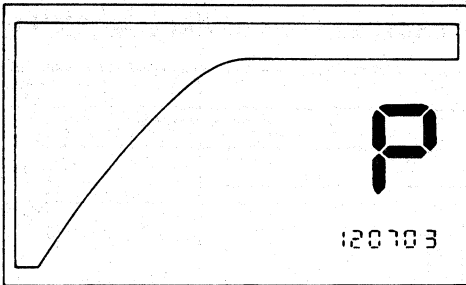
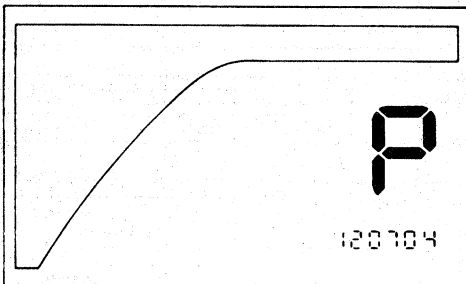
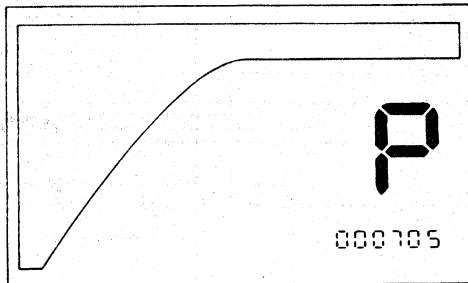
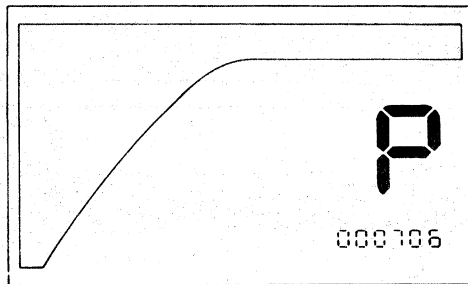
NOTE: MOST OF THE TESTS ARE FOR FACTORY USE ONLY AND ARE TO BE IGNORED WHETHER THEY PASS OR FAIL.

TEST	TEST NAME	COMMENTS
0	ENTER TEST MODE	ALL ZEROS DISPLAYED
		
1	MICRO COMPUTER CHECK (RAM, ROM, TIMER)	ODOMETER DISPLAY HAS SOFTWARE REVISION LEVEL, STRAP OPTION, AND TEST NUMBER
		
2	BATTERY A/D TEST	FOR FACTORY USE ONLY (IGNORE)
		

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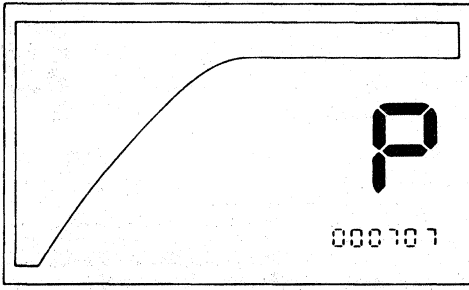
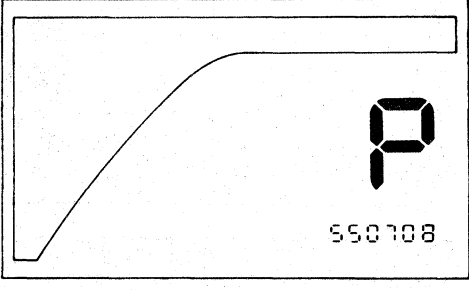
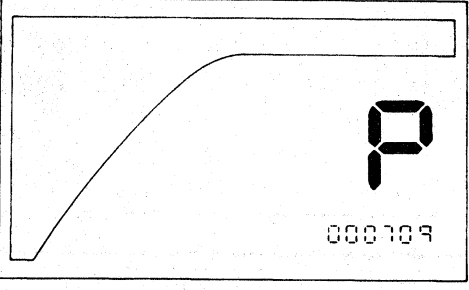
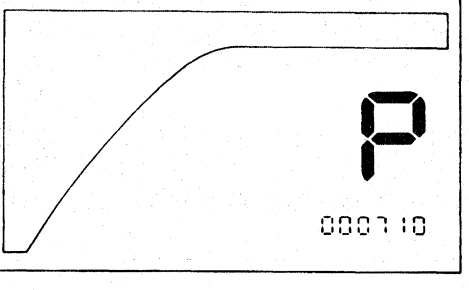
## DIAGNOSIS (Continued)

## SELF-TEST SPEED/ODO/TACH MODULE — Continued

TEST	TEST NAME	COMMENTS
3	DRIVER 1 BACK PLANE FREQUENCY TEST	FOR FACTORY USE ONLY (IGNORE)
		
4	DRIVER 2 BACK PLANE FREQUENCY TEST	FOR FACTORY USE ONLY (IGNORE)
		
5	SPEED INPUT TEST	FOR FACTORY USE ONLY (IGNORE)
		
6	TACH INPUT TEST	FOR FACTORY USE ONLY (IGNORE)
		

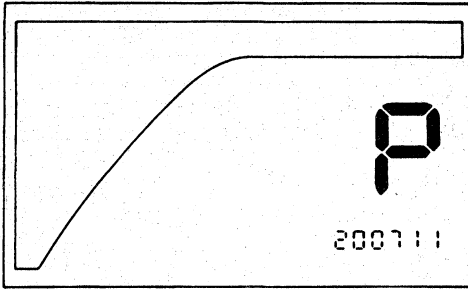
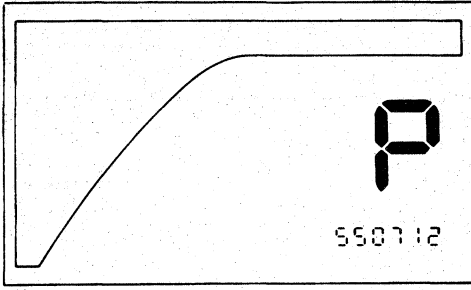
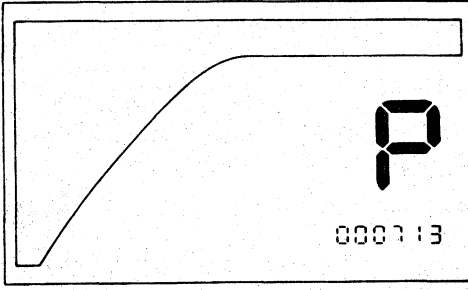
## DIAGNOSIS (Continued)

## SELF-TEST SPEEDO/ODO/TACH MODULE — Continued

TEST	TEST NAME	COMMENTS
7	NON-VOLATILE MEMORY READ TEST	CHECKS FOR ERRORS IN ODOMETER MEMORY. NOTE: ODOMETER IS STILL FUNCTIONAL IF TEST DOES NOT PASS. ODOMETER IS UNUSABLE ONLY IF ALL MEMORY LOCATIONS ARE BAD AND "ERROR" IS DISPLAYED.
		
8	SWITCH INPUT TEST	FOR FACTORY USE ONLY (IGNORE)
		
9	TACHOMETER SELECT STRAP TEST	FOR FACTORY USE ONLY (IGNORE)
		
10	TRIP ODOMETER NVM CHECK TEST	FOR FACTORY USE ONLY (IGNORE)
		

## DIAGNOSIS (Continued)

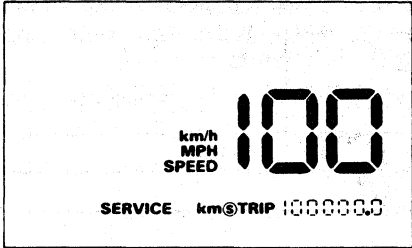
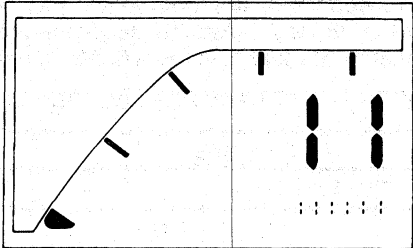
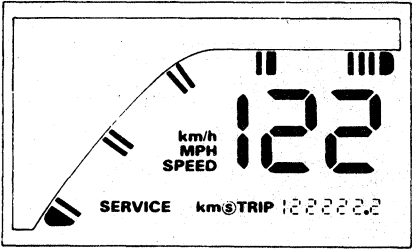
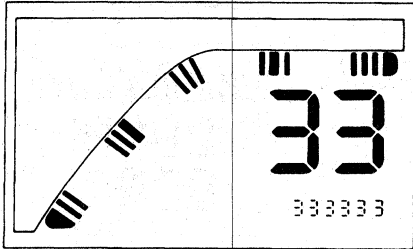
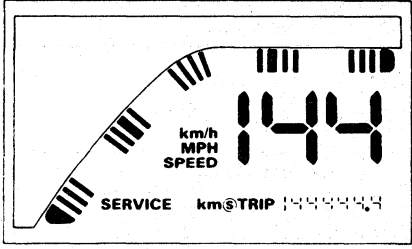
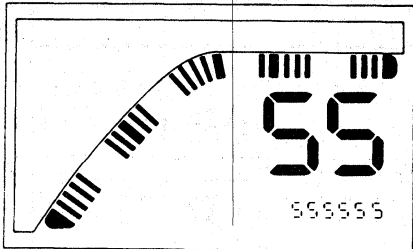
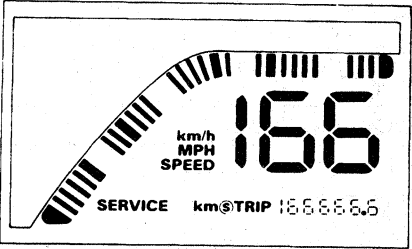
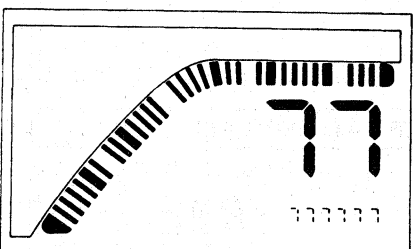
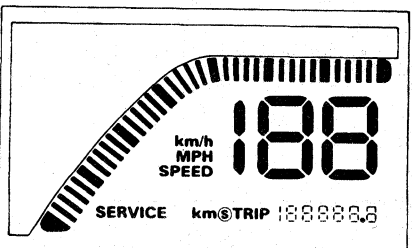
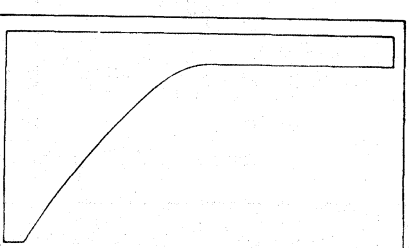
## SELF-TEST SPEEDO/ODO/TACH MODULE — Continued

TEST	TEST NAME	COMMENTS
11	THERMISTOR TEST	FOR FACTORY USE ONLY (IGNORE)
		
12	DIMMING TEST	FOR FACTORY USE ONLY (IGNORE)
		
13	LOW MILEAGE TEST	FOR FACTORY USE ONLY (IGNORE)
		

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## DIAGNOSIS (Continued)

## SELF-TEST SPEED/ODO/TACH MODULE — Continued

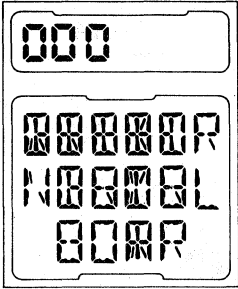
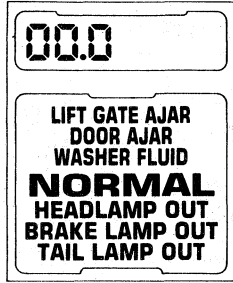
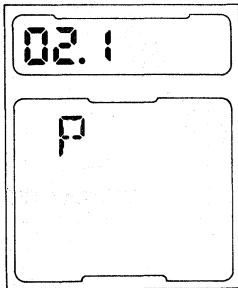
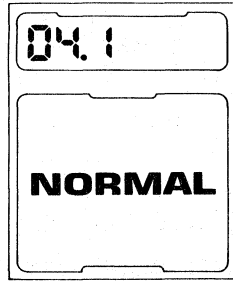
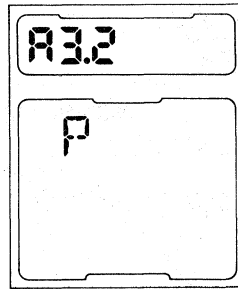
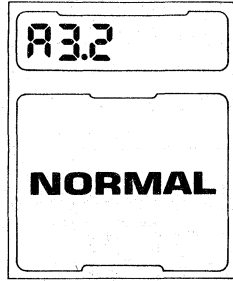
TEST	TEST NAME	COMMENTS
14	DISPLAY TESTS ( 1 TO 10)	SEE THAT DISPLAYS MATCH FIGURES
	 <p>DISPLAY TEST 1</p>	 <p>DISPLAY TEST 2</p>
	 <p>DISPLAY TEST 3</p>	 <p>DISPLAY TEST 4</p>
	 <p>DISPLAY TEST 5</p>	 <p>DISPLAY TEST 6</p>
	 <p>DISPLAY TEST 7</p>	 <p>DISPLAY TEST 8</p>
	 <p>DISPLAY TEST 9</p>	 <p>DISPLAY TEST 10</p>
15	RESET CIRCUIT TEST (WATCH DOG TIMER)	TEST PASSES IF DISPLAY PROVES OUT (ALL ON, ALL OFF, NORMAL DISPLAY)

## DIAGNOSIS (Continued)

## SELF TEST FUEL COMPUTER/SYSTEM SCANNER MODULE

Some vehicles may be equipped with new graphics for the Fuel Computer/System Scanner module. The graphics will result in different displays when going through self-test. The display seen will depend on the graphics in the vehicle. Both sets of graphics are shown for reference. Enter test mode by holding the FUEL ECON button in and turning the ignition from OFF to RUN. Advance through tests by successively pressing the FUEL ECON button. A tone and a P or NORMAL on the display indicate that the test passed. No tone and an F or LIFTGATE AJAR and TAIL LAMP OUT on the display indicate that the test failed. The test number is indicated in the tenths digit of the fuel computer display. Exit test mode by completing the last test (watch dog timer test) or by turning the ignition to OFF.

NOTE: MOST OF THE TESTS ARE FOR FACTORY USE ONLY AND ARE TO BE IGNORED WHETHER THEY PASS OR FAIL.

TEST	TEST NAME	COMMENTS
0	ENTER TEST MODE	ALL ZEROS DISPLAYED
<div style="display: flex; align-items: center; justify-content: space-around;"> <div style="border: 1px solid black; padding: 5px; text-align: center;">  </div> <div>OR</div> <div style="border: 1px solid black; padding: 5px; text-align: center;">  </div> </div>		
1	MICRO COMPUTER CHECK (RAM, ROM, TIMER)	FUEL COMPUTER PORTION OF DISPLAY HAS SOFTWARE REVISION LEVEL AND TEST NUMBER
<div style="display: flex; align-items: center; justify-content: space-around;"> <div style="border: 1px solid black; padding: 5px; text-align: center;">  </div> <div>OR</div> <div style="border: 1px solid black; padding: 5px; text-align: center;">  </div> </div>		
2	BATTERY A/D INPUT TEST	FOR FACTORY USE ONLY (IGNORE)
<div style="display: flex; align-items: center; justify-content: space-around;"> <div style="border: 1px solid black; padding: 5px; text-align: center;">  </div> <div>OR</div> <div style="border: 1px solid black; padding: 5px; text-align: center;">  </div> </div>		



## DIAGNOSIS (Continued)

## SELF TEST FUEL COMPUTER/SYSTEM SCANNER MODULE — Continued

TEST	TEST NAME	COMMENTS
3	FUEL LEVEL A/D INPUT TEST	FOR FACTORY USE ONLY (IGNORE)
<div style="display: flex; align-items: center; justify-content: space-around;"> <div style="border: 1px solid black; padding: 5px; text-align: center;"> 83.3  P </div> <div>OR</div> <div style="border: 1px solid black; padding: 5px; text-align: center;"> 83.3 INST AVG MILES L/100 km TO MPG EMPTY  NORMAL </div> </div>		
4	DRIVER 1 BACK PLANE FREQUENCY TEST	FOR FACTORY USE ONLY (IGNORE)
<div style="display: flex; align-items: center; justify-content: space-around;"> <div style="border: 1px solid black; padding: 5px; text-align: center;"> 20.4  P </div> <div>OR</div> <div style="border: 1px solid black; padding: 5px; text-align: center;"> 20.4  NORMAL </div> </div>		
5	DRIVER 2 BACK PLANE FREQUENCY TEST	FOR FACTORY USE ONLY (IGNORE)
<div style="display: flex; align-items: center; justify-content: space-between;"> <div style="border: 1px solid black; padding: 5px; text-align: center;"> 20.5  P </div> <div style="flex-grow: 1; text-align: right; padding-right: 20px;"> <b>NOTE:</b> For vehicles with new graphics this test step is non-existent. </div> </div>		
6	SPEED/DISTANCE INPUT TEST	FOR FACTORY USE ONLY (IGNORE)
<div style="display: flex; align-items: center; justify-content: space-around;"> <div style="border: 1px solid black; padding: 5px; text-align: center;"> 88.6  P </div> <div>OR</div> <div style="border: 1px solid black; padding: 5px; text-align: center;"> 00.5  NORMAL </div> </div>		

## DIAGNOSIS (Continued)

## SELF TEST FUEL COMPUTER/SYSTEM SCANNER MODULE — Continued

TEST	TEST NAME	COMMENTS
7	FUEL FLOW INPUT TEST	FOR FACTORY USE ONLY (IGNORE)
<div> <div>88.7</div> <div>P</div> </div> <div>OR</div> <div> <div>00.6</div> <div>NORMAL</div> </div>		
8	ENGLISH/METRIC INPUT TEST	FOR FACTORY USE ONLY (IGNORE)
<div> <div>00.8</div> <div>P</div> </div> <div>OR</div> <div> <div>00.7</div> <div>NORMAL</div> </div>		
9	SWITCH A/D INPUT TEST	FOR FACTORY USE ONLY (IGNORE)
<div> <div>88.9</div> <div>P</div> </div> <div>OR</div> <div> <div>7C.8</div> <div>NORMAL</div> </div>		
10	SYSTEM SCANNER INPUT TEST	FOR FACTORY USE ONLY (IGNORE)
<div> <div>00.A</div> <div>P</div> </div> <div>OR</div> <div> <div>00.9</div> <div>NORMAL</div> </div>		

## DIAGNOSIS (Continued)

## SELF TEST FUEL COMPUTER/SYSTEM SCANNER MODULE — Continued

TEST	TEST NAME	COMMENTS
11	STANDBY RAM POWER DOWN TEST	FOR FACTORY USE ONLY (IGNORE)
<div style="display: flex; justify-content: space-around; align-items: center;"> <div style="border: 1px solid black; padding: 5px; text-align: center;">88.6</div> <div style="border: 1px solid black; padding: 5px; text-align: center;">00A</div> </div> <div style="display: flex; justify-content: space-around; align-items: center; margin-top: 10px;"> <div style="border: 1px solid black; padding: 5px; text-align: center;">P</div> <div style="text-align: center;">OR</div> <div style="border: 1px solid black; padding: 5px; text-align: center;">NORMAL</div> </div>		
12	DISPLAY TESTS (1 TO 12)	SEE THAT DISPLAYS MATCH FIGURES
NOTE: If vehicle has new graphics, refer to Test Step 12A.		
<div style="display: grid; grid-template-columns: repeat(4, 1fr); gap: 10px;"> <!-- Display Test 1 --> <div style="border: 1px solid black; padding: 5px;"> <div style="border: 1px solid black; padding: 2px; text-align: center;">00.0 INST AVG MILES L/100 km km TO MPG EMPTY</div> <div style="border: 1px solid black; height: 80px; margin-top: 5px;"></div> </div> <div style="text-align: center;">DISPLAY TEST 1</div> <!-- Display Test 2 --> <div style="border: 1px solid black; padding: 5px;"> <div style="border: 1px solid black; padding: 2px; text-align: center;">111</div> <div style="border: 1px solid black; padding: 5px; text-align: center;">OIL LEVEL LOW</div> </div> <div style="text-align: center;">DISPLAY TEST 2</div> <!-- Display Test 3 --> <div style="border: 1px solid black; padding: 5px;"> <div style="border: 1px solid black; padding: 2px; text-align: center;">22.2 INST AVG MILES L/100 km km TO MPG EMPTY</div> <div style="border: 1px solid black; padding: 5px; text-align: center;">DOOR AJAR</div> </div> <div style="text-align: center;">DISPLAY TEST 3</div> <!-- Display Test 4 --> <div style="border: 1px solid black; padding: 5px;"> <div style="border: 1px solid black; padding: 2px; text-align: center;">333</div> <div style="border: 1px solid black; padding: 5px; text-align: center;">LIFT GATE AJAR</div> </div> <div style="text-align: center;">DISPLAY TEST 4</div> <!-- Display Test 5 --> <div style="border: 1px solid black; padding: 5px;"> <div style="border: 1px solid black; padding: 2px; text-align: center;">44.4 INST AVG MILES L/100 km km TO MPG EMPTY</div> <div style="border: 1px solid black; padding: 5px; text-align: center;">HEAD LAMP OUT</div> </div> <div style="text-align: center;">DISPLAY TEST 5</div> <!-- Display Test 6 --> <div style="border: 1px solid black; padding: 5px;"> <div style="border: 1px solid black; padding: 2px; text-align: center;">555</div> <div style="border: 1px solid black; padding: 5px; text-align: center;">TAIL LAMP OUT</div> </div> <div style="text-align: center;">DISPLAY TEST 6</div> <!-- Display Test 7 --> <div style="border: 1px solid black; padding: 5px;"> <div style="border: 1px solid black; padding: 2px; text-align: center;">66.6 INST AVG MILES L/100 km km TO MPG EMPTY</div> <div style="border: 1px solid black; padding: 5px; text-align: center;">BRAKE LAMP OUT</div> </div> <div style="text-align: center;">DISPLAY TEST 7</div> <!-- Display Test 8 --> <div style="border: 1px solid black; padding: 5px;"> <div style="border: 1px solid black; padding: 2px; text-align: center;">777</div> <div style="border: 1px solid black; padding: 5px; text-align: center;">WASHER LEVEL LOW</div> </div> <div style="text-align: center;">DISPLAY TEST 8</div> <!-- Display Test 9 --> <div style="border: 1px solid black; padding: 5px;"> <div style="border: 1px solid black; padding: 2px; text-align: center;">88.8 INST AVG MILES L/100 km km TO MPG EMPTY</div> <div style="border: 1px solid black; padding: 5px; text-align: center;">NORMAL</div> </div> <div style="text-align: center;">DISPLAY TEST 9</div> <!-- Display Test 10 --> <div style="border: 1px solid black; padding: 5px;"> <div style="border: 1px solid black; padding: 2px; text-align: center;">999</div> <div style="border: 1px solid black; height: 80px; margin-top: 5px;"></div> </div> <div style="text-align: center;">DISPLAY TEST 10</div> <!-- Display Test 11 --> <div style="border: 1px solid black; padding: 5px;"> <div style="border: 1px solid black; padding: 2px; text-align: center;">88.8 INST AVG MILES L/100 km km TO MPG EMPTY</div> <div style="border: 1px solid black; padding: 5px; text-align: center;">888888 N0000L 8000</div> </div> <div style="text-align: center;">DISPLAY TEST 11</div> <!-- Display Test 12 --> <div style="border: 1px solid black; padding: 5px;"> <div style="border: 1px solid black; height: 30px; margin-bottom: 5px;"></div> <div style="border: 1px solid black; height: 80px;"></div> </div> <div style="text-align: center;">DISPLAY TEST 12</div> </div>		

## DIAGNOSIS (Continued)

TEST	TEST NAME	COMMENTS	
12A	DISPLAY TEST (1 to 12)	SEE THAT DISPLAYS MATCH FIGURES	
NOTE: Use this test only if vehicle is equipped with new graphics.			
	<div><div>00.0</div><div>INST AVG MILES L/100 km km TO MPG EMPTY</div><div></div></div> <div>DISPLAY TEST 1</div>	<div><div>11.1</div><div></div><div>LIFT GATE AJAR</div></div> <div>DISPLAY TEST 2</div>	<div><div>22.2</div><div>INST AVG MILES L/100 km km TO MPG EMPTY</div><div>DOOR AJAR</div></div> <div>DISPLAY TEST 3</div>
	<div><div>33.3</div><div></div><div>WASHER FLUID</div></div> <div>DISPLAY TEST 4</div>	<div><div>44.4</div><div>INST AVG MILES L/100 km km TO MPG EMPTY</div><div>HEADLAMP OUT</div></div> <div>DISPLAY TEST 5</div>	<div><div>55.5</div><div></div><div>BRAKE LAMP OUT</div></div> <div>DISPLAY TEST 6</div>
	<div><div>66.6</div><div>INST AVG MILES L/100 km km TO MPG EMPTY</div><div>TAIL LAMP OUT</div></div> <div>DISPLAY TEST 7</div>	<div><div>77.7</div><div></div><div>NORMAL</div></div> <div>DISPLAY TEST 8</div>	<div><div>88.8</div><div>INST AVG MILES L/100 km km TO MPG EMPTY</div><div>LIFT GATE AJAR WASHER FLUID BRAKE LAMP OUT</div></div> <div>DISPLAY TEST 9</div>
	<div><div>99.9</div><div>INST AVG MILES L/100 km km TO MPG EMPTY</div><div>DOOR AJAR HEADLAMP OUT TAIL LAMP OUT</div></div> <div>DISPLAY TEST 10</div>	<div><div>88.8</div><div>INST AVG MILES L/100 km km TO MPG EMPTY</div><div>LIFT GATE AJAR DOOR AJAR WASHER FLUID NORMAL HEADLAMP OUT BRAKE LAMP OUT TAIL LAMP OUT</div></div> <div>DISPLAY TEST 11</div>	<div><div></div><div></div><div></div></div> <div>DISPLAY TEST 12</div>
13	RESET CIRCUIT TEST (WATCH DOG TIMER)	TEST PASSES IF DISPLAY PROVES OUT (ALL ON, ALL OFF, NORMAL DISPLAY)	

**DIAGNOSIS (Continued)****ELECTRONIC INSTRUMENT CLUSTER DIAGNOSIS INDEX**

<b>SPEEDO/ODO/TACH MODULE DIAGNOSIS GUIDE</b>		
<b>1</b>	Display totally black	GO to Pinpoint Test <b>TA</b>
<b>2</b>	Display not illuminated	GO to Pinpoint Test <b>TA</b>
<b>3</b>	Display lit but too dim	GO to Pinpoint Test <b>TA</b>
<b>4</b>	Display scrambled, segments half lit (ghost segments), segments blink or missing, display always incorrect	GO to Pinpoint Test <b>TB</b>
<b>5</b>	Display stuck with all segments on	GO to Pinpoint Test <b>TB</b>
<b>6</b>	No beep when buttons pushed or speed alarm given	GO to Pinpoint Test <b>TG</b>
<b>7</b>	Module does not respond to buttons	GO to Pinpoint Test <b>TE</b>
<b>8</b>	Speedometer and odometer will not switch between English and metric	GO to Pinpoint Test <b>TF</b>
<b>TACHOMETER DIAGNOSIS GUIDE</b>		
<b>9</b>	Tachometer always indicates too high or too low	GO to Pinpoint Test <b>TC</b>
<b>10</b>	No tachometer indication	GO to Pinpoint Test <b>TD</b>
<b>11</b>	Tachometer indication erratic	GO to Pinpoint Test <b>TD</b>
<b>SPEEDOMETER DIAGNOSIS GUIDE</b>		
<b>12</b>	Speedometer reads 0 MPH (km/h) at all speeds when vehicle is in motion	GO to Pinpoint Test <b>TH</b>
<b>13</b>	Speedometer reads constantly too high or too low	GO to Pinpoint Test <b>TJ</b>
<b>14</b>	Speed indication jumps up and down erratically	GO to Pinpoint Test <b>TK</b>
<b>ODOMETER DIAGNOSIS GUIDE</b>		
<b>15</b>	Display reads "error" and service symbol is on	GO to Pinpoint Test <b>TL</b>
<b>16</b>	Display has "S" illuminated	GO to Pinpoint Test <b>TM</b>
<b>17</b>	Odometer does not accumulate mileage, or counts 10 miles and jumps back 10 miles	GO to Pinpoint Test <b>TN</b>
<b>18</b>	Odometer reading incorrect, increases or decreases a large amount	GO to Pinpoint Test <b>TP</b>
<b>19</b>	Mileage constantly reads too high or too low	GO to Pinpoint Test <b>TQ</b>
<b>TRIP ODOMETER DIAGNOSIS GUIDE</b>		
<b>20</b>	Symptoms same as regular odometer	GO to Odometer Diagnosis
<b>21</b>	Cannot call up trip odometer, only regular odometer displayed	GO to Pinpoint Test <b>TR</b>
<b>22</b>	Trip odometer will not reset	GO to Pinpoint Test <b>TS</b>

CK8736-A

**DIAGNOSIS (Continued)****ELECTRONIC INSTRUMENT CLUSTER DIAGNOSIS INDEX — Continued**

<b>SPEED ALARM DIAGNOSIS GUIDE</b>		
<b>23</b>	Speed alarm cannot be set, does not respond to speed alarm button ►	GO to Pinpoint Test <b>TT</b>
<b>24</b>	No beeping when "speed" symbol is flashing ►	GO to Pinpoint Test <b>TG</b>
<b>SERVICE REMINDER DIAGNOSIS GUIDE</b>		
<b>25</b>	"Service" symbol does not go out when reset ►	GO to Pinpoint Test <b>TU</b>
<b>26</b>	Do not get three beeps when service reminder is reset ►	GO to Pinpoint Test <b>TV</b>
<b>FUEL COMPUTER/SYSTEM SCANNER MODULE DIAGNOSIS GUIDE</b>		
<b>27</b>	Display totally black ►	GO to Pinpoint Test <b>FA</b>
<b>28</b>	Display back lighted but blank ►	GO to Pinpoint Test <b>FB</b>
<b>29</b>	Display not illuminated ►	GO to Pinpoint Test <b>FA</b>
<b>30</b>	Display lit but too dim ►	GO to Pinpoint Test <b>FA</b>
<b>31</b>	Display scrambled, segments half lit (ghost segments), segments blink or missing, display always incorrect ►	GO to Pinpoint Test <b>FF</b>
<b>32</b>	Display stuck with all segments on ►	GO to Pinpoint Test <b>FF</b>
<b>33</b>	No beep when buttons pushed ►	GO to Pinpoint Test <b>TG</b>
<b>34</b>	Fuel computer/system scanner module will not switch between English and metric ►	GO to Pinpoint Test <b>FG</b>
<b>35</b>	Module does not respond to buttons ►	GO to Pinpoint Test <b>TE</b>
<b>36</b>	Instantaneous fuel economy always reads zero miles/gal or 99 L/100km ►	GO to Pinpoint Test <b>FC</b>
<b>37</b>	Instantaneous fuel economy always reads 99 miles/gal or 0 L/100km ►	GO to Pinpoint Test <b>FD</b>
<b>38</b>	DTE always reads zero miles or fuel computer display CO ►	GO to Pinpoint Test <b>FE</b>
<b>MAGNETIC GAUGE DIAGNOSIS GUIDE</b>		
<b>39</b>	Fuel gauge inoperative ►	GO to Pinpoint Test <b>A</b>
<b>40</b>	Fuel gauge inaccurate ►	GO to Pinpoint Test <b>B</b>
<b>41</b>	Temperature gauge inoperative ►	GO to Pinpoint Test <b>C</b>
<b>42</b>	Temperature gauge inaccurate ►	GO to Pinpoint Test <b>D</b>

CK8737-B

## DIAGNOSIS (Continued)

## MODULE DISPLAY NOT ILLUMINATED, TOO DIM, OR TOTALLY BLACK

TEST STEP		RESULT	ACTION TO TAKE
TA0	VERIFY CONDITION		
			GO to TA1.
TA1	CHECK FUEL COMPUTER/SVS SCANNER DISPLAY		
	<ul style="list-style-type: none"> <li>Turn ignition to RUN position.</li> <li>Check for back lighting of fuel computer/system scanner module.</li> </ul>	Other module OK	REPLACE burned out bulbs as outlined.
		Other module not OK or too dim	GO to TA2.
TA2	VERIFY ILLUMINATION GROUND		
	<ul style="list-style-type: none"> <li>Disconnect ground cable to battery.</li> <li>Remove cluster.</li> <li>Reconnect battery cable.</li> <li>Measure resistance between Pin 3C and Pin 11B (Circuit 57 continuity check).</li> <li>Resistance should be less than 1 ohm.</li> </ul>	<div>OK</div>	GO to TA3.
		<div>OK</div>	SERVICE illumination ground (Circuit 57).
TA3	CHECK MODULE ILLUMINATION IN RUN AND WITH HEADLAMPS ON		
	<ul style="list-style-type: none"> <li>Turn ignition to RUN position.</li> <li>Check for display back lighting.</li> <li>Turn headlamps on.</li> <li>Move dimmer control to maximum brightness.</li> <li>Check for display back lighting.</li> </ul>	Does not light in RUN or with headlamps on	GO to TA4.
		Illuminated in RUN but not with headlamps on	GO to TA5.
		Illuminated with headlamps on but not in RUN	GO to TA4.
		Illuminated but too dim	GO to TA6.
TA4	CHECK POWER TO BULBS (RUN)		
	<ul style="list-style-type: none"> <li>Disconnect ground cable to battery.</li> <li>Remove cluster.</li> <li>Reconnect battery cable.</li> <li>Measure voltage on LCD illumination line Pin 8C (Circuit 484/19).</li> </ul>	Greater than 10V	REPLACE EIC (speedo module).*
		Less than 10V	SERVICE illumination circuits, fuses or headlamp switch.
TA5	CHECK POWER TO BULBS (HEADLAMPS ON)		
	<ul style="list-style-type: none"> <li>Disconnect ground cable to battery.</li> <li>Remove cluster.</li> <li>Reconnect battery cable.</li> <li>Turn headlamp switch on.</li> <li>Move dimmer control to maximum brightness.</li> <li>Measure voltage on LCD illumination line Pin 8C (Circuit 484/19).</li> </ul>	Greater than 10V	REPLACE EIC (speedo module).*
		Less than 10V	SERVICE illumination circuits, fuses or headlamp switch.

\*When replacing EIC, affix odometer sticker to door pillar.

CK8738-A

## DIAGNOSIS (Continued)

## MODULE DISPLAY NOT ILLUMINATED, TOO DIM, OR TOTALLY BLACK — Continued

TEST STEP		RESULT	ACTION TO TAKE
<b>TA6</b>	<b>CHECK DISPLAY ILLUMINATION BULBS</b>		
<ul style="list-style-type: none"> <li>• Disconnect ground cable to battery.</li> <li>• Remove cluster.</li> <li>• Reconnect battery cable and turn ignition to RUN.</li> <li>• Check bulbs for burned out filaments.</li> </ul>		Both bulbs on	GO to TA7.
		One or both bulbs burned out or blackened	REPLACE burned out bulb as outlined.
<b>TA7</b>	<b>CHECK FOR CORRECT BULB TYPE</b>		
<ul style="list-style-type: none"> <li>• Disconnect ground cable to battery.</li> <li>• Remove cluster.</li> <li>• Check for correct bulb type (Halogen).</li> </ul>		OK	GO to TA4 (RUN) or TA5 (Headlamps on).
		OK	REPLACE with correct bulb as outlined.

\*When replacing EIC, affix odometer sticker to door pillar.

CK8739-A

## DISPLAY SCRAMBLED, SEGMENTS HALF LIT (GHOST SEGMENTS), SEGMENTS BLINK OR MISSING. DISPLAY INCORRECT ALL THE TIME, DISPLAY STUCK WITH ALL SEGMENTS ON

TEST STEP		RESULT	ACTION TO TAKE
<b>TB1</b>	<b>OBSERVE PROVE OUT</b>		
			GO to TB2.
<b>TB2</b>	<b>ENTER SELF TEST MODE</b>		
<ul style="list-style-type: none"> <li>• Hold the TRIP RESET button in and then turn ignition from OFF to RUN.</li> <li>• Observe "zeros" on digital display and then release the TRIP RESET button (note that a tone will be heard while in test mode).</li> </ul>		Display has F on it	REPLACE EIC (Speedo module).*
		Does not go into test mode (zeros did not appear or remains in normal operation mode)	TRIP RESET button not held down, or button damaged. GO to Pinpoint Test SA.
		Display has P on it and codes where odometer is displayed	GO to TB3.
<b>TB3</b>	<b>ADVANCE TO DISPLAY TEST</b>		
<ul style="list-style-type: none"> <li>• Enter test mode (Step TB2).</li> <li>• Advance to the display test portion of self test by pressing the TRIP RESET button until Step 12, Display No. 1 of Speedo/Odo/Tach Self-Test appears.</li> <li>• Inspect the display for problems as the test is advanced through each step by pressing the TRIP RESET button. Verify that the displays match Step 12, Display No. 2 through Display No. 10 of Speedo/Odo/Tach Module Self-Test.</li> <li>• The last display step will turn all segments off.</li> </ul>		OK	System OK.
		OK	REPLACE EIC (speedo module).*

\*When replacing EIC, affix odometer sticker to door pillar.

CK8740-A



## DIAGNOSIS (Continued)

## TACH ALWAYS INDICATES TOO HIGH OR TOO LOW

TEST STEP		RESULT	ACTION TO TAKE					
TC0	VERIFY CONDITION							
			▶ GO to TC1.					
TC1	ENTER TEST MODE							
<ul style="list-style-type: none"><li>Place speedo/tach module in test mode as follows:<ul style="list-style-type: none"><li>Hold in the TRIP RESET button and then turn the ignition from OFF to RUN.</li><li>Observe "zeros" on the digital display and then release the TRIP RESET button.</li></ul></li></ul>		Display has F on it	▶ REPLACE EIC (speedo module).*					
		Does not go into test mode (zeros did not appear or remains in normal operation mode)	▶ TRIP RESET button not held down, or damaged button. GO to Pinpoint Test TE.					
		Display has P on it and codes where odometer is located	▶ GO to TC2.					
TC2	VERIFY TACH STRAP OPTIONS							
<ul style="list-style-type: none"><li>After entering test mode, module should be at test 1 (note 01 in ones and tenths digits of odometer).</li><li>Note code number where odometer is normally located (xx0S01).</li><li>Verify that the value of S is as follows:</li></ul> <table><tr><td>ENGINE</td><td>OPTION CODE (VALUE OF S)</td></tr><tr><td>6-Cylinder</td><td>0 1 2 3</td></tr><tr><td>4-Cylinder</td><td>4 5 6 7</td></tr></table>		ENGINE	OPTION CODE (VALUE OF S)	6-Cylinder	0 1 2 3	4-Cylinder	4 5 6 7	<div>OK▶ REPLACE EIC (speedo module).*</div> <div><del>OK</del>▶ GO to TC3.</div>
ENGINE	OPTION CODE (VALUE OF S)							
6-Cylinder	0 1 2 3							
4-Cylinder	4 5 6 7							
TC3	CHECK TACH OPTION STRAP WIRING							
<ul style="list-style-type: none"><li>Disconnect ground cable to battery.</li><li>Remove cluster.</li><li>Check Pin 12C (tach select Circuit 393) for open or ground according to engine as follows:</li></ul> <table><tr><td>ENGINE</td><td>Pin 12C (TACH SELECT)</td></tr><tr><td>6-Cylinder</td><td>Gnd</td></tr><tr><td>4-Cylinder</td><td>Open</td></tr></table>		ENGINE	Pin 12C (TACH SELECT)	6-Cylinder	Gnd	4-Cylinder	Open	<div>OK▶ REPLACE EIC (speedo module).*</div> <div><del>OK</del>▶ SERVICE wiring to match table.</div>
ENGINE	Pin 12C (TACH SELECT)							
6-Cylinder	Gnd							
4-Cylinder	Open							

\*When replacing EIC, affix odometer sticker to door pillar.

CK8741-A

## DIAGNOSIS (Continued)

## NO TACH INDICATION OR TACH INDICATION ERRATIC

TEST STEP		RESULT	ACTION TO TAKE
<b>TD0</b>	<b>VERIFY CONDITION</b>		
	<ul style="list-style-type: none"> <li>Make sure engine is operating properly and is not misfiring.</li> </ul>	<p>(OK) ►</p> <p>(X) ►</p>	<p>GO to <b>TD1</b>.</p> <p>SERVICE engine as necessary.</p>
<b>TD1</b>	<b>CHECK WIRING</b>		
	<ul style="list-style-type: none"> <li>Disconnect ground cable to battery.</li> <li>Remove cluster.</li> <li>Measure resistance between pin 9C and coil.</li> <li>Wiggle connections and wiring near coil to check for intermittents.</li> </ul>	<p>Less than 100 ohms ►</p> <p>Greater than 100 ohms ►</p>	<p>REPLACE EIC (speedo module).* RECHECK operation.</p> <p>SERVICE wiring circuit 11 for open circuit.</p>

\*When replacing EIC, affix odometer sticker to door pillar.

CK8742-A

## DIAGNOSIS (Continued)

## MODULE DOES NOT RESPOND TO BUTTONS (SWITCH TEST)





TEST STEP			RESULT	ACTION TO TAKE
TE0	VERIFY CONDITION			
				GO to TE1.
TE1	CHECK FOR BUTTON BEEP			
<ul style="list-style-type: none"><li>Turn ignition to RUN position.</li><li>Press problem button and listen for beep.</li><li>The buttons control the modules as follows:</li></ul>			Button beeps	REPLACE EIC (problem module).*
			Button does not beep	GO to TE2.
WIRE COLOR      BUTTON      MODULE CONTROLLED				
Orange      MPH/kmh      speedo & fc/ss				
Orange      ODO SEL      speedo/tach				
Orange      TRIP RESET      speedo/tach				
Orange      SPEED ALARM      speedo/tach				
Blue      FUEL ECON      fuel comp/ss				
Blue      DTE      fuel comp/ss				
Blue      ECON RESET      fuel comp/ss				
Green      Signal Gnd      speedo & fc/ss				
TE2	CHECK SWITCH WIRING CONNECTIONS			
<ul style="list-style-type: none"><li>Remove trim panel to expose cluster.</li><li>Verify that connection from switch assembly to EIC is secure and properly aligned.</li></ul>			OK	GO to TE3.
			OK	CONNECT connector and RECHECK.
TE3	CHECK SWITCH ASSY (NO SWITCH PRESSED)			
<ul style="list-style-type: none"><li>Unplug switch assembly from EIC.</li><li>Measure the resistance between colored wire of problem button (refer to table in TE1) and green wire.</li><li>The resistance with no switch pressed should be 1045 ohms to 1155 ohms.</li></ul>			OK	GO to TE4.
			OK	REPLACE switch assembly.
TE4	CHECK SWITCH ASSY PROBLEM BUTTON PRESSED			
<ul style="list-style-type: none"><li>Unplug switch assembly from EIC.</li><li>Measure the resistance between colored wire of problem button (refer to table in TE1) and green wire.</li><li>The resistance should be as follows:</li></ul>			OK	REPLACE EIC (problem module).*
			OK	REPLACE switch assembly.
BUTTON      RESISTANCE IN OHMS				
MPH/kmh      206 to 227				
ODO SEL      847 to 935				
TRIP RESET      675 to 745				
SPEED ALARM      353 to 389				
FUEL ECON      206 to 227				
DTE      847 to 935				
ECON RESET      523 to 577				

\*When replacing EIC, affix odometer sticker to door pillar.

CK8743-A

## DIAGNOSIS (Continued)

**SPEEDOMETER AND ODOMETER WILL NOT SWITCH BETWEEN ENGLISH (MPH, MILES) AND METRIC (KM/H, KM)**

TEST STEP		RESULT	ACTION TO TAKE
<b>TF0</b>	<b>VERIFY CONDITION</b>		
<ul style="list-style-type: none"> <li>• Turn ignition to RUN.</li> <li>• Press MPH/kmh button.</li> </ul>		English and Metric labels change. Odometer changes and speed (if number other than zero is displayed) changes	System OK.
		No change	GO to <b>TF1</b> .
<b>TF1</b>	<b>CHECK OTHER READOUTS</b>		
<ul style="list-style-type: none"> <li>• Turn ignition to RUN.</li> <li>• Press MPH/kmh button.</li> <li>• Verify that any of the following readouts change with the MPH/kmh button: Fuel Computer ATC temperature readout</li> </ul>		No change	GO to <b>TF2</b> .
		Change with MPH/kmh button	REPLACE EIC (speedo module).*
<b>TF2</b>	<b>CHECK BUTTON SWITCH CONNECTION</b>		
<ul style="list-style-type: none"> <li>• Remove trim panel to expose cluster.</li> <li>• Verify that connection from switch assembly is secure and properly aligned.</li> </ul>			GO to <b>TF3</b> .
			CONNECT connector and RECHECK.
<b>TF3</b>	<b>CHECK MPH/KMH SWITCH</b>		
<ul style="list-style-type: none"> <li>• Perform Pinpoint Test TE.</li> </ul>			REPLACE EIC (speedo module).*
			REPLACE switch assembly.

\*When replacing EIC, affix odometer sticker to door pillar.

CK8744-A

## DIAGNOSIS (Continued)

## NO BEEP WHEN BUTTONS PUSHED OR WHEN SPEED ALARM IS FLASHING

TEST STEP		RESULT	ACTION TO TAKE
<b>TG0</b>	VERIFY CONDITION		
			GO to TG1.
<b>TG1</b>	REVIEW OPERATION		
	<ul style="list-style-type: none"> <li>• SPEED ALARM button does not beep or set alarm unless the vehicle is moving at least 20 MPH or 20 km/h.</li> <li>• TRIP RESET button does not beep or reset trip odometer unless the trip odometer is displayed.</li> <li>• ECON RESET button does not beep or reset fuel economy unless average fuel economy is displayed.</li> <li>• Tone generator module will not beep if another sound is being produced.</li> <li>• Turn ignition to RUN position.</li> <li>• Press each of the following buttons and listen for beep.               <ul style="list-style-type: none"> <li>MPH/kmh</li> <li>ODO SEL</li> <li>TRIP RESET</li> <li>SPEED ALARM</li> <li>FUEL ECON</li> <li>DTE</li> <li>ECON RESET</li> </ul> </li> </ul>	All buttons beep No beeps from any button Some buttons beep	System OK. GO to TG2. Tone generator OK. GO to TG4.
<b>TG2</b>	CHECK TONE GENERATOR MODULE		
	<ul style="list-style-type: none"> <li>• Check for fasten seat belt reminder chime or the key left in the ignition reminder chime.</li> </ul>	(OK) (X)	GO to TG3. SERVICE tone generator module.
<b>TG3</b>	CHECK WIRING CIRCUIT 183		
	<ul style="list-style-type: none"> <li>• Disconnect ground cable of battery.</li> <li>• Remove cluster and secure connectors from shorting.</li> <li>• Reconnect battery cable.</li> <li>• Turn ignition to RUN and wait for the fasten seat belt reminder chime to end.</li> <li>• Jumper Pin 5C to ground and listen for tone.</li> <li>• Next, jumper Pin 13A to ground and listen for tone.</li> </ul>	(OK) (X)	REPLACE EIC (speedo module).* SERVICE wiring circuit 183 for opens. CHECK for correct tone generator module part number or operation.
<b>TG4</b>	IDENTIFY BUTTONS NOT BEEPING		
	<ul style="list-style-type: none"> <li>• From step TG1, identify which button group does not beep.</li> </ul>	MPH/kmh ODO SEL TRIP RESET SPEED ALARM FUEL ECON DTE ECON RESET	GO to TG5. GO to TG6.

\*When replacing EIC, affix odometer sticker to door pillar.

CK8745-A

## DIAGNOSIS (Continued)

## NO BEEP WHEN BUTTONS PUSHED OR WHEN SPEED ALARM IS FLASHING — Continued

TEST STEP		RESULT	ACTION TO TAKE
<b>TG5</b>	<b>CHECK SPEEDO/TACH MODULE WIRING (CKT 183)</b>		
	<ul style="list-style-type: none"> <li>● Disconnect ground cable of battery.</li> <li>● Remove cluster and secure connectors from shorting.</li> <li>● Reconnect battery cable.</li> <li>● Turn ignition to RUN and wait for the fasten seat belt reminder chime to end.</li> <li>● Jumper Pin 5C to ground and listen for tone.</li> </ul>	<p>⓪ →</p> <p>ⓧ →</p>	<p>REPLACE EIC (speedo module).*</p> <p>SERVICE wiring Circuit 183 between Pin 5C and tone generator for opens.</p>
<b>TG6</b>	<b>CHECK FUEL COMP/SYS SCANNER WIRING (CIRCUIT 183)</b>		
	<ul style="list-style-type: none"> <li>● Disconnect ground cable of battery.</li> <li>● Remove cluster and secure connectors from shorting.</li> <li>● Reconnect battery cable.</li> <li>● Turn ignition to RUN and wait for the fasten seat belt reminder chime to end.</li> <li>● Jumper Pin 13A to ground and listen for tone.</li> </ul>	<p>⓪ →</p> <p>ⓧ →</p>	<p>REPLACE EIC (fuel comp module).*</p> <p>SERVICE wiring Circuit 183 between Pin 13A and tone generator for opens.</p>

\*When replacing EIC, affix odometer sticker to door pillar.

CK8746-A

## DIAGNOSIS (Continued)

## SPEEDO READS 0 MPH (km/h) AT ALL SPEEDS WHEN VEHICLE IN MOTION

TEST STEP		RESULT	ACTION TO TAKE
TH0	VERIFY CONDITION		
			▶ GO to TH1.
TH1	VERIFY DISPLAY PROVEOUT		
<ul style="list-style-type: none"><li>• Turn ignition to RUN.</li><li>• Observe display proveout (all segments ON, then OFF, and then normal display).</li></ul>		<div>Ⓚ▶</div> <div>ⓧ▶</div>	<div>GO to TH2.</div> <div>REPLACE EIC (speedo module).*</div>
TH2	CHECK ODOMETER		
<ul style="list-style-type: none"><li>• Verify that odometer advances when vehicle is driven forward.</li></ul>		<div>Ⓚ▶</div> <div>ⓧ▶</div>	<div>REPLACE EIC (speedo module).*</div> <div>GO to TH3.</div>
TH3	CHECK SPEED CONTROL		
<ul style="list-style-type: none"><li>• Test drive vehicle and check operation of speed control.</li></ul>		<div>Ⓚ▶</div> <div>▶</div> <div>Not OK or not equipped with speed control</div>	<div>GO to TH8.</div> <div>GO to TH4.</div>
TH4	CHECK WIRING TO SPEED SENSOR		
<ul style="list-style-type: none"><li>• Disconnect connector to speed sensor.</li><li>• Using an ohmmeter, measure the resistance between the two wires in the harness to the speed sensor.</li><li>• Resistance should be greater than 500 ohms.</li></ul>		<div>Ⓚ▶</div> <div>ⓧ▶</div>	<div>GO to TH5.</div> <div>SERVICE wiring Circuit 150, speed control, or cluster for shorts.</div>
TH5	CHECK SPEED SENSOR RESISTANCE		
<ul style="list-style-type: none"><li>• Using an ohmmeter, check resistance at speed sensor.</li><li>• Resistance should be 200 to 230 ohms.</li></ul>		<div>Ⓚ▶</div> <div>ⓧ▶</div>	<div>GO to TH6.</div> <div>REPLACE speed sensor. CHECK speedometer operation.</div>
TH6	CHECK DRIVEN GEAR AND RETAINER CLIP		
<ul style="list-style-type: none"><li>• Disconnect speed sensor from transmission.</li><li>• Verify presence of driven gear with all teeth in good condition and the presence of retainer clip.</li></ul>		<div>Ⓚ▶</div> <div>ⓧ▶</div>	<div>GO to TH7.</div> <div>REPLACE with proper gear and/or clip.</div>

\*When replacing EIC, affix odometer sticker to door pillar.

CK8747-A

## DIAGNOSIS (Continued)

**SPEEDOMETER READS 0 MPH (km/h) AT ALL SPEEDS WHEN VEHICLE IN MOTION — Continued**

TEST STEP		RESULT	ACTION TO TAKE
<b>TH7</b>	<b>CHECK DRIVE GEAR ON TRANSMISSION</b>		
	<ul style="list-style-type: none"> <li>Verify presence of drive gear on transmission output shaft.</li> </ul>	(OK) ► (X) ►	GO to <b>TH8</b> .  SERVICE transmission gear.
<b>TH8</b>	<b>CHECK WIRING TO CLUSTER</b>		
	<ul style="list-style-type: none"> <li>Reconnect speed sensor wiring.</li> <li>Disconnect ground cable to battery. Remove cluster.</li> <li>Using an ohmmeter, check resistance between Pin 11C and Pin 7C (ground) of connector.</li> <li>Resistance should be 160 to 230 ohms.</li> </ul>	(OK) ► (X) ►	REPLACE EIC (speedo module).*  SERVICE connectors or wiring from cluster to speed sensor Circuit 150. CHECK speedometer operation.

\*When replacing EIC, affix odometer sticker to door pillar.

CK8735-A

**SPEEDOMETER READS CONSTANTLY TOO HIGH OR LOW**

TEST STEP		RESULT	ACTION TO TAKE
<b>TJ0</b>	<b>VERIFY CONDITION</b>		
		►	GO to <b>TJ1</b> .
<b>TJ1</b>	<b>CHECK ODOMETER ACCURACY</b>		
	<ul style="list-style-type: none"> <li>Over a known distance, compare the odometer reading with the distance traveled.</li> </ul>	(OK) ► (X) ►	System OK.  GO to <b>TJ2</b> .
<b>TJ2</b>	<b>CHECK SPEED SENSOR DRIVE GEAR</b>		
	<ul style="list-style-type: none"> <li>Remove speed sensor from transmission and verify that correct drive gear is installed for vehicle transmission/axle/tire combination.</li> </ul>	(OK) ► (X) ►	GO to <b>TJ3</b> .  INSTALL correct gear with retaining clip.
<b>TJ3</b>	<b>CHECK DRIVE GEAR ON TRANSMISSION OUTPUT SHAFT</b>		
	<ul style="list-style-type: none"> <li>Check that correct drive gear is installed on transmission output shaft.</li> </ul>	(OK) ► (X) ►	REPLACE EIC (speedo module).*  INSTALL correct shaft/gear.

\*When replacing EIC, affix odometer sticker to door pillar.

CK8748-A



## DIAGNOSIS (Continued)

## SPEED INDICATION JUMPS UP AND DOWN ERRATICALLY

TEST STEP		RESULT	ACTION TO TAKE
TK0	VERIFY CONDITION		
			GO to TK1.
TK1	CHECK SPEED SENSOR DRIVE GEAR		
	<ul style="list-style-type: none"> <li>Remove speed sensor from transmission.</li> <li>Check that all gear teeth are in good condition, retainer clip is installed and gear does not slip on shaft.</li> </ul>	(OK) → (X) →	GO to TK2. REPLACE drive gear and/or retaining clip.
TK2	CHECK WIRING TO SPEED SENSOR		
	<ul style="list-style-type: none"> <li>Disconnect connector to speed sensor.</li> <li>Using an ohmmeter, check for intermittent resistance between the two wires in the harness to the speed sensor.</li> <li>Resistance should be greater than 500 ohms.</li> </ul>	(OK) → (X) →	GO to TK3. SERVICE wiring Circuit 150, speed control. Cluster for intermittent shorts or opens. CHECK speedometer operation.
TK3	CHECK SPEED SENSOR RESISTANCE		
	<ul style="list-style-type: none"> <li>Using an ohmmeter, check for intermittent resistance at speed sensor.</li> <li>Resistance should be 200 to 230 ohms.</li> </ul>	(OK) → (X) →	GO to TK4. REPLACE speed sensor. CHECK speedometer operation.
TK4	CHECK WIRING TO CLUSTER		
	<ul style="list-style-type: none"> <li>Reconnect speed sensor wiring.</li> <li>Disconnect ground cable to battery.</li> <li>Remove cluster.</li> <li>Using an ohmmeter, check for intermittent resistance between Pin 11C and 7C (ground) of connector.</li> </ul>	(OK) → (X) →	REPLACE EIC (speedo module). SERVICE connectors or wiring from cluster to speed sensor, Circuit 150. CHECK speedometer operation.

\*When replacing EIC, affix odometer sticker to door pillar.

CK8749-A

## ODOMETER DISPLAY READS "Error" AND SERVICE SYMBOL ON

TEST STEP		RESULT	ACTION TO TAKE
TL0	VERIFY CONDITION		
			REPLACE EIC (speedo module).*

\*When replacing EIC, affix odometer sticker to door pillar.

CK8750-A

## DIAGNOSIS (Continued)

## DISPLAY HAS "S" ILLUMINATED

TEST STEP		RESULT	ACTION TO TAKE
<b>TM0</b>	VERIFY CONDITION		
			GO to <b>TM1</b> .
<b>TM1</b>	DETERMINE IF SPEEDO MODULE IS ORIGINAL		
<ul style="list-style-type: none"> <li>Check for mileage sticker on door pillar.</li> <li>Check for option code as follows: Put module in test mode by holding the TRIP RESET button in and then turning the ignition from OFF to RUN. Observe "zeros" on display and then release the TRIP RESET button. Note option code number displayed on tens digit of odometer (xx0S01).</li> <li>Speedo module is original or replacement as follows:  VALUE FOR S 0, 1, 4 or 5: Replacement 2, 3, 6 or 7: Original</li> </ul>		Original	REPLACE EIC (speedo module). AFFIX sticker with original mileage to door pillar. "S" should be illuminated and odometer should indicate zero miles.
		Replacement	System OK.

CK8751-A

## ODOMETER DOES NOT ACCUMULATE MILEAGE, OR COUNTS 10 MILES AND JUMPS BACK 10 MILES







TEST STEP		RESULT	ACTION TO TAKE
<b>TN0</b>	VERIFY CONDITION		
		Odometer will not accumulate	GO to <b>TN1</b> .
		Odometer accumulates 16 Km (10 miles), then loses 16 Km (10 miles)	REPLACE EIC (speedo module).*
<b>TN1</b>	VERIFY SPEEDOMETER		
<ul style="list-style-type: none"> <li>Verify that speedometer works properly.</li> </ul>		OK	REPLACE EIC (speedo module).*
		OK	GO to Pinpoint Test TH.

\*When replacing EIC, affix odometer sticker to door pillar.

CK8752-A

## DIAGNOSIS (Continued)

## ODOMETER READING INCORRECT, INCREASES OR DECREASES A LARGE AMOUNT

TEST STEP		RESULT	ACTION TO TAKE
TP1	CHECK COMPUTER CHIP (SELF TEST)		
<ul style="list-style-type: none"><li>● Hold the TRIP RESET button in and then turn the ignition from OFF to RUN.</li><li>● Observe “zeros” on display and then release the TRIP RESET button.</li><li>● Test one (micro check), as indicated by the “01” on the ones and tenths digit of the odometer, should pass by displaying a P on the speedo ones digit and sounding a constant “pass” tone.</li></ul>		<div> ➡</div> <div> ➡</div>	<p>GO to <b>TP2</b>.</p> <p>REPLACE EIC (speedo module).*</p>
TP2	CHECK ODOMETER MEMORY (SELF TEST)		
<ul style="list-style-type: none"><li>● Advance from test one in step TP1 to odometer memory test by successively pressing the TRIP RESET button until test “07” is displayed.</li><li>● Test passes if a P is displayed on speedo ones digit and a “pass” tone is heard.</li></ul>		<div> ➡</div> <div> ➡</div>	<p>GO to <b>TP3</b>.</p> <p>REPLACE EIC (speedo module).*</p>
TP3	CHECK SPEEDOMETER		
<ul style="list-style-type: none"><li>● Check speedometer for correct operation. Perform Pinpoint Tests TJ and TK.</li></ul>		<div> ➡</div> <div> ➡</div>	<p>REPLACE EIC (speedo module).*</p> <p>GO to Pinpoint Test TK.</p>

\*When replacing EIC, affix odometer sticker to door pillar.

CK8753-A

## MILEAGE CONSTANTLY READS TOO HIGH OR LOW

TEST STEP		RESULT	ACTION TO TAKE
TQ0	VERIFY CONDITION		
			▶ GO to TQ1.
TQ1	CHECK SPEEDOMETER		
● Perform Pinpoint Test TJ.		Ⓞ ▶	GO to TQ2.
		Ⓞ/▶	GO to Pinpoint Test TJ.
TQ2	CHECK DISPLAY		
● Perform Pinpoint Test TB.		Ⓞ ▶	GO to TQ3.
		Ⓞ/▶	GO to Pinpoint Test TB.
TQ3	CHECK ODOMETER MEMORY		
● Perform Pinpoint Test TP.		Ⓞ ▶	System OK.
		Ⓞ/▶	GO to Pinpoint Test TP.

CK8754-A

## DIAGNOSIS (Continued)

## CANNOT CALL UP TRIP ODOMETER, ONLY REGULAR ODOMETER DISPLAYED

TEST STEP		RESULT	ACTION TO TAKE
<b>TR0</b>	VERIFY CONDITION		
			GO to <b>TR1</b> .
<b>TR1</b>	CHECK FOR BUTTON TONE		
	<ul style="list-style-type: none"> <li>• Turn ignition to RUN.</li> <li>• After display has proved out and the fasten seat belt reminder chime has finished, press the ODO SEL button and listen for beep tone as button is activated.</li> </ul>	Beep tone heard  No beep tone	REPLACE EIC (speedo module).*  GO to <b>TR2</b> .
<b>TR2</b>	CHECK SWITCH WIRING CONNECTIONS		
	<ul style="list-style-type: none"> <li>• Remove trim panel to expose cluster.</li> <li>• Verify that connector from switch assembly to EIC is secure and properly aligned.</li> </ul>	(OK) (X)	GO to <b>TR3</b> . SERVICE connector as required and RECHECK.
<b>TR3</b>	CHECK SWITCH ASSEMBLY		
	<ul style="list-style-type: none"> <li>• Remove switch module assembly and perform Pinpoint Test TE.</li> </ul>	(OK) (X)	REPLACE EIC (speedo module).* REPLACE switch assembly.

\*When replacing EIC, affix odometer sticker to door pillar.

CK8755-A

## DIAGNOSIS (Continued)

## TRIP ODOMETER WILL NOT RESET

TEST STEP		RESULT	ACTION TO TAKE
<b>TS0</b>	VERIFY CONDITION		
			GO to TS1.
<b>TS1</b>	CHECK FOR BUTTON TONE		
	<ul style="list-style-type: none"> <li>• Turn ignition to RUN.</li> <li>• After display has proved out and the fasten seat belt reminder chime has finished, press the TRIP button to call up trip odometer.</li> <li>• Then press TRIP RESET button and listen for beep tone as button is activated.</li> </ul>	Beep tone heard  No beep tone	REPLACE EIC (speedo module).*  GO to TS2.
<b>TS2</b>	CHECK SWITCH WIRING CONNECTIONS		
	<ul style="list-style-type: none"> <li>• Remove trim panel to expose cluster.</li> <li>• Verify that connector from switch assembly to EIC is secure and properly aligned.</li> </ul>	OK OK	GO to TS3. SERVICE connector as required and RECHECK.
<b>TS3</b>	CHECK SWITCH ASSEMBLY		
	<ul style="list-style-type: none"> <li>• Remove switch module assembly and perform Pinpoint Test TE.</li> </ul>	OK OK	REPLACE EIC (speedo module).* REPLACE switch assembly.

\*When replacing EIC, affix odometer sticker to door pillar.

CK8756-A

## DIAGNOSIS (Continued)

## SPEED ALARM CANNOT BE SET, DOES NOT RESPOND TO SPEED ALARM BUTTON

TEST STEP		RESULT	ACTION TO TAKE
TT0	VERIFY CONDITION		
			GO to TT1.
TT1	REVIEW OPERATION		
	<ul style="list-style-type: none"> <li>Speed alarm will not set or button beep unless the vehicle is moving at least 20 MPH or 20 km/h (similar to speed control).</li> </ul>	(OK) → System OK. (X) → GO to TT2.	
TT2	CHECK FOR BUTTON TONE		
	<ul style="list-style-type: none"> <li>With vehicle traveling at least 20 km/h (20 MPH), press the SPEED ALARM button and listen for beep tone as button is activated.</li> </ul>	Beep tone heard → REPLACE EIC (speedo module).* No beep tone → GO to TT3.	
TT3	CHECK SWITCH WIRING CONNECTIONS		
	<ul style="list-style-type: none"> <li>Remove trim panel to expose cluster.</li> <li>Verify that connector from switch assembly to EIC is secure and properly aligned.</li> </ul>	(OK) → GO to TT4. (X) → SERVICE connector as required and RECHECK.	
TT4	CHECK SWITCH ASSEMBLY		
	<ul style="list-style-type: none"> <li>Remove switch module assembly and perform Pinpoint Test TE.</li> </ul>	(OK) → REPLACE EIC (speedo module).* (X) → REPLACE switch assembly.	

\*When replacing EIC, affix odometer sticker to door pillar.

CK8757-A

## DIAGNOSIS (Continued)

**"SERVICE" SYMBOL DOES NOT GO OUT WHEN RESET**

TEST STEP		RESULT	ACTION TO TAKE
TU0	VERIFY CONDITION		
			▶ GO to TU1.
TU1	VERIFY THREE BEEP ACKNOWLEDGEMENT		
<ul style="list-style-type: none"><li>• Verify that three beeps are received when service reminder is reset (push both the ODO SEL and TRIP RESET buttons at the same time).</li></ul>		<div>Ⓚ▶</div> <div>Ⓚ▶</div>	<div>REPLACE EIC (speedo module).*</div> <div>GO to TU2.</div>
TU2	CHECK ODO SEL BUTTON		
<ul style="list-style-type: none"><li>• Press ODO SEL button.</li><li>• The display should change between regular and trip odometers.</li></ul>		<div>Ⓚ▶</div> <div>Ⓚ▶</div>	<div>GO to TU3.</div> <div>GO to Pinpoint Test TE.</div>
TU3	CHECK TRIP RESET BUTTON		
<ul style="list-style-type: none"><li>• Call up trip odometer with the ODO SEL button.</li><li>• Press the TRIP RESET button.</li><li>• The trip odometer should zero.</li></ul>		<div>Ⓚ▶</div> <div>Ⓚ▶</div>	<div>REPLACE EIC (speedo module).*</div> <div>GO to Pinpoint Test TE.</div>

\*When replacing EIC, affix odometer sticker to door pillar.

CK8758-A

**DO NOT GET THREE BEEPS WHEN SERVICE REMINDER IS RESET**

TEST STEP		RESULT	ACTION TO TAKE
TV0	VERIFY CONDITION		
			▶ GO to TV1.
TV1	CHECK BUTTON BEEPS		
● Press the various buttons and listen for beep.		(OK) ▶ <del>(OK)</del> ▶	GO to TV2. GO to Pinpoint Test TE.
TV2	CHECK ODO SEL BUTTON		
● Press ODO SEL button. ● The display should change between regular and trip odometers.		(OK) ▶ <del>(OK)</del> ▶	GO to TV3. GO to Pinpoint Test TE.
TV3	CHECK TRIP RESET BUTTON		
● Call up trip odometer with the ODO SEL button. ● Press the TRIP RESET button. ● The trip odometer should zero.		(OK) ▶ <del>(OK)</del> ▶	REPLACE EIC (speedo module).* GO to Pinpoint Test TE.

\*When replacing EIC, affix odometer sticker to door pillar.

CK8759-A

## DIAGNOSIS (Continued)

## FUEL COMPUTER DISPLAY NOT ILLUMINATED, TOO DIM, OR TOTALLY BLACK

TEST STEP		RESULT	ACTION TO TAKE
<b>FA0</b>	VERIFY CONDITION		
			GO to <b>FA1</b> .
<b>FA1</b>	CHECK OTHER DISPLAYS		
	<ul style="list-style-type: none"> <li>• Turn ignition key to RUN position.</li> <li>• Check for back lighting of speedo/tach display.</li> </ul>	Other module OK	GO to <b>FA2</b> .
		Other module not OK	GO to <b>FA3</b> .
<b>FA2</b>	CHECK CONTINUITY OF ILLUMINATION CIRCUIT		
	<ul style="list-style-type: none"> <li>• Disconnect ground cable to battery.</li> <li>• Check for continuity on Circuit 168 between Pin 1C and Pin 12A.</li> </ul>	<div>OK</div>	REPLACE burned out bulb as outlined.
		<div>✗</div>	SERVICE wiring as required.
<b>FA3</b>	VERIFY ILLUMINATION GROUND		
	<ul style="list-style-type: none"> <li>• Disconnect ground cable to battery.</li> <li>• Remove cluster.</li> <li>• Reconnect battery cable.</li> <li>• Measure resistance between Pin 3C and Pin 11B (Circuit 57 continuity check).</li> <li>• Resistance should be less than 1 ohm.</li> </ul>	<div>OK</div>	GO to <b>FA4</b> .
		<div>✗</div>	SERVICE illumination ground (Circuit 57).
<b>FA4</b>	CHECK MODULE ILLUMINATION IN RUN AND WITH HEADLAMPS ON		
	<ul style="list-style-type: none"> <li>• Turn ignition to RUN position.</li> <li>• Check for display back lighting.</li> <li>• Turn headlamps on.</li> <li>• Move dimmer control to maximum brightness.</li> <li>• Check for display back lighting.</li> </ul>	Does not light in RUN or with headlamps on	GO to <b>FA5</b> .
		Illuminated in RUN but not with headlamps on	GO to <b>FA6</b> .
		Illuminated with headlamps on but not in RUN	GO to <b>FA5</b> .
		Illuminated but too dim	GO to <b>FA7</b> .
<b>FA5</b>	CHECK POWER TO BULBS (RUN)		
	<ul style="list-style-type: none"> <li>• Disconnect ground cable to battery.</li> <li>• Remove cluster.</li> <li>• Reconnect battery cable.</li> <li>• Measure voltage on LCD illumination line Pin 8C (Circuit 484/19).</li> </ul>	Greater than 10V	REPLACE EIC.*
		Less than 10V	SERVICE illumination circuits, fuses or headlamp switch.

\*When replacing EIC, affix odometer sticker to door pillar.

CK8760-A



## DIAGNOSIS (Continued)

## FUEL COMPUTER DISPLAY NOT ILLUMINATED, TOO DIM, OR TOTALLY BLACK — Continued

TEST STEP		RESULT	ACTION TO TAKE
<b>FA6</b>	CHECK POWER TO BULBS (HEADLAMPS ON)		
<ul style="list-style-type: none"> <li>• Disconnect ground cable to battery.</li> <li>• Remove cluster.</li> <li>• Reconnect battery cable.</li> <li>• Turn headlamp switch on.</li> <li>• Move dimmer control to maximum brightness.</li> <li>• Measure voltage on LCD illumination line Pin 8C (Circuit 484/19).</li> </ul>		Greater than 10V	REPLACE EIC.*
		Less than 10V	SERVICE illumination circuits, fuses or headlamp switch.
<b>FA7</b>	CHECK DISPLAY ILLUMINATION BULBS		
<ul style="list-style-type: none"> <li>• Disconnect ground cable to battery.</li> <li>• Remove cluster.</li> <li>• Reconnect battery cable and turn ignition switch to RUN.</li> <li>• Check bulbs for burned out filaments.</li> </ul>		Both bulbs on	GO to <b>FA8</b> .
		One or both bulbs burned out or blackened	REPLACE burned out bulb as outlined.
<b>FA8</b>	CHECK FOR CORRECT BULB TYPE		
<ul style="list-style-type: none"> <li>• Disconnect ground cable to battery.</li> <li>• Remove cluster.</li> <li>• Check for correct bulb type (Halogen).</li> </ul>		OK	GO to <b>FA5</b> (RUN) or <b>FA6</b> (Headlamps on).
		<del>OK</del>	REPLACE with correct bulb as outlined.

\*When replacing EIC, affix odometer sticker to door pillar.

CK8761-A

## DIAGNOSIS (Continued)

## FUEL COMPUTER/SYSTEM SCANNER MODULE DISPLAY BLANK (BUT BACK LIGHTED)

TEST STEP		RESULT	ACTION TO TAKE
<b>FB0</b>	<b>VERIFY CONDITION</b>		
	<ul style="list-style-type: none"> <li>Turn ignition to RUN position.</li> </ul>	Display back lighted but blank	GO to <b>FB1</b> .
<b>FB1</b>	<b>CHECK OTHER MODULE</b>		
	<ul style="list-style-type: none"> <li>Turn ignition to RUN position.</li> <li>Verify that speedo/tach module is functioning.</li> </ul>	(OK) → GO to <b>FB2</b> . (X) → GO to <b>FB4</b> .	
<b>FB2</b>	<b>CHECK VOLTAGE TO FUEL COMP/SYS SCANNER</b>		
	<ul style="list-style-type: none"> <li>Disconnect ground cable to battery.</li> <li>Remove cluster and secure connector from shorting.</li> <li>Reconnect battery cable.</li> <li>Turn ignition to RUN.</li> <li>Check that voltage on Circuit 298 (Pin 3A) and Circuit 797 (Pin 14A) is equal to battery voltage (10 V minimum).</li> </ul>	(OK) → GO to <b>FB3</b> . (X) → SERVICE Circuit 298 and/or 797 for open circuit.	
<b>FB3</b>	<b>CHECK FUEL COMP/SYS SCANNER GROUND</b>		
	<ul style="list-style-type: none"> <li>Check for continuity between Circuit 563 (Pin 10A) and battery ground cable.</li> </ul>	(OK) → REPLACE EIC (fuel comp module).* (X) → SERVICE module ground for open circuit from cluster to ground.	
<b>FB4</b>	<b>CHECK MODULE RUN FUSE CIRCUIT 298</b>		
	<ul style="list-style-type: none"> <li>Check for blown fuse in RUN Circuit 298.</li> </ul>	(OK) → GO to <b>FB2</b> . (X) → GO to <b>FB5</b> .	
<b>FB5</b>	<b>CHECK FOR SHORT IN CIRCUIT 298</b>		
	<ul style="list-style-type: none"> <li>Before replacing fuse:</li> <li>Turn ignition to OFF.</li> <li>Disconnect battery ground cable.</li> <li>Connect ohmmeter from Circuit 298 side of fuse to ground.</li> </ul>	No short → REPLACE fuse. Short → SERVICE Circuit 298 for shorts.	

\*When replacing EIC, affix odometer sticker to door pillar.

CK8762-A

## DIAGNOSIS (Continued)

## INSTANTANEOUS FUEL ECONOMY ALWAYS READS 0 MILES/GAL OR 99 L/100KM

TEST STEP		RESULT	ACTION TO TAKE
FC0	VERIFY CONDITION		
			▶ GO to FC1.
FC1	CHECK SPEEDO OPERATION		
● Verify that speedometer is operating properly.		OK ▶	GO to FC2.
		<del>OK</del> ▶	GO to Pinpoint Test TH.
FC2	CHECK MODULE INTERCONNECTION		
● Disconnect ground cable to battery.		OK ▶	REPLACE EIC (fuel comp module).*
● Remove cluster.			
● Check continuity of Circuit 565 between Pin 10C of speedo and Pin 18A of fuel computer.		<del>OK</del> ▶	SERVICE Circuit 565 as required.

\*When replacing EIC, affix odometer sticker to door pillar.

CK8763-A

## INSTANTANEOUS FUEL ECONOMY ALWAYS READS 99 MILES/GAL OR 0 L/100 KM

TEST STEP		RESULT	ACTION TO TAKE
FD0	VERIFY CONDITION		
			GO to FD1.
FD1	CHECK CONTINUITY OF CIRCUIT 305 (FUEL FLOW)		
<ul style="list-style-type: none"><li>Verify continuity and absence of shorts in Circuit 305.</li></ul>		<div>OK</div> <div><del>OK</del></div>	<div>GO to FD2.</div> <div>SERVICE wiring Circuit 305 as required.</div>
FD2	CHECK FOR FUEL FLOW PULSES		
<ul style="list-style-type: none"><li>Verify proper operation of fuel flow function in EEC. Refer to Engine/Emission Diagnosis manual.**</li></ul>		<div>OK</div> <div><del>OK</del></div>	<div>REPLACE EIC (fuel comp module).*</div> <div>SERVICE or REPLACE EEC or fuel flow sensor system as required.</div>

\*When replacing EIC, affix odometer sticker to door pillar.

\*\*Can be purchased as a separate item.

CK8764-A

## DIAGNOSIS (Continued)

## DTE ALWAYS READS ZERO MILES











TEST STEP		RESULT	ACTION TO TAKE
FE0	VERIFY CONDITION		
			GO to FE1.
FE1	CHECK CONTINUITY OF CIRCUIT 205		
	<ul style="list-style-type: none"> <li>• Disconnect ground cable to battery.</li> <li>• Remove cluster.</li> <li>• Check continuity of Circuit 205 Pin 16A to fuel sender.</li> </ul>	GO to FE2. <del>OK</del>	SERVICE wiring Circuit 205 for open.
FE2	CHECK FUEL SENDER RESISTANCE		
	<ul style="list-style-type: none"> <li>• Verify that fuel sender is in proper resistance range with full and empty tank by measuring the resistance between Pin 16A (Circuit 205) and Pin 10A (ground).</li> <li>• Resistance should be: Full Tank — Less than 5 ohms Empty Tank — Greater than 140 ohms</li> </ul>	OK <del>OK</del>	REPLACE EIC (fuel comp module).* SERVICE fuel sender and/or wiring Circuit 205 to cluster.

\*When replacing EIC, affix odometer sticker to door pillar.

CK8765-A

## DIAGNOSIS (Continued)

**FUEL COMPUTER DISPLAY SCRAMBLED, SEGMENTS HALF LIT (GHOST SEGMENTS),  
SEGMENTS BLINK OR MISSING, DISPLAY INCORRECT ALL THE TIME,  
DISPLAY STUCK WITH ALL SEGMENTS ON**

TEST STEP		RESULT	ACTION TO TAKE
<b>FF1</b>	<b>CHECK DISPLAY PROVE OUT</b>		
<ul style="list-style-type: none"> <li>Turn ignition from OFF to RUN and observe the display prove out.</li> </ul>		All segments prove out normally (all on, then all off) 	GO to FF2.
		 	REPLACE EIC (fuel comp module).*
<b>FF2</b>	<b>ENTER SELF-TEST MODE</b>		
<ul style="list-style-type: none"> <li>Hold FUEL ECON button in and then turn ignition from OFF to RUN.</li> <li>Observe "zeros" on upper digital display and then release the FUEL ECON button. (Note that a tone will be heard while in test mode).</li> </ul>		Display has F on it 	REPLACE EIC (fuel comp module).*
		Does not go into test mode (zeros did not appear or remains in normal operation mode) 	FUEL ECON button not held down or switch damaged. GO to Pinpoint Test TE.
		Display has P on it 	GO to FF3.
<b>FF3</b>	<b>ADVANCE TO DISPLAY TEST</b>		
<ul style="list-style-type: none"> <li>Enter test mode (step FF2).</li> <li>Advance to the display test portion (Step 12) of Self-Test by pressing the FUEL ECON button until Step 12, Display No. 1 under Fuel Computer/System Scanner Module Self-Test appears.</li> <li>Inspect the display for problems as the test is advanced through each step by pressing the FUEL ECON button. Verify that the displays match Step 12, Display No. 2 through Display No. 12 of Fuel Computer/System Scanner Module Self-Test.</li> <li>The last display step will turn all segments off.</li> </ul>		 	System OK.
		 	REPLACE EIC (fuel comp module).*

\*When replacing EIC, affix odometer sticker to door pillar.

CK8766-A

## DIAGNOSIS (Continued)

## FUEL COMPUTER MODULE WILL NOT SWITCH BETWEEN ENGLISH AND METRIC

TEST STEP		RESULT	ACTION TO TAKE
FG0	VERIFY CONDITION		
			▶ GO to <b>FG1</b> .
FG1	CHECK SPEEDO/TACH		
● Verify that English/Metric function is operating properly in the speedo/tach module.		OK ▶	GO to <b>FG2</b> .
		<del>OK</del> ▶	GO to Pinpoint Test <b>TF</b> .
FG2	CHECK CONTINUITY OF E/M CIRCUIT 506		
● Disconnect ground cable to battery.		OK ▶	REPLACE EIC (fuel computer module).*
● Remove cluster.			
● Check continuity of Circuit 506 between Pin 15A and Pin 4C.		<del>OK</del> ▶	SERVICE wiring Circuit 506 as required.

\*When replacing EIC, affix odometer sticker to door pillar.

CK8767-A

## FUEL GAUGE INOPERATIVE — POINTER DOES NOT MOVE — PINPOINT TEST A

TEST STEP		RESULT	ACTION TO TAKE
A1	VERIFY CONDITION		
● Verify condition.		Gauge pointer does not move	GO to A2.
		Gauge pointer moves	GO to B1.
A2	CHECK OTHER GAUGES		
● Check power to cluster. With ignition on, observe other gauges and warning lamps for proper operation. If necessary, use voltmeter or test lamp to verify voltage at B+ terminal of cluster connector.		Other gauges and warning lamps operate properly; voltage present at cluster	GO to B1.
		Other gauges and warning lamps do not operate properly; no voltage present at cluster	REPAIR power to cluster.

CK8572-A

## DIAGNOSIS (Continued)

## FUEL GAUGE INACCURATE — PINPOINT TEST B

TEST STEP		RESULT	ACTION TO TAKE
<b>B1</b>	TEST BOX CHECK		
	<ul style="list-style-type: none"> <li>Insert Instrument Gauge System Tester, Rotunda 021-00038 in sender circuit. Disconnect Circuit 14405 connector under instrument panel and connect tester to cluster side of connector. Set tester to LOW (22 ohms).</li> </ul>	Gauge reads E Pointer does not move	GO to <b>B2</b> . REPLACE gauge.
<b>B2</b>	TEST BOX CHECK		
	<ul style="list-style-type: none"> <li>Set tester to HIGH (145 ohms).</li> </ul>	Gauge reads F Gauge does not read F	GO to <b>B3</b> . REPLACE gauge.
<b>B3</b>	CHECK SENDER WIRING		
	<ul style="list-style-type: none"> <li>Check sender circuit wiring for shorts or open with ohmmeter.</li> </ul>	(OK) (X)	REPLACE sender. SERVICE wiring.

CK8573-B

MAGNETIC TEMP/OIL GAUGE INOPERATIVE — POINTER DOES NOT MOVE  
PINPOINT TEST C

TEST STEP		RESULT	ACTION TO TAKE
<b>C1</b>	VERIFY CONDITION		
	<ul style="list-style-type: none"> <li>Verify Condition.</li> </ul>	Gauge pointer does not move Gauge pointer moves	GO to <b>C2</b> . GO to <b>D1</b> .
<b>C2</b>	CHECK OTHER GAUGES		
	<ul style="list-style-type: none"> <li>Check power to cluster. With ignition on, observe other gauges and warning lamps for proper operation. If necessary, use voltmeter or test lamp to verify voltage at B+ terminal of cluster connector.</li> </ul>	Other gauges and warning lamps operate correctly; voltage present at cluster Other gauges and warning lamps do not operate correctly; no voltage present at cluster	GO to <b>D1</b> . SERVICE power to cluster.

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## DIAGNOSIS (Continued)

TEMP/OIL GAUGE INACCURATE  
PINPOINT TEST D

TEST STEP		RESULT	ACTION TO TAKE
<b>D1</b>	<b>TEST BOX CHECK</b>		
	<ul style="list-style-type: none"> <li>Insert Instrument Gauge, System Tester, Rotunda 021-00038 or equivalent in sender circuit. Disconnect connector at sender and connect tester to cluster side of connector. Set tester to LOW (73 ohms).</li> </ul>	Gauge reads C or L → Pointer does not move →	GO to <b>D2</b> . GO to <b>D3</b> .
<b>D2</b>	<b>TEST BOX CHECK</b>		
	<ul style="list-style-type: none"> <li>Set tester to HIGH (10 ohms).</li> </ul>	Gauge reads H → Gauge does not read H →	REPLACE sender. GO to <b>D3</b> .
<b>D3</b>	<b>CHECK SENDER WIRING</b>		
	<ul style="list-style-type: none"> <li>Check sender circuit wiring for shorts or open with ohmmeter, using Rotunda Digital Volt-Ohmmeter, or equivalent.</li> </ul>	(OK) → (X) →	REPLACE gauge. SERVICE wiring.

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## SPECIFICATIONS

<b>GAUGES</b>	
Size (Less Terminals)	29mm Diameter x 25mm Length (1.14 in. Diameter x 1 in. Length)
Weight (Less Dial and Pointer)	40 Grams (1.4 Ounces)
Mounting	Flange on Steel Body
Operating Temperature	-30°C to 80°C (-22°F to 176°F)
Pointer Travel	85° (Fuel) 90° (Temp. and Oil)
Electrical Connection	Three Pin Terminals
Operating Voltage	11-16 VDC

CK8578-B

## SPECIAL SERVICE TOOLS

<b>ROTUNDA EQUIPMENT</b>	
<b>Model</b>	<b>Description</b>
021-00038	Instrument Gauge System Tester
014-00407	Digital Volt/Ohmmeter

CK8580-B



# SECTION 33-10 Speedometer—Mechanical

SUBJECT	PAGE	SUBJECT	PAGE
DESCRIPTION AND OPERATION .....	33-10-1	REMOVAL AND INSTALLATION	
DIAGNOSIS AND TESTING .....	33-10-2	Speedometer/Odometer Assembly .....	33-10-1
MAJOR SERVICE OPERATIONS		SPECIFICATIONS .....	33-10-5
Cable Core and Casing, Damaged .....	33-10-1	VEHICLE APPLICATION .....	33-10-1
Drive and Driven Gears, Damaged .....	33-10-1		
Speedometer System Noisy .....	33-10-1		

## VEHICLE APPLICATION

Taurus/Sable.

## DESCRIPTION AND OPERATION

The speedometer is connected to the output shaft of the transmission by means of a flexible shaft (core), and a drive gear located inside the transmission. The core drives the speedometer which registers speed in miles per hour and also drives an odometer which records distance traveled in miles and tenths of a mile.

The core or flexible shaft is housed in a flexible casing.

## MAJOR SERVICE OPERATIONS

### Speedometer System Noisy

Applying heavy amounts of lubricant to the cable core will only stop the noise temporarily unless the actual source of noise is found and corrected. If the speed sensor or speedometer head are replaced, ensure that the square drive holes contain a sufficient amount of Silicone Damping Grease D7AZ-19A331-A (ESE-M1C171-A) or equivalent. If not, apply a 4.6mm (3/16-inch) diameter ball of damping grease into the drive holes as required.

### Cable Core and Casing, Damaged

1. To check for a kinked cable core, remove the core, clean it with solvent and wipe it dry. Lay the core out straight on a clean, flat surface and roll it back and forth. Any kinks or damage will be seen. Then take an end in each hand, allowing the core to hang in approximately a 229-304mm (9-12 inches) loop. Rotate both ends to ensure that the core turns evenly.
2. Routing of the cable is particularly important where the cable leaves the speedometer head. The optimum routing would provide that the cable and housing take virtually no change of direction for at least a length of 127mm (5-inches) from the speedometer head.
3. When installing a new cable (core and casing), it is necessary that extra care be taken to verify that the new assembly is guided and routed properly to eliminate any kinks.

4. Proper lubrication of the cable core is accomplished by a light application of Silicone Damping Grease D7AZ-19A331-A (ESE-M1C171-A) or equivalent after the cable has been wiped clean. A light film is all that is required.
5. Before connecting the cable assembly to the speedometer head, apply a 4.6mm (3/16-inch) diameter ball of Silicone Damping Grease D7AZ-19A331-A (ESE-M1C171-A) or equivalent to the drive hole of the speedometer head.

### Drive and Driven Gears, Damaged

1. A scored, nicked or gouged driven gear is usually indicative of improper gear mesh on those vehicles that have the drive gear integral with the transmission output shaft. The output shaft should be carefully inspected for imperfections and replaced if necessary.
2. A driven gear with two or three adjoining teeth badly scored is indicative of improper assembly procedure. The gear should be inserted in the transmission while simultaneously turning the driveshaft. This will ensure initial gear engagement and prevent gear damage. **Never use force.**
3. Whenever a drive gear is replaced, a new driven gear should also be installed, regardless of its apparent condition.

## REMOVAL AND INSTALLATION

### Speedometer/Odometer Assembly

Federal law requires that the odometer in any replacement speedometer must register the same mileage as that registered in the removed speedometer.

Refer to Section 33-01 for conventional speedometer removal and installation.

Refer to Section 33-05 for electronic speedometer removal and installation.

## DIAGNOSIS AND TESTING

The Ford Car Master Parts catalog and the Lincoln/Mercury Parts and Accessories catalog show the proper speedometer transmission gears to use for

various transaxle and tire size combinations. The correct gears must be used to comply with Federal law.

## NOISY, ERRATIC, INOPERATIVE, OR INACCURATE

TEST STEP		RESULT	ACTION TO TAKE
<b>A0</b>	<b>VERIFY CONDITION</b>		
	<ul style="list-style-type: none"> <li>Make sure quick connect is properly attached at speedometer head. Make sure cable is connected at the speed sensor, if applicable.</li> </ul>	Noisy ► Erratic or pointer waver ► Inoperative speed indication ► Inoperative odometer ► Inaccurate speed indication ►	GO to <b>A1</b> . GO to <b>A6</b> . GO to <b>A11</b> . GO to <b>A12</b> . GO to <b>A18</b> .
<b>A1</b>	<b>CHECK FOR NOISE</b>		
	<ul style="list-style-type: none"> <li>With engine running in neutral, check for noise.</li> </ul>	(OK) ► (X) ►	GO to <b>A2</b> . CHECK for other causes of vehicle noise.
<b>A2</b>	<b>CHECK SENSOR</b>		
	<ul style="list-style-type: none"> <li>Check sensor for erratic or noisy operation.</li> </ul>	(OK) ► (X) ►	GO to <b>A3</b> . REPLACE sensor.
<b>A3</b>	<b>CHECK CABLE</b>		
	<ul style="list-style-type: none"> <li>Check cable for kinks or bends.</li> </ul>	(OK) ► (X) ►	GO to <b>A4</b> . If kinks are severe, REPLACE cable. For minor bends, ADJUST cable routing to obtain generous curves and RECHECK for condition resolution.
<b>A4</b>	<b>CHECK CABLE (CONTINUED)</b>		
	<ul style="list-style-type: none"> <li>Disconnect cable and check core for kinks, burrs or bent tips.</li> </ul>	(OK) ► (X) ►	GO to <b>A5</b> . REPLACE core.
<b>A5</b>	<b>CHECK DRIVEN GEAR</b>		
	<ul style="list-style-type: none"> <li>Check for damaged driven gear.</li> </ul>	(OK) ► (X) ►	REPLACE speedometer head. REPLACE gear.

## DIAGNOSIS AND TESTING (Continued)

## NOISY, ERRATIC, INOPERATIVE, OR INACCURATE (Continued)

TEST STEP		RESULT	ACTION TO TAKE
<b>A6</b>	<b>CHECK SPEED SENSOR</b>		
	<ul style="list-style-type: none"> <li>Check speed sensor for erratic rotation or binding.</li> </ul>	(OK) ► (X) ►	GO to A7. REPLACE sensor.
<b>A7</b>	<b>CHECK CABLE</b>		
	<ul style="list-style-type: none"> <li>Check cable for kinks or bends in routing.</li> </ul>	(OK) ► (X) ►	GO to A8. If kinks or bends are severe, REPLACE cable. For minor bends, ADJUST cable routing to obtain generous curves and RECHECK for condition resolution.
<b>A8</b>	<b>CHECK DRIVEN GEAR</b>		
	<ul style="list-style-type: none"> <li>Check for damaged driven gear.</li> </ul>	(OK) ► (X) ►	GO to A9. REPLACE gear.
<b>A9</b>	<b>CHECK CORE</b>		
	<ul style="list-style-type: none"> <li>Disconnect cable and check core for kinks, burrs, or bent tips.</li> </ul>	(OK) ► (X) ►	GO to A10. REPLACE core.
<b>A10</b>	<b>RECHECK CORE</b>		
	<ul style="list-style-type: none"> <li>Reinstall core and turn by hand to feel for rough or irregular motion.</li> </ul>	(OK) ► (X) ►	REPLACE speedometer head. REPLACE cable.
<b>A11</b>	<b>CHECK ODOMETER</b>		
	<ul style="list-style-type: none"> <li>Check to see that odometer is operating.</li> </ul>	(OK) ► (X) ►	REPLACE speedometer head. GO to A13.
<b>A12</b>	<b>CHECK POINTER OPERATION</b>		
	<ul style="list-style-type: none"> <li>Check to see that pointer operates.</li> </ul>	(X) ► (OK) ►	GO to A13. REPLACE speedometer head.

## DIAGNOSIS AND TESTING (Continued)

## NOISY, ERRATIC, INOPERATIVE, OR INACCURATE (Continued)

TEST STEP		RESULT	ACTION TO TAKE
<b>A13</b>	<b>CHECK MAGNET SHAFT</b>		
	<ul style="list-style-type: none"> <li>Disconnect cable and check that magnet shaft in speedometer head turns freely.</li> </ul>	(OK) ► (X) ►	GO to <b>A14</b> . REPLACE speedometer head.
<b>A14</b>	<b>CHECK DRIVE AND DRIVEN GEAR</b>		
	<ul style="list-style-type: none"> <li>Check drive and driven gear for damage or wear.</li> </ul>	(OK) ► (X) ►	GO to <b>A15</b> . REPLACE damaged gear.
<b>A15</b>	<b>CHECK CABLE</b>		
	<ul style="list-style-type: none"> <li>Check speedometer cable for kinks or improper routing.</li> </ul>	(OK) ► (X) ►	GO to <b>A16</b> . REPLACE cable.
<b>A16</b>	<b>CHECK SENSOR SHAFT</b>		
	<ul style="list-style-type: none"> <li>Disconnect cable from speed sensor and check that shaft in sensor turns freely.</li> </ul>	(OK) ► (X) ►	GO to <b>A17</b> . REPLACE sensor.
<b>A17</b>	<b>CHECK CORE</b>		
	<ul style="list-style-type: none"> <li>Check for broken core.</li> </ul>	(OK) ► (X) ►	If core is seized and will not turn, REPLACE cable. REPLACE core.
<b>A18</b>	<b>CHECK ODOMETER</b>		
	<ul style="list-style-type: none"> <li>Check accuracy of odometer over a measured distance.</li> </ul>	(X) ► (OK) ►	GO to <b>A19</b> . REPLACE speedometer head.
<b>A19</b>	<b>CHECK DRIVEN GEAR</b>		
	<ul style="list-style-type: none"> <li>Check for proper driven gear.</li> </ul>	(OK) ► (X) ►	GO to <b>A20</b> . REPLACE gear.
<b>A20</b>	<b>CHECK DRIVE GEAR, AXLE AND TIRES</b>		
	<ul style="list-style-type: none"> <li>Check for proper drive gear, axle and tires.</li> </ul>	(OK) ► (X) ►	REPLACE speedometer head. REPLACE incorrect component or driven gear.

**SPECIFICATIONS****TORQUE SPECIFICATIONS**

Description	N·m	Lb·Ft
Speedometer Cable or Speed Sensor Nut	3.4-4.5	2.5-3.3

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**SPEEDOMETER CALIBRATION TOLERANCE SPECIFICATIONS**

Vehicle	48 km/h (30 mph) Actual Speed	97 km/h (60 mph) Actual Speed	Odometer Measure Over Actual 16.1 km Distance (10 Mile)
Actual Vehicle (Indicated)	45-56 km/h (28-35 mph)	93-109 km/h (58-68 mph)	15.4-16.7 km (9.6-10.4 Miles)

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# SECTION 33-11 Tachometer

SUBJECT	PAGE	SUBJECT	PAGE
DESCRIPTION AND OPERATION .....	33-11-1	REMOVAL AND INSTALLATION .....	33-11-1
DIAGNOSIS .....	33-11-2	VEHICLE APPLICATION .....	33-11-1

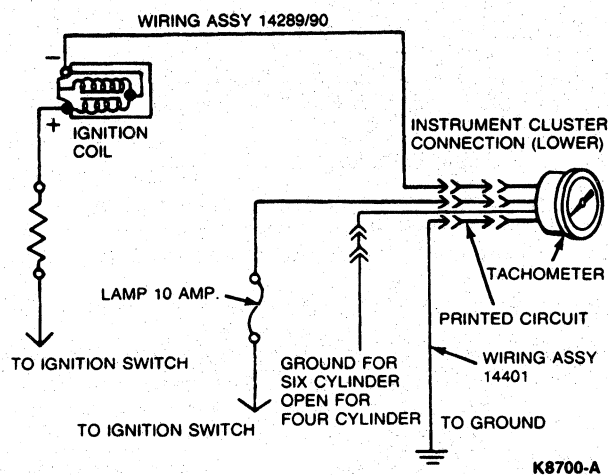
## VEHICLE APPLICATION

Taurus/Sable.

## DESCRIPTION AND OPERATION

The tachometer is an electrically operated instrument which indicates engine speed in revolutions per minute (rpm). The tachometer range is 0 to 7000 rpm.

The tachometer is mounted in the instrument cluster assembly. The schematic wiring diagram shows the tachometer system.

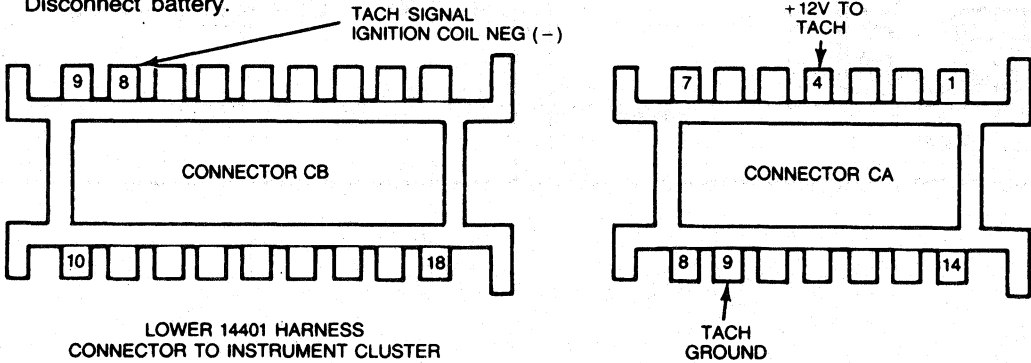


## REMOVAL AND INSTALLATION

Refer to Section 33-01.

## DIAGNOSIS

## INOPERATIVE, ERRATIC, WRONG INDICATION

TEST STEP		RESULT	ACTION TO TAKE
<b>A0</b>	<b>CHECK OPERATION</b>		
	<ul style="list-style-type: none"> <li>Check tachometer operation.</li> </ul>	Inoperative Erratic or wrong indication	GO to A1. GO to A2.
<b>A1</b>	<b>CHECK FUSE</b>		
	<ul style="list-style-type: none"> <li>Check tachometer fuse.</li> </ul>	<del>OK</del> OK	REPLACE fuse. GO to A2.
<b>A2</b>	<b>CHECK WIRING</b>		
	<ul style="list-style-type: none"> <li>Check for loose wiring connections in engine compartment and at instrument cluster.</li> </ul>	<del>OK</del> OK	SECURE loose connections. GO to A3.
<b>A3</b>	<b>CHECK RESISTANCE AND VOLTAGE</b>		
	<ul style="list-style-type: none"> <li>Disconnect battery.</li> <li>Remove instrument cluster and make resistance and voltage checks at lower 14401 wire harness connectors CA and CB as follows (refer to pin locations below):</li> <li>(1) Check pin 9-CA resistance to chassis ground — should read 1 ohm or less.</li> <li>(2) Check pin 8-CB resistance to negative terminal of ignition coil (gasoline engine) or positive terminal of magnetic sensor on injection pump (diesel engine) — should be 1 ohm or less.</li> <li>(3) Connect battery. Turn ignition switch on. Check for +12V at pin 4-CA. Turn ignition switch off. Disconnect battery.</li> </ul>	<del>OK</del> OK	Condition is not in tachometer. SERVICE wiring. GO to A4.
 <p>Diagram showing the LOWER 14401 HARNESS CONNECTOR TO INSTRUMENT CLUSTER. It includes two connector diagrams: Connector CB (pins 9, 8, 10, 18) and Connector CA (pins 7, 4, 1, 8, 9, 14). Pin 9 of Connector CB is labeled 'TACH SIGNAL IGNITION COIL NEG (-)'. Pin 4 of Connector CA is labeled '+12V TO TACH'. Pin 9 of Connector CA is labeled 'TACH GROUND'.</p>			
<b>A4</b>	<b>CHECK RETENTION NUTS</b>		
	<ul style="list-style-type: none"> <li>Check for loose tachometer connector clips on rear of instrument cluster, or damaged printed circuit.</li> </ul>	<del>OK</del> OK	TIGHTEN or REPLACE clips. REPLACE printed circuit. REPLACE tachometer.

# SECTION 33-15 Clock

SUBJECT	PAGE	SUBJECT	PAGE
DESCRIPTION AND OPERATION .....	33-15-1	REMOVAL AND INSTALLATION .....	33-15-2
DIAGNOSIS		VEHICLE APPLICATION .....	33-15-1
Clock Connector .....	33-15-2		

## VEHICLE APPLICATION

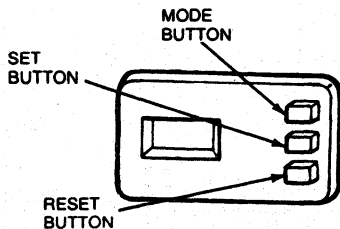
Taurus/Sable.

## DESCRIPTION AND OPERATION

The electronic digital clock displays time in a 12-hour format. Display dims when headlamps are on.

To set TIME (TIME mode designated by non-flashing colon) press:

1. MODE button.
2. RESET button to select hours.
3. SET button to change hours and AM or PM.
4. RESET button to select minutes.
5. SET button to change minutes.
6. RESET to return to TIME.



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To set DATE (DATE mode designated by absence of colon) press:

1. MODE button.
2. RESET button to select month.
3. SET button to change month.
4. RESET button to select days.
5. SET button to change day.
6. RESET button to return to DATE.

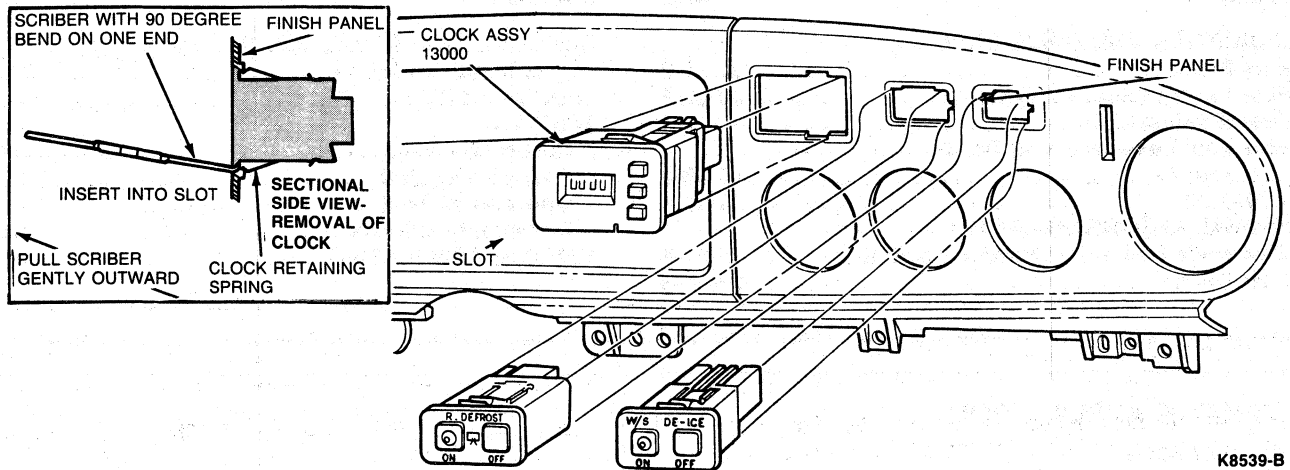
To set ELAPSED-TIME (ELAPSED-TIME designated by flashing colon) press:

1. MODE button.
2. SET button to stop and start ELAPSED-TIME.
3. RESET button to zero ELAPSED-TIME.
4. MODE button to return to TIME.



## REMOVAL AND INSTALLATION

1. Using a 90 degree bent scriber or a similar hardened steel tool, insert the bent end of scriber into slot at bottom center of clock.



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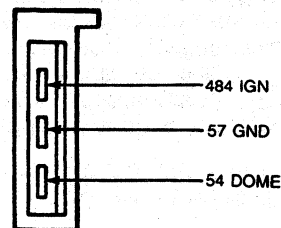
2. Gently pull scriber outward until bottom clock retaining spring releases.
3. Grasp clock and pull outward to remove.
4. Disconnect electrical connector.
5. To install, connect electrical connector and snap clock back into proper place.

## DIAGNOSIS

NOTE: Clock display can be read with ignition off. Display illuminates with the ignition switch in the ACC or RUN position.

1. Check fuse on dome circuit 54.
2. Check GND circuit 57.
3. Bulb should light when ignition switch is in RUN position. Check circuit 484.

### Clock Connector



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# SECTION 33-20 Fuel Indicating System—Conventional

SUBJECT	PAGE	SUBJECT	PAGE
<b>DESCRIPTION AND OPERATION</b>		<b>REMOVAL AND INSTALLATION (Cont'd.)</b>	
Fuel Filter .....	33-20-2	Fuel Sending Unit .....	33-20-2
Fuel Level Indicating System .....	33-20-1	<b>SPECIAL SERVICE TOOLS</b> .....	33-20-7
Fuel Sending Unit .....	33-20-1	<b>TESTING</b>	
Low Fuel Level Warning Switch		Calibration Test .....	33-20-4
Assembly .....	33-20-2	Fuel Sender Unit .....	33-20-4
<b>DIAGNOSIS</b> .....	33-20-5	Operational Test .....	33-20-3
<b>REMOVAL AND INSTALLATION</b>		Preliminary Checks .....	33-20-3
Electronic Low Fuel Warning Assembly .....	33-20-3	<b>VEHICLE APPLICATION</b> .....	33-20-1
Fuel Gauge .....	33-20-3		

## VEHICLE APPLICATION

Taurus/Sable.

## DESCRIPTION AND OPERATION

The fuel indicating system covered in this Section is for conventional cluster applications only. For information on the fuel indicating system used with the electronic clusters, refer to Section 33-05.

### Fuel Level Indicating System

The fuel level indicating system is a "magnetic" type indicating system, which consists of the sending unit located in the fuel tank, and a fuel gauge located in the instrument cluster.

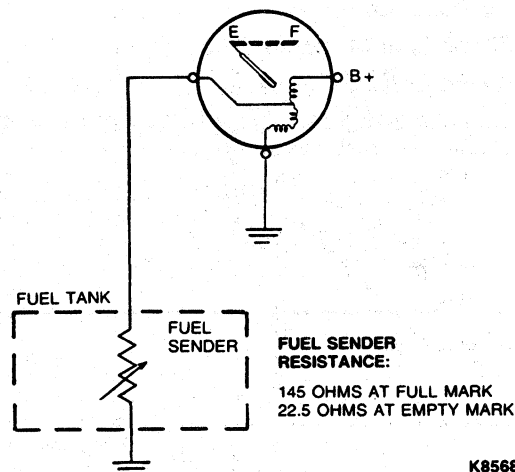
The sending unit changes resistance according to the level of fuel in the fuel tank, which varies the current flow through the gauge. The pointer position varies proportionately to the current flow. In this system, the sending unit resistance is low when the fuel level is low and high when the fuel level is high.

The pointer of the magnetic gauge remains in position when the ignition is turned off.

**NOTE:** The fuel gauge pointer may show some movement during normal driving due to fuel movement in the tank.

### Fuel Sending Unit

The fuel sending unit consists of a variable resistor controlled by the level of an attached float in the fuel tank. When the fuel level is low, resistance in the sender is low and movement of the gauge indicator dial is minimal (from EMPTY position). When the fuel level is high, the resistance in the sender is high and gauge indicator dial movement is greater (further from the EMPTY position).





**REMOVAL AND INSTALLATION (Continued)**

4. Disconnect tank lines at sending unit.
5. Disconnect wiring connector from fuel sender.
6. Turn sending unit locking ring counterclockwise using Fuel Tank Sender Wrench T86T-9275-A or equivalent. Remove locking ring, sending unit, and sealing gasket.

**Installation**

1. Clean fuel gauge sending unit mounting surface at fuel tank.
2. Position a new sealing gasket and sending unit on fuel tank. Secure by rotating locking ring clockwise against stop.
3. Connect fuel tank lines and wiring connector.
4. Install fuel tank. Secure fuel tank band straps.
5. Fill tank.
6. Check fuel gauge operation and check for fuel leaks.

**Fuel Gauge****Removal**

1. Remove instrument cluster finish panel retaining screws and remove finish panel. Refer to Section 33-01.
2. On Sable vehicles with tachometer cluster, remove lower trim panel attaching screws and remove trim panel.
3. Remove eight mask-and-lens mounting screws and remove mask and lens.
4. On Sable vehicles with tachometer cluster, remove two lower floodlamp bulb and socket assemblies.
5. Lift main dial assembly from backplate.  
NOTE: The gauges are mounted to main dial, and some effort may be required to pull quick-connect electrical terminals from clips.
6. On column shift vehicles only, remove two screws attaching transmission selector indicator (PRNDL or PRNⓈD1) to main dial and remove indicator from cluster.
7. Manually rotate pointer to align it with slot in dial. Remove mounting screws and carefully pull gauge away from dial, guiding pointer through slot.

**Installation**

1. Carefully position pointer parallel to rectangular raised portion of dial.

**CAUTION: The gauges are calibrated at the factory. Excessively rough handling could disturb the calibration.**

2. Guide the pointer carefully through slot in main dial. Then, position gauge on mounting bosses and install mounting screws. Tighten screws to 0.8-1.4 N·m (7-12 lb-in).

3. On column shift vehicles, install transmission selector indicator.
4. Install main dial assembly to cluster backplate by aligning it on guides. Press carefully and firmly to seat all electrical terminals.
5. On Sable vehicles with tachometer cluster, install two lower floodlamp bulb and socket assemblies.
6. Position mask-and-lens assembly and install eight mask-and-lens attaching screws.
7. On Sable vehicles with tachometer cluster, install lower trim panel.
8. Install instrument cluster finish panel as outlined in Section 33-01.

**Electronic Low Fuel Warning Assembly****Removal and Installation**

1. Remove instrument cluster as outlined in Section 33-01.
2. Remove screw attaching assembly to cluster and remove assembly.
3. To install, position assembly on cluster and install attaching screw. Tighten screw to 0.8-1.4 N·m (7-12 lb-in).
4. Install instrument cluster as outlined in Section 33-01.

**TESTING****Preliminary Checks**

1. Visually inspect fuel tank for damage. A fuel tank that is collapsed or distorted from its normal shape will seriously affect fuel indicating system operation.
2. A vehicle may be encountered where fuel tank does not fill completely. This will result in the fuel gauge not reaching FULL mark. Check by shaking vehicle after first fuel blow-back or pump nozzle cutoff and then slowly metering fuel into tank with shut-off nozzle withdrawn to just inside the leaded fuel restrictor door. If fuel gauge reaches full after this procedure, fuel indication system is operating satisfactorily.

**Operational Test**

Follow the instructions with the Rotunda Instrument Gauge System Tester 021-00038 or equivalent. If a tester is not available, refer to Diagnosis, Pinpoint Tests A and B.

**TESTING (Continued)****Calibration Test**

The required test equipment consists of a Rotunda Instrument Gauge System Tester 021-00038 or equivalent, a pair of 22 ohm and 145 ohm resistors or another fuel sender of known quality.

**If test is performed with the resistors:** Disconnect the wiring connector at the sender unit, connect the resistor between the gauge lead and a suitable ground, and turn ignition switch to the ON position. With the 145 ohm resistor, the gauge pointer should contact the FULL mark at minimum edge of pointer to edge of mark. With the 22 ohm resistor, the gauge pointer should contact the EMPTY mark (edge of pointer to edge of mark).

**If the test is performed with a fuel sender of known quality, use the following procedure:**

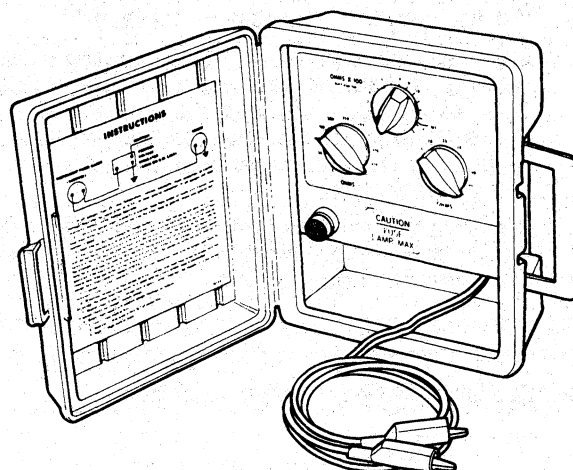
1. Disconnect the wiring connector from the sender and connect it to the test sender.
2. Turn ignition switch to the ON position.
3. Move the float rod against the FULL stop position (away from the fuel filter). The gauge should read on or above the FULL mark.
4. Move the float rod against the EMPTY stop position (toward the fuel filter). The gauge should read on or below the EMPTY mark.

NOTE: Allow the gauge to stabilize approximately two minutes at each stop.

5. If the gauge performs as indicated, perform the fuel sender unit test(s).
6. If the gauge is out of calibration at the EMPTY mark, or both the EMPTY and FULL mark, replace the gauge.

**Fuel Sender Unit****In Vehicle Test**

1. Inspect fuel tank for distortion or damage.  
NOTE: If the fuel tank is distorted or damaged, it must be serviced or replaced before further testing. Refer to Bench Test procedure if fuel sender is removed from fuel tank.
2. Connect one lead of an ohmmeter to the ground terminal of the fuel sender connector, the other lead to the variable resistor terminal. Follow manufacturers terminal connector application on the tester.



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**Ohmmeter should read between 15 and 160 ohms.**

If the fuel sender resistance is above 160 ohms or below 15 ohms, replace the fuel sender.

3. Fill the fuel tank to capacity. The ohmmeter reading should be between 145 and 160 ohms resistance.  
If the FULL fuel tank fuel sender resistance reading is below 145 ohms or above 160 ohms, the fuel sender unit must be replaced.
4. Use Rotunda Gasoline Tanker 034-00002 and Adapter Hose 034-00011 or equivalents. Then, drain all the fuel from the fuel tank observing the ohmmeter reading while the fuel tank is being drained. Resistance should increase smoothly without jumping or hesitating. If resistance reading jumps or hesitates, replace fuel sender unit.
5. When the fuel tank is empty, the ohmmeter reading should be between 15 and 22 ohms resistance.  
If the EMPTY tank's fuel sender resistance reading is below 15 ohms or above 22 ohms, replace the fuel sender unit.

**Bench Test**

1. Connect one lead of a Rotunda Digital Multimeter 007-00001, AC/DC Ohmmeter or equivalent to the ground terminal of the fuel sender connector, and the other lead to the variable resistor terminal.

When the float rod is against the EMPTY stop (closest to the fuel filter), the sender resistance reading should be 14-18 ohms.

## TESTING (Continued)

If the EMPTY fuel tank sender resistance reading is below 14 ohms or above 18 ohms, the fuel sender unit must be replaced.

2. Observe the ohmmeter reading while slowly moving the float between the EMPTY and FULL float rod stops. The resistance increase or decrease should be smooth without jumping or hesitation. The ohmmeter should read between 14 and 165 ohms.

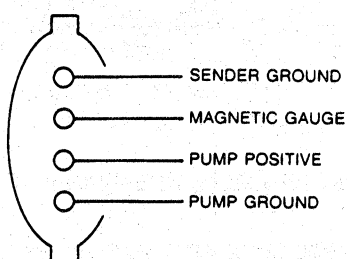
If resistance reading jumps or hesitates while slowly moving the float rod, the fuel sender must be replaced.

3. Move the float rod to the FULL STOP position (furthest away from fuel filter). The ohmmeter should read between 155 and 165 ohms of resistance.

If the ohmmeter reading is below 155 ohms or above 165 ohms resistance, the fuel sender must be replaced.

4. Before installing a fuel sender unit, the wire harness connector should be connected to the fuel sender unit and the float rod moved from the EMPTY to FULL stops to check the fuel gauge readings.

## Sender Unit Connector Pin Locations



NOTE: Check the float before installing a fuel sender unit in the fuel tank. Ensure the float rod is not bent and that the float is not:

- a. Badly distorted/damaged.
- b. Hitting the filter.
- c. Filled with fuel.
- d. Loose on float rod.

Check the fuel sender locating tabs. Ensure the tabs are not bent, allowing the sender unit to rotate on the gasket surface as the locking ring is installed.

## DIAGNOSIS

Refer to the following charts for magnetic gauge diagnosis.

## FUEL GAUGE INOPERATIVE — POINTER DOES NOT MOVE — PINPOINT TEST A

TEST STEP		RESULT	ACTION TO TAKE
A1	VERIFY CONDITION		
	<ul style="list-style-type: none"> <li>Verify condition.</li> </ul>	Gauge pointer does not move Gauge pointer moves	GO to A2. GO to B1.
A2	CHECK OTHER GAUGES		
	<ul style="list-style-type: none"> <li>Check power to cluster. With ignition on, observe other gauges and warning lamps for proper operation. If necessary, use voltmeter or test lamp to verify voltage at B+ terminal of cluster connector.</li> </ul>	Other gauges and warning lamps operate properly; voltage present at cluster Other gauges and warning lamps do not operate properly; no voltage present at cluster	GO to B1. REPAIR power to cluster.

CK8572-A

## DIAGNOSIS (Continued)

## FUEL GAUGE INACCURATE — PINPOINT TEST B

TEST STEP		RESULT	ACTION TO TAKE
<b>B1</b>	TEST BOX CHECK		
	<ul style="list-style-type: none"> <li>Insert Instrument Gauge System Tester, Rotunda 021-00038 in sender circuit. Disconnect Circuit 14405 connector under instrument panel and connect tester to cluster side of connector. Set tester to LOW (22 ohms).</li> </ul>	Gauge reads E Pointer does not move	GO to <b>B2</b> . REPLACE gauge.
<b>B2</b>	TEST BOX CHECK		
	<ul style="list-style-type: none"> <li>Set tester to HIGH (145 ohms).</li> </ul>	Gauge reads F Gauge does not read F	GO to <b>B3</b> . REPLACE gauge.
<b>B3</b>	CHECK SENDER WIRING		
	<ul style="list-style-type: none"> <li>Check sender circuit wiring for shorts or open with ohmmeter.</li> </ul>	OK OK	REPLACE sender. SERVICE wiring.

CK8573-B

## INDICATOR LAMP STAYS ON CONTINUALLY — MORE THAN 1/4 TANK OF FUEL — PINPOINT TEST C

TEST STEP		RESULT	ACTION TO TAKE
<b>C1</b>	VERIFY CONDITION		
	<ul style="list-style-type: none"> <li>Verify condition.</li> </ul>	Indicator lamp stays on with more than 1/4 tank of fuel.	GO to <b>C2</b> .
<b>C2</b>	CHECK LAMP		
	<ul style="list-style-type: none"> <li>Disconnect Circuit 14405 connector under instrument panel and connect a 33 ohm resistor between fuel sender feed to gauge and ground.</li> </ul>	Indicator lamp on. Gauge pointer should indicate approximately 1/16 tank. Indicator lamp off	GO to <b>C3</b> . REPLACE ELFW module at instrument cluster.
<b>C3</b>	REPLACE RESISTOR		
	<ul style="list-style-type: none"> <li>Replace the resistor from test E2 with a 56 ohm resistor.</li> </ul>	With ignition switch in ON/ACC, indicator lamp is off. Gauge pointer should indicate approximately 1/4 tank. Indicator lamp on	REPLACE ELFW module at instrument cluster.

CK8946-B

## INDICATOR LAMP STAYS OFF CONTINUALLY — PINPOINT TEST D

TEST STEP		RESULT	ACTION TO TAKE
D1	VERIFY CONDITION	Indicator lamp stays off.	GO to D2.
	<ul style="list-style-type: none"> <li>• Verify condition.</li> </ul>		
D2	CHECK INDICATOR LAMP	Indicator lamp on  Indicator lamp off	GO to E2.  CHECK power circuit to lamp REPLACE lamp.
	<ul style="list-style-type: none"> <li>• With ignition switch in the ON/ACC position, ground lamp circuit between lamp and Low Fuel Module.</li> </ul>		

CK8947-B

## SPECIAL SERVICE TOOLS

Tool Number	Description
T86T-9275-A	Fuel Tank Sender Wrench

CK8949-A

## ROTUNDA EQUIPMENT

Model	Description
Rotunda 007-00001	Digital Volt-Ohm Meter
Rotunda 021-00038	Instrument Gauge System Tester
Rotunda 034-00002	Gasoline Tanker
Rotunda 034-00011	Gasoline Tanker Adapter Hose

CK8392-C



# SECTION 33-30 Charge Indicator—Lamp

SUBJECT	PAGE	SUBJECT	PAGE
DESCRIPTION AND OPERATION .....	33-30-1	TESTING .....	33-30-1
REMOVAL AND INSTALLATION .....	33-30-2	VEHICLE APPLICATION .....	33-30-1

## VEHICLE APPLICATION

Taurus/Sable.

## DESCRIPTION AND OPERATION

A red alternator charge indicator lamp is located in the instrument cluster. This lamp glows when there is no alternator output.

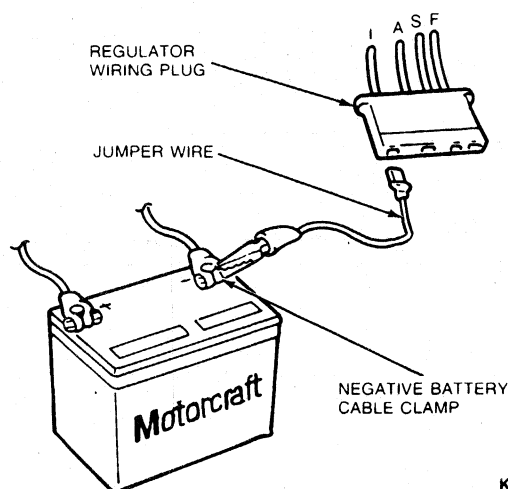
When the ignition switch contacts are closed (switch turned on), battery current flows through the charge indicator lamp and the parallel resistor (500 ohm), to the regulator and the lamp comes on.

When the alternator builds up enough voltage to energize a circuit in the voltage regulator, the charge indicator lamp goes out.

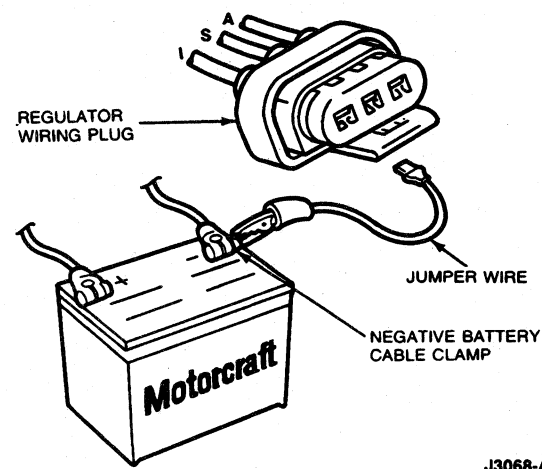
## TESTING

1. If the charge indicator lamp does not come on, disconnect the wiring plug connector from the regulator. Connect a jumper wire from wiring connector I terminal to battery negative post cable clamp.
2. Turn ignition to RUN position with engine off. If indicator lamp does not light, check for presence of bulb socket resistor. If resistor is missing, replace bulb socket. If resistor is present, check for contact of bulb socket leads to the flexible printed circuit. If good, check indicator bulb for continuity and replace bulb if burned out. If bulb checks good, perform regulator I circuit test.
3. If indicator lamp does light, remove jumper wire and reconnect wiring plug to regulator. Connect voltmeter negative lead to battery negative post cable clamp and contact voltmeter positive lead to regulator A terminal screw. Battery voltage should be indicated. If battery voltage is not indicated, service A circuit wiring.

## EVR System



## IAR System



**REMOVAL AND INSTALLATION**

Remove instrument cluster to gain access to the indicator bulb. Refer to Section 33-01.

To remove indicator bulb, turn bulb and socket assembly one-quarter turn counterclockwise and remove. To install, position new bulb and socket assembly to printed circuit and turn it clockwise one-quarter turn.

**NOTE:** The indicator bulb and socket assembly has an integral resistor and must be replaced with the same type.

# SECTION 33-34 Oil Pressure Indicator—Lamp

SUBJECT	PAGE	SUBJECT	PAGE
DESCRIPTION AND OPERATION .....	33-34-1	TESTING .....	33-34-1
REMOVAL AND INSTALLATION		VEHICLE APPLICATION .....	33-34-1
Indicator Lamp .....	33-34-2		
Switch Unit .....	33-34-2		

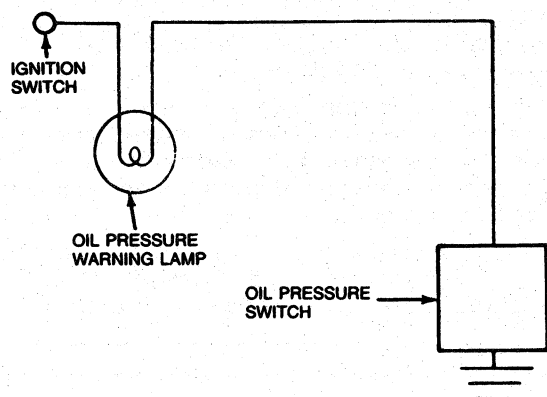
## VEHICLE APPLICATION

Taurus/Sable.

## DESCRIPTION AND OPERATION

A red indicator lamp glows when the oil pressure is below a prescribed value. The lamp should come on when the ignition switch is first turned to the RUN position. The indicator lamp should go out within a few seconds after the engine starts, indicating that the oil pressure is OK.

The lamp is connected between the oil pressure switch unit (mounted on the engine) and the coil terminal of the ignition switch.



K6408-B

## TESTING

To test the indicator lamp, turn the ignition switch to RUN. Do not start the engine. The lamp should come on. Start the engine. The lamp should go out, indicating that the oil pressure is OK.

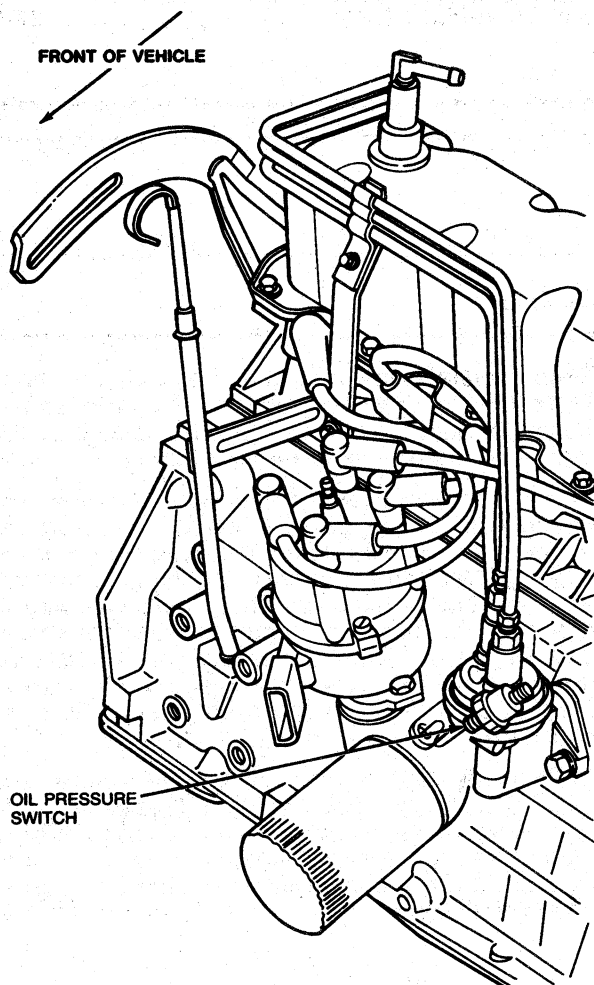
To test the oil pressure switch on the engine, turn the ignition switch to RUN but do not start the engine. The indicator lamp should come on. If the indicator lamp does not come on, remove the wire from the switch terminal and connect the wire to ground. If the lamp now comes on, the oil pressure switch is inoperative, or not properly grounded to the engine. If the lamp does not come on, the warning lamp is burned out or the system wiring is open circuited.

If the lamp stays on with the engine running and good oil pressure, disconnect the oil pressure switch lead wire. If the lamp goes out, replace the oil pressure switch. If the lamp does not go out, check for a short circuit in the wiring from the oil pressure switch to the bulb.

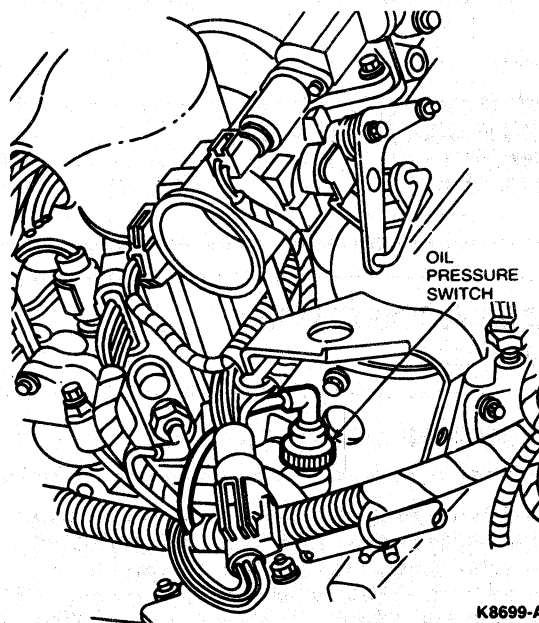
## REMOVAL AND INSTALLATION

**Switch Unit****Removal and Installation**

The oil pressure switch unit is mounted as shown.

**2.5L CFI Engine**

K6409-B

**3.0L EFI Engine**

K8699-A

To remove switch unit, disconnect wire at unit terminal and unscrew unit from its mounting. Install new switch unit and tighten to 11-24 N·m (8-18 lb-ft). Connect wire to unit terminal, and check operation of unit. Be sure to use Teflon® Tape D0AZ-19554-C or equivalent, or Electrically Conductive Water Resistant Sealer C3AZ-19554-B or equivalent on threads of unit.

The pressure switch-type unit used with the indicator lamp system is **not** interchangeable with the variable resistance-type unit (sender) used with gauge system. Refer to the master parts catalog for proper parts usage.

**CAUTION:** Installation of the wrong part will result in an inoperative oil pressure indicating system and a damaged sender unit or gauge.

**Indicator Lamp****Removal and Installation**

It is necessary to remove the instrument cluster to gain access to the indicator bulb. Refer to Section 33-01.

To remove the indicator bulb, turn the bulb and socket assembly one-quarter turn counterclockwise and remove. To install, position the new bulb and socket assembly to the printed circuit and turn it clockwise one-quarter turn.

# SECTION 33-40 Warning Indicator—Low Oil Level

SUBJECT	PAGE	SUBJECT	PAGE
DESCRIPTION .....	33-40-1	REMOVAL AND INSTALLATION	
DIAGNOSIS AND TESTING		Sensor .....	33-40-4
Sensor Test .....	33-40-2	VEHICLE APPLICATION .....	33-40-1
System Check .....	33-40-2		

## VEHICLE APPLICATION

Taurus/Sable.

## DESCRIPTION

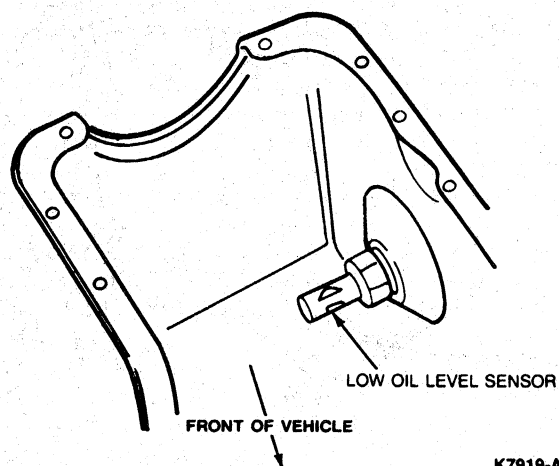
This system consists of a float-type sensor mounted to the side of the engine oil pan, an electronic control module and an instrument panel warning lamp. The warning lamp should come on during engine starting as a bulb prove-out. When the ignition switch is turned to the RUN or START position, the control module determines whether the sensor is grounded (oil low) or ungrounded (oil not low). If the oil level is adequate, the light will go out in RUN. If oil level is approximately 1.4 liters (1.5 quarts) or more low, the relay turns the warning lamp on. The lamp remains on until the oil level is no longer low, or the ignition is turned off. After the ignition is turned off, the module will reset for approximately 90-150 seconds. The delay allows time for oil drainback before another reading is allowed to occur. If the engine is restarted during this delay period, the last reading will be displayed.

### Low Oil Level Warning Lamp



K6969-B

## Sensor Installation



K7919-A

## DIAGNOSIS AND TESTING

### System Check

With oil at FULL mark on dipstick and the engine oil warm to ensure that the oil drains properly from the oil sensor, turn ignition to ON and start engine. Warning lamp should come on briefly in START for bulb prove-out, then go out. Turn engine off. Drain 1.9 liters (2 quarts) of oil from engine. Wait about 150 seconds, then restart engine. Warning lamp should come on and stay on.

If lamp does not come on, check the following:

- Lamp.
- Fuse.
- Low oil level relay.
- Low oil level sensor.

### Sensor Test

Connect positive lead of a VOM to sensor terminal and negative lead to sensor housing. With sensor

submerged in oil (engine full), meter should read "open." Resistance should be greater than 100,000 ohms. With sensor out of oil (oil drained), resistance should be less than 4,000 ohms.

NOTE: Sensor must be horizontal when this test is conducted.

It is best to conduct test with sensor in pan with hot oil to ensure that oil properly drains from sensor. If removed from pan, sensor **must** first be submerged in warm oil to ensure proper orientation of the float before testing. The sensor must be held horizontally during bench testing to ensure that the float remains correctly oriented.

NOTE: The module is located on the instrument panel shake brace.

## DIAGNOSIS AND TESTING (Continued)

**TEST EQUIPMENT: VOM**  
**LAMP STAYS ON AFTER STARTING ENGINE — OIL NOT LOW**

TEST STEP		RESULT	ACTION TO TAKE
<b>1A</b>			
	<ul style="list-style-type: none"> <li>Verify oil level is full then check electronic relay ground by disconnecting wire from sensor and restart engine.</li> </ul>	Lamp goes off  Lamp stays on	CHECK sensor resistance. If less than 100 K ohms, REPLACE sensor. If greater than 100 K ohms — REPLACE electronic relay.  GO to Step 2A.
<b>2A</b>			
	<ul style="list-style-type: none"> <li>Check wiring circuit between oil sensor and terminal No. 4 of electronic relay.</li> </ul>	Wire shorted to ground  Wire OK	REPAIR wiring.  REPLACE electronic relay.
<b>LAMP DOES NOT STAY ON WHEN LOW ON OIL 1.9 LITRES (TWO QUARTS)</b>			
<b>1B</b>			
	<ul style="list-style-type: none"> <li>Check electronic relay by disconnecting wire from terminal No. 4. Wait approximately 150 seconds. Then short terminal to ground. Start engine.</li> </ul>	Lamp stays on  Lamp does not stay on	RECONNECT wire. GO to Step 2B.  REPLACE electronic relay.
<b>2B</b>			
	<ul style="list-style-type: none"> <li>Check sensor resistance between sensor terminal and ground.</li> </ul>	Greater than 4K ohms  Less than 4K ohms	REPLACE sensor.  CHECK wiring or connector to sensor for open circuit.
<b>NOTE: Ignition should be turned OFF for a minimum of 150 seconds between checks to be sure that the electronic relay has "reset."</b>			
<b>LAMP BLINKS INTERMITTENTLY WHILE DRIVING</b>			
<b>1C</b>			
	<ul style="list-style-type: none"> <li>Check for loose connections to relay or bulb.</li> </ul>	Not OK  Connection OK	SERVICE connections.  REPLACE electronic relay.

CK7921-C

## REMOVAL AND INSTALLATION

### Sensor

#### Removal and Installation

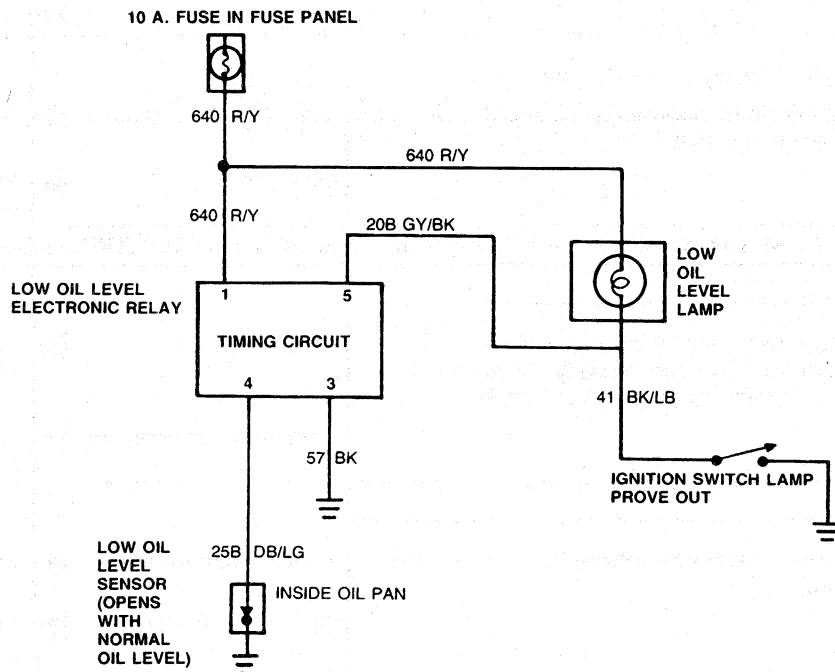
1. With engine off, drain at least 1.9 liters (2 quarts) of oil from engine.
2. Disconnect electrical connection.
3. Remove sensor with a 26mm (1-inch) socket or end wrench.
4. To install, reverse Steps 1, 2 and 3.

NOTE: When replacing oil level sensor, tighten sensor as follows:

- When replaced using an all-plastic gasket, tighten to 34-47 N·m (25-35 lb-ft).
- When replaced using a plastic gasket with a rubber O-ring, tighten to 27-40 N·m (20-30 lb-ft).

#### Electrical Schematic—Low Oil Level Relay

WIRING SCHEMATIC



K7920-B



# **WIRING HARNESSES, CONNECTORS AND CIRCUIT PROTECTION**

## **GROUP 34**

(14000)

SECTION TITLE	PAGE	SECTION TITLE	PAGE
FUSES AND CIRCUIT BREAKERS .....	34-50-1	WIRING HARNESSES—TAURUS/SABLE .....	34-20-1
WIRING HARNESS—CONNECTORS .....	34-01-1		

## **SECTION 34-01 Wiring Harness—Connectors**

SUBJECT	PAGE	SUBJECT	PAGE
REMOVAL AND INSTALLATION .....	34-01-1	VEHICLE APPLICATION .....	34-01-1

### **VEHICLE APPLICATION**

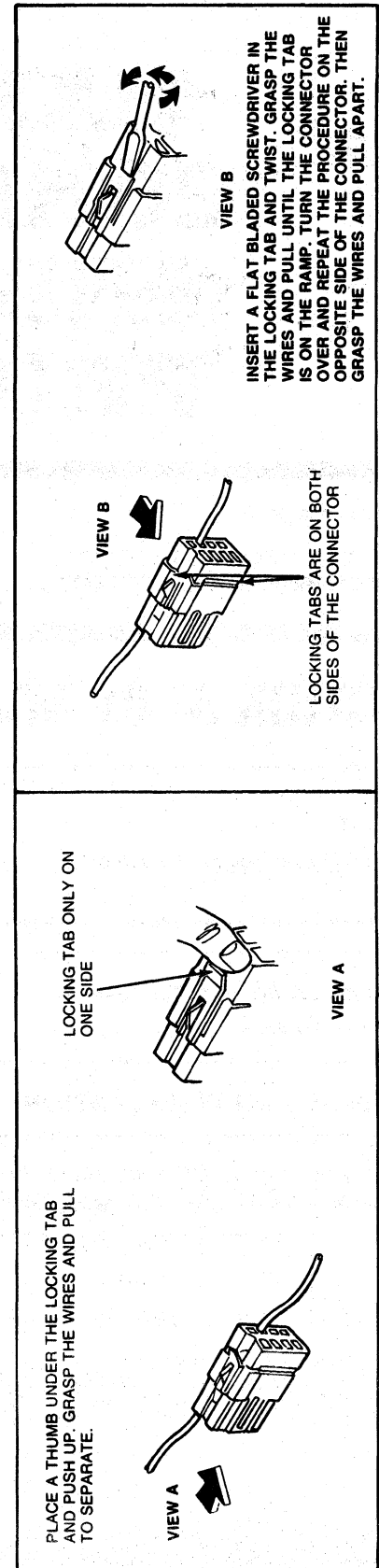
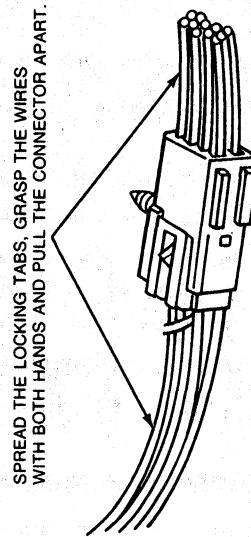
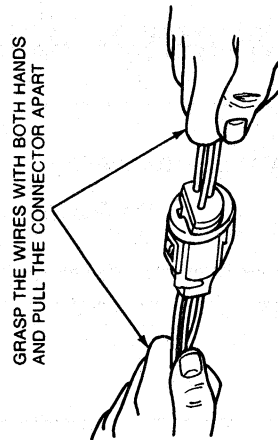
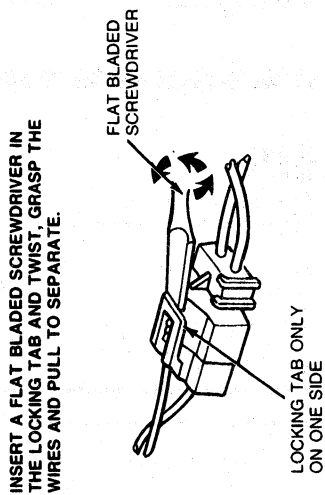
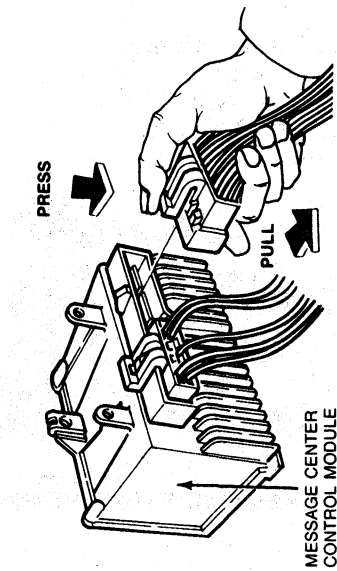
Taurus/Sable.

### **REMOVAL AND INSTALLATION**

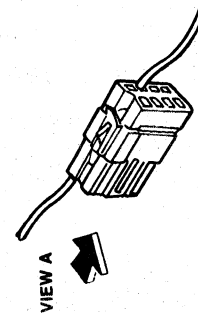
The following illustrations show typical electrical connectors and their disengagements.

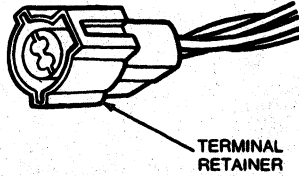
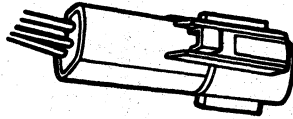
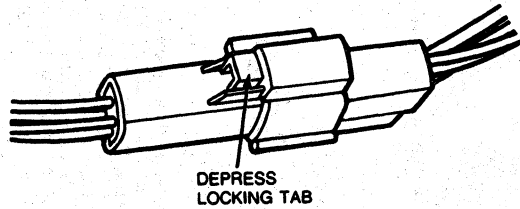
## REMOVAL AND INSTALLATION (Continued)

## In-Line Connectors

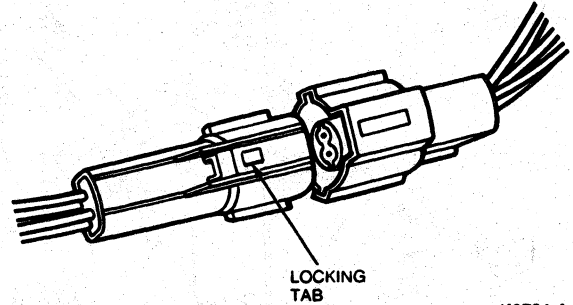


PLACE A THUMB UNDER THE LOCKING TAB AND PUSH UP. GRASP THE WIRES AND PULL TO SEPARATE.



**REMOVAL AND INSTALLATION (Continued)****Submersible In-Line Connector****IN LINE CONNECTOR DISENGAGEMENT PROCEDURE**

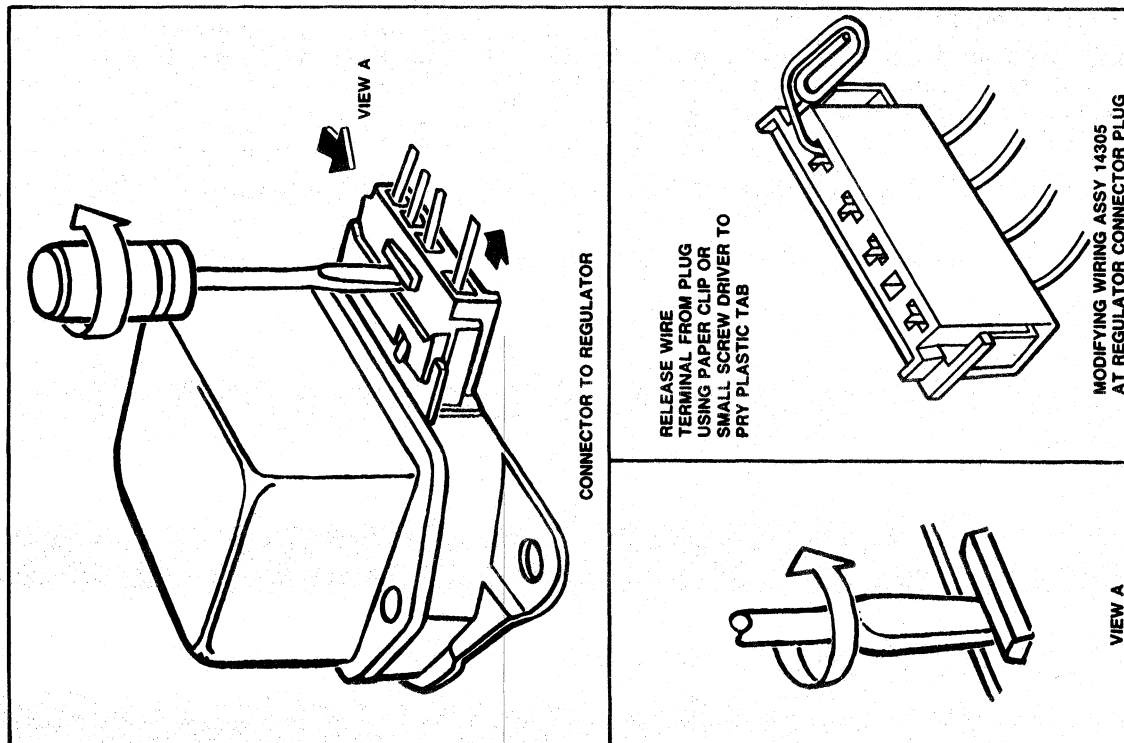
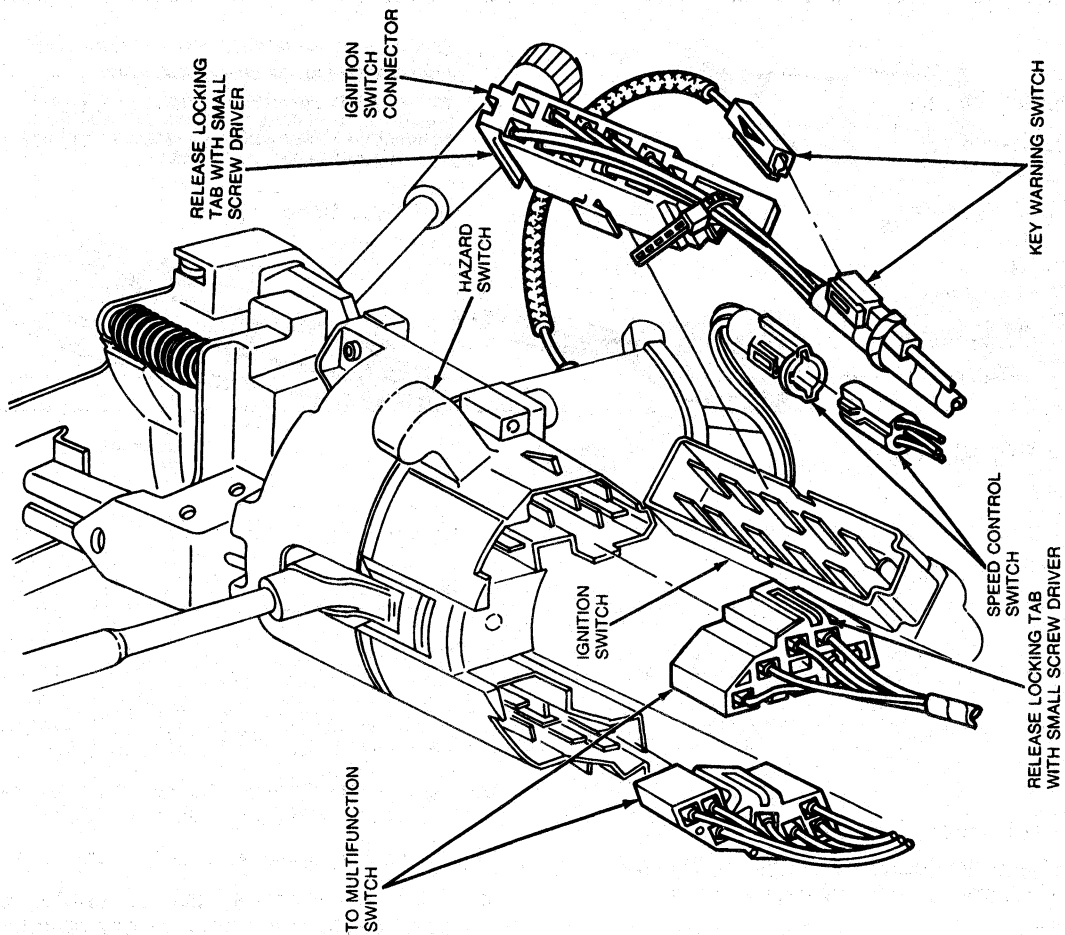
1. GRASP EACH END OF CONNECTOR BODY.
2. WHILE HOLDING CONNECTOR BODY, USE THUMB PRESSURE TO DEPRESS LOCKING TAB AND PULL CONNECTOR APART (NOTE: "WIGGLING" THE PARTS WILL MAKE SEPARATION EASIER.)



K8724-A

## REMOVAL AND INSTALLATION (Continued)

## Component Connectors



## SECTION 34-20 Wiring Harnesses—Taurus/Sable

SUBJECT	PAGE	SUBJECT	PAGE
<b>REMOVAL AND INSTALLATION</b>		<b>REMOVAL AND INSTALLATION (Cont'd.)</b>	
Deck Lid .....	34-20-11	Instrument Panel, Main .....	34-20-5
Door, Front .....	34-20-10	Lamps, Front .....	34-20-2
Door, Rear .....	34-20-11	Lift Gate .....	34-20-12
Engine Wiring .....	34-20-4	Lower Back Panel—Sedan .....	34-20-12
Fender Apron, LH .....	34-20-3	Package Tray .....	34-20-8
Fender Apron, RH .....	34-20-3	Rear Quarter Back Panel .....	34-20-13
Floorpan, LH .....	34-20-7	Roof .....	34-20-9
Floorpan, RH .....	34-20-7	<b>VEHICLE APPLICATION</b> .....	<b>34-20-1</b>

### VEHICLE APPLICATION

Taurus/Sable.

### REMOVAL AND INSTALLATION

The illustrations show the complete wiring harness installation for Taurus/Sable vehicles. Refer to the illustrations for the harness being replaced while performing the following Removal and Installation procedures.

#### Removal

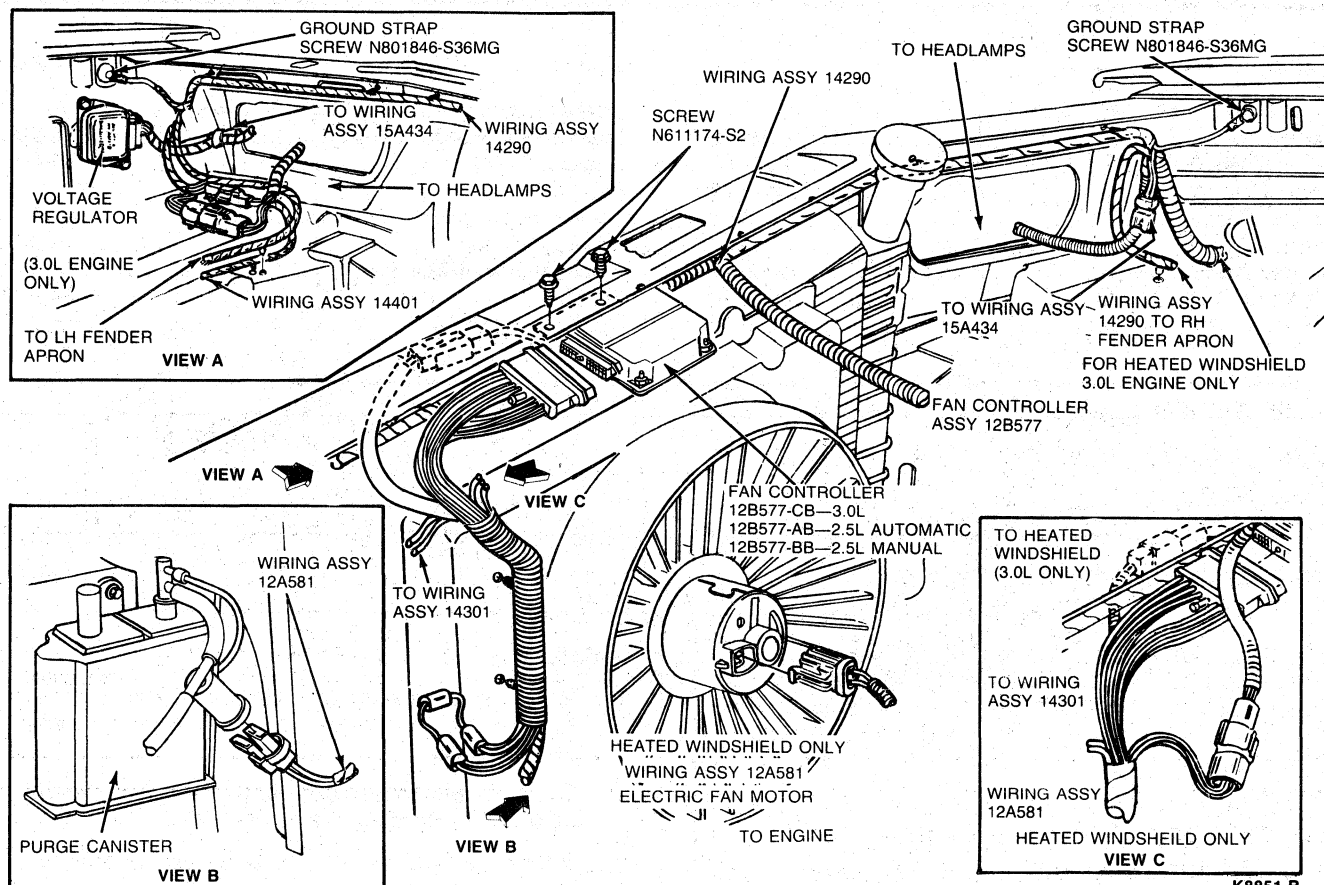
1. Disconnect battery ground cable.  
NOTE: Refer to Group 45 if it is necessary to remove any trim panels to gain access to the harness.
2. Disconnect all wiring harness connectors.
3. Disengage harness from all locators, straps and/or clips as necessary, including ground wire eyelets. Remove harness from vehicle.

#### Installation

1. Position harness in vehicle. Ensure that harness is engaged in all locators, straps and/or clips.
2. Connect all harness connectors to components or other harnesses as necessary.
3. Secure ground eyelets to body as necessary.
4. Connect battery ground cable. Check all applicable circuits for proper operation.
5. Install any trim removed during harness removal. Refer to Group 45.

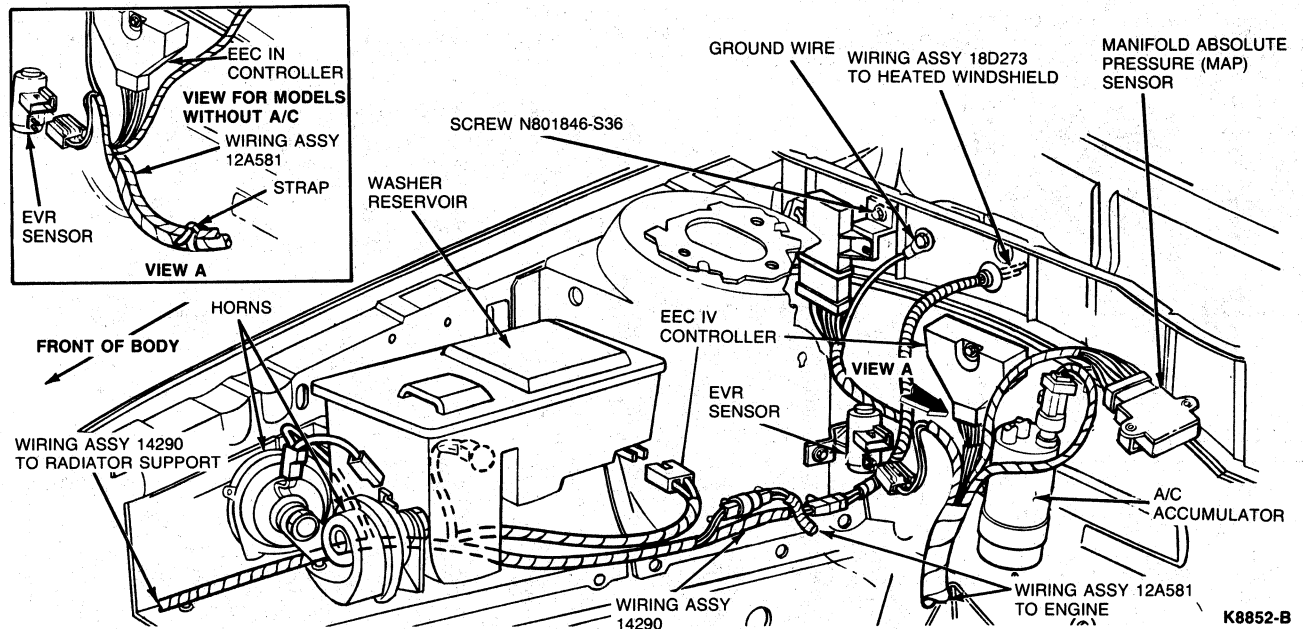
## REMOVAL AND INSTALLATION (Continued)

## Lamps, Front

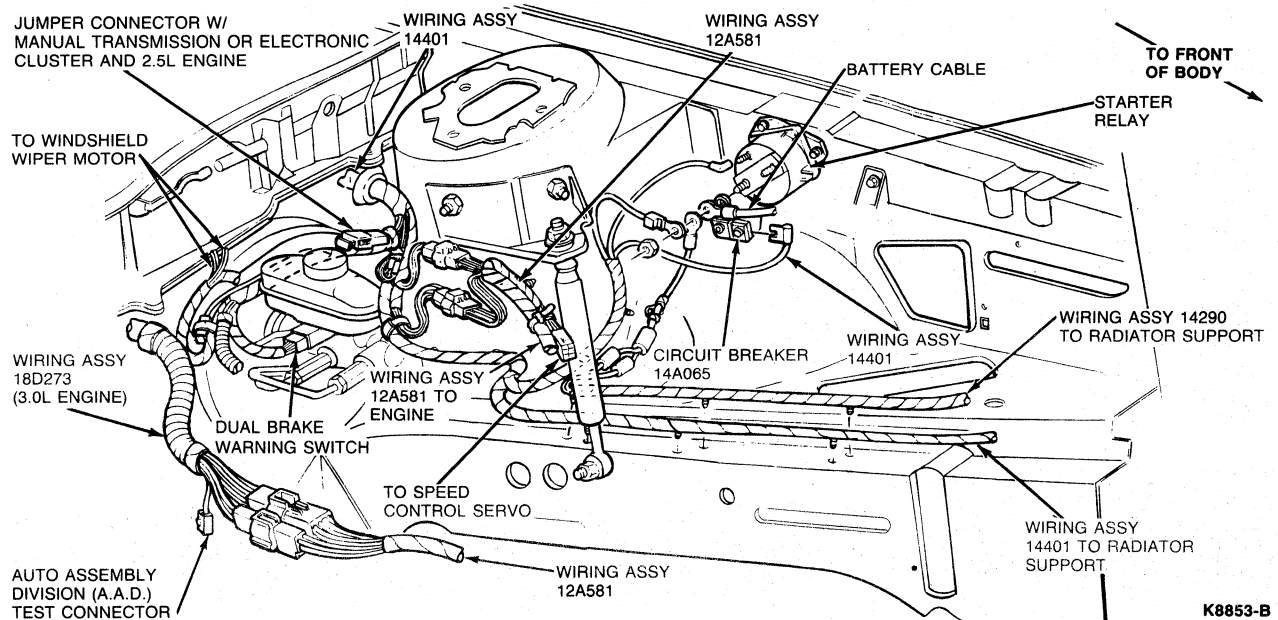


## REMOVAL AND INSTALLATION (Continued)

### Fender Apron, RH 3.0L (186 CID) Engine



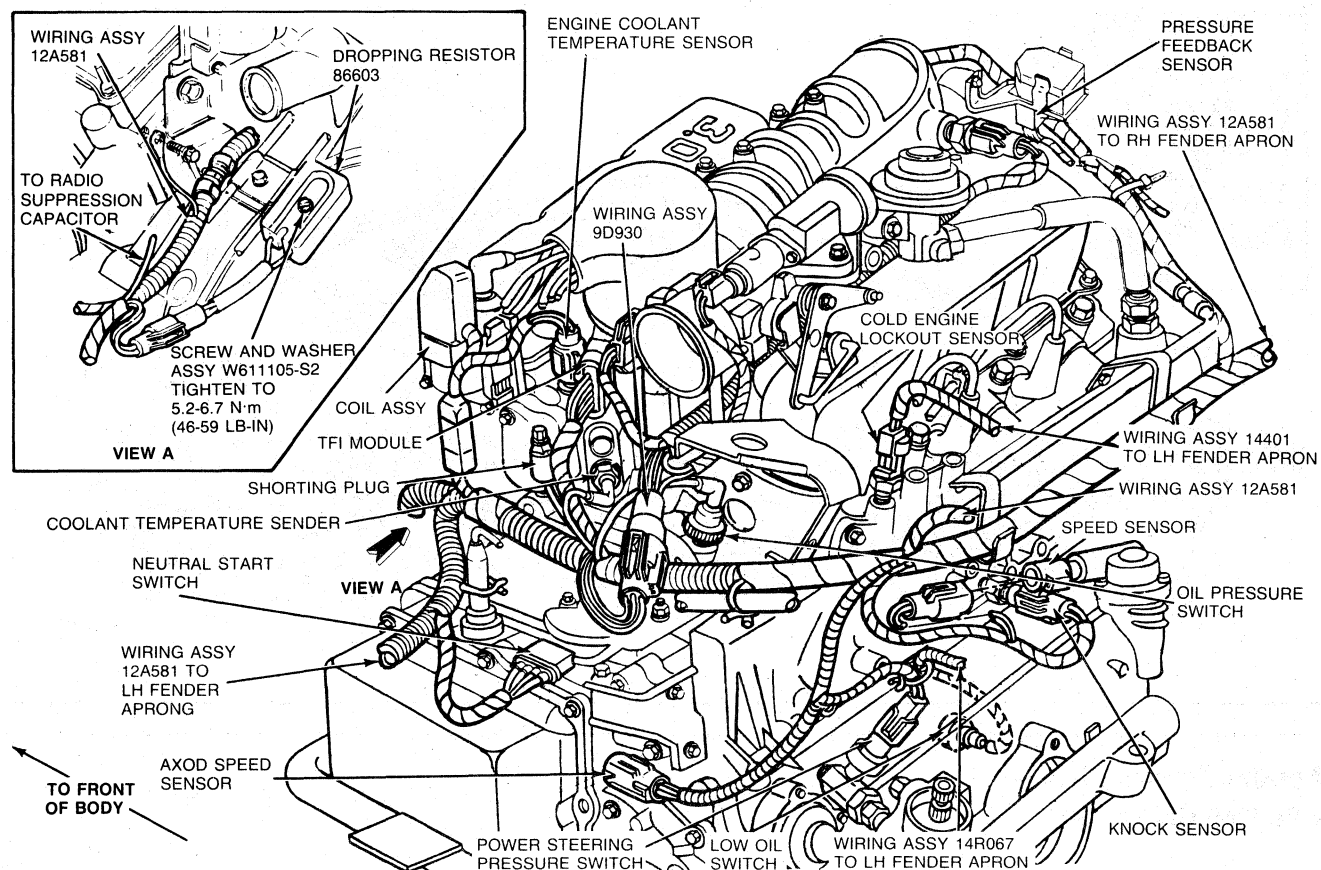
### Fender Apron, LH 3.0L (186 CID) Engine



## REMOVAL AND INSTALLATION (Continued)

## Engine Wiring

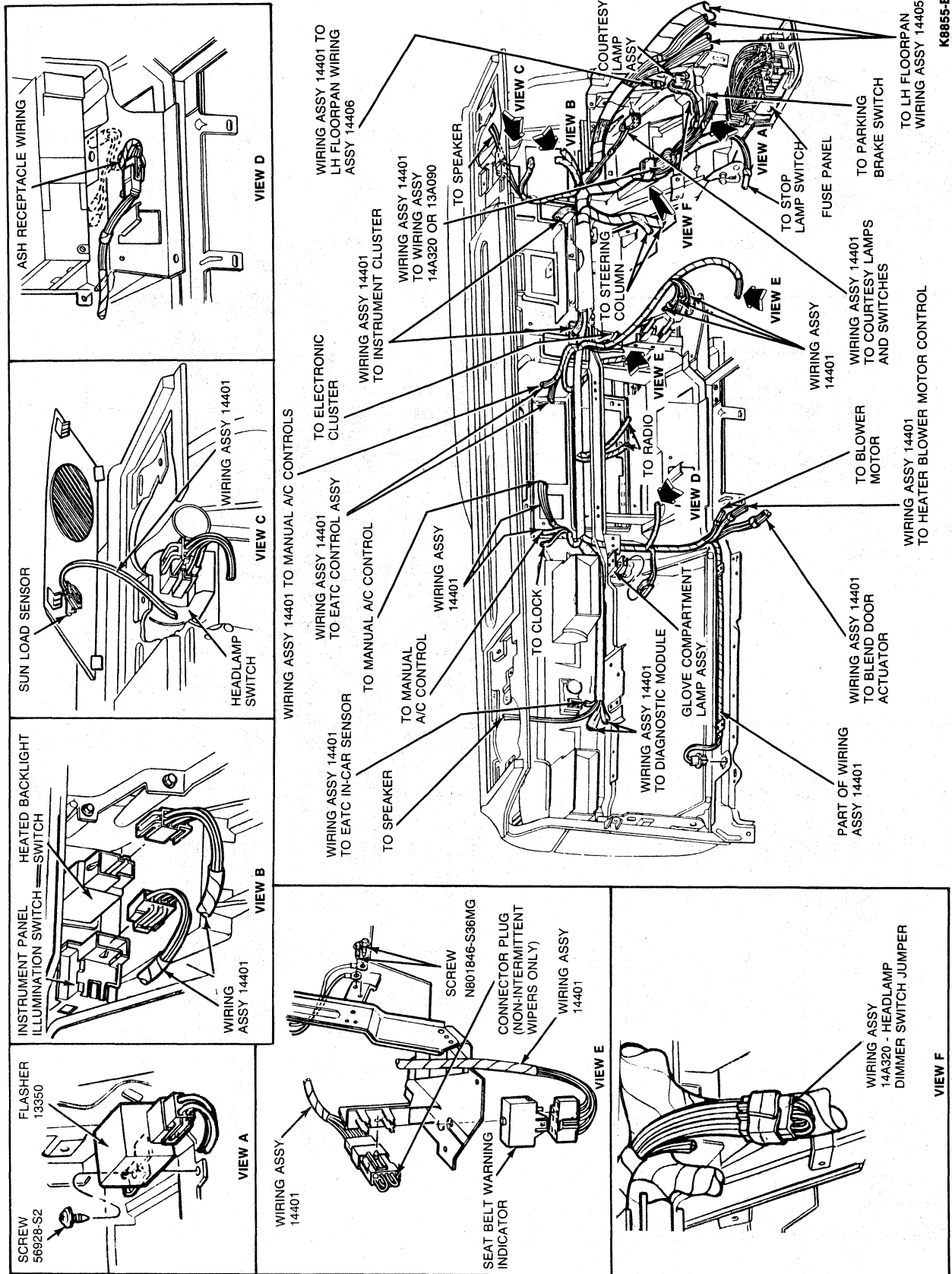
### 3.0L (186 CID) Engine



**K8854-B**



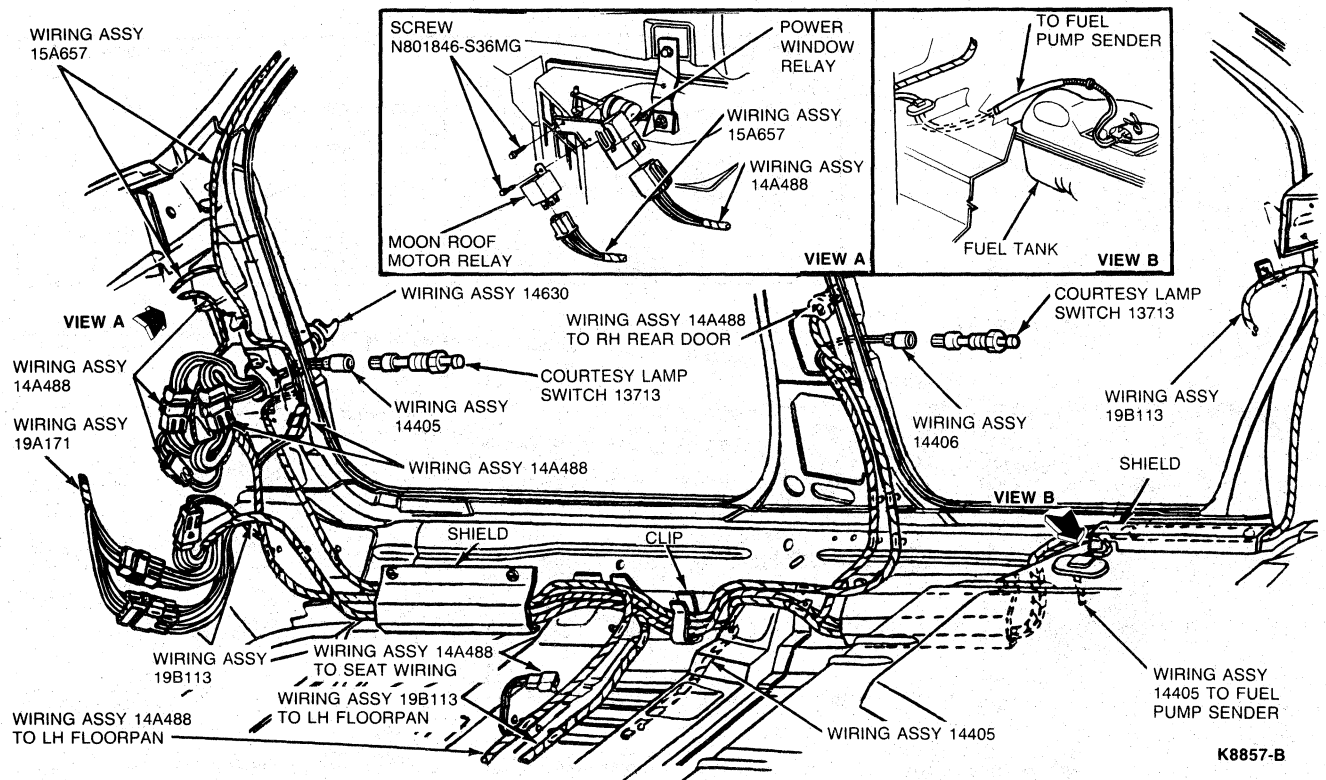
## REMOVAL AND INSTALLATION (Continued)

Instrument Panel, Main  
Taurus

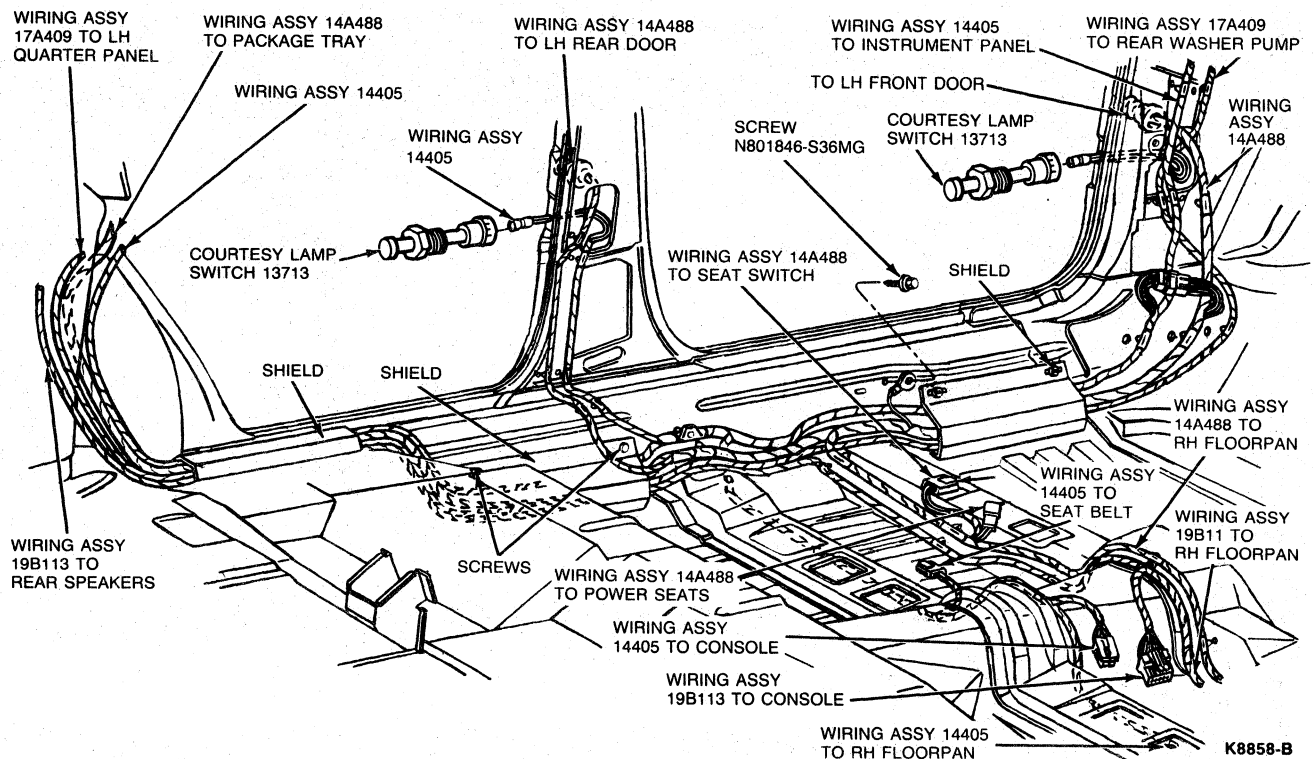


## REMOVAL AND INSTALLATION (Continued)

## Floorpan, RH

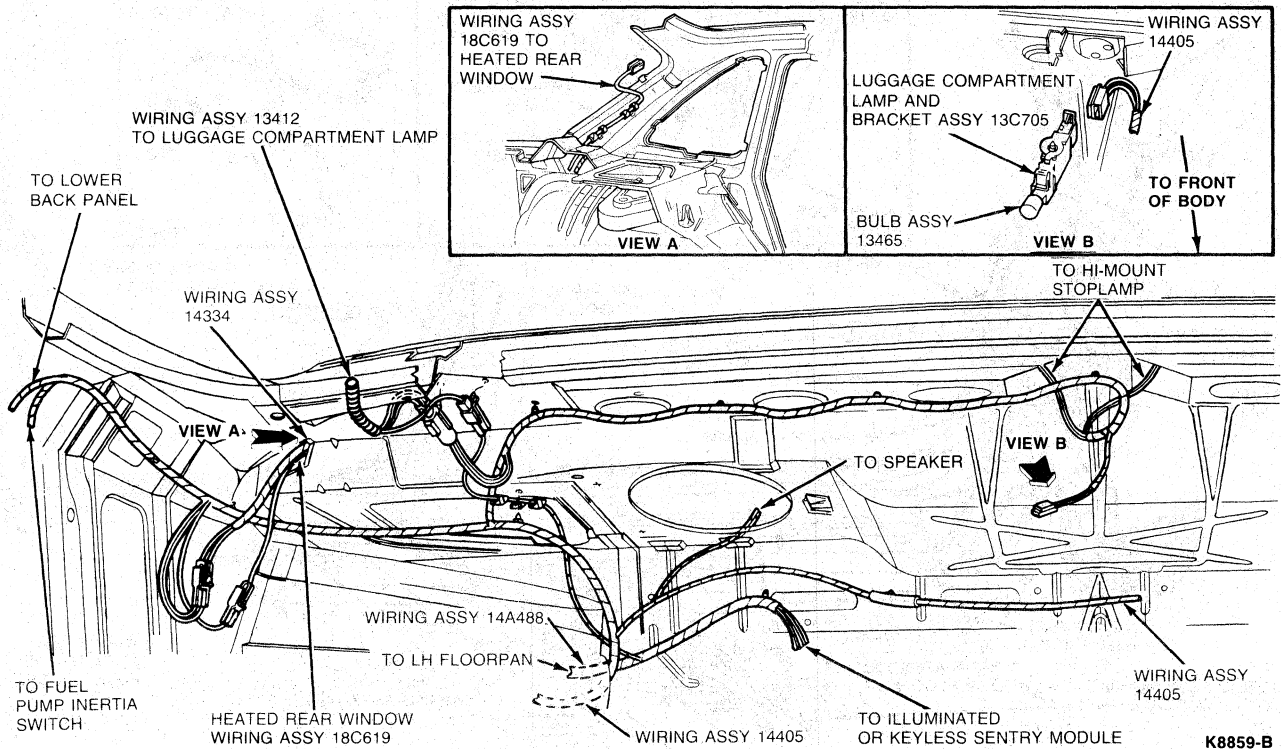


## Floorpan, LH



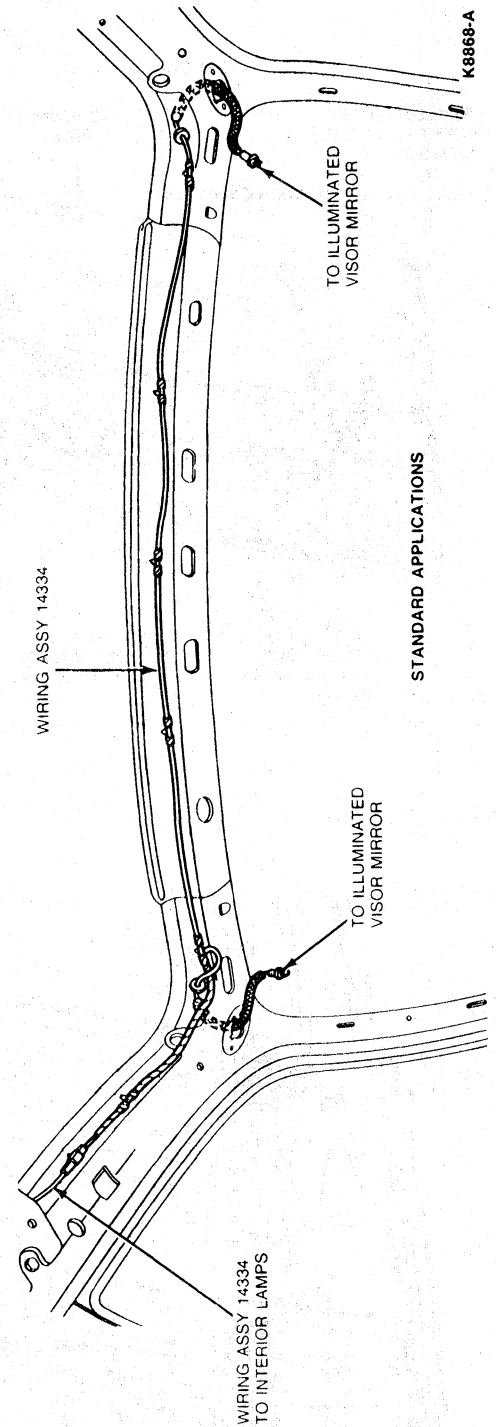
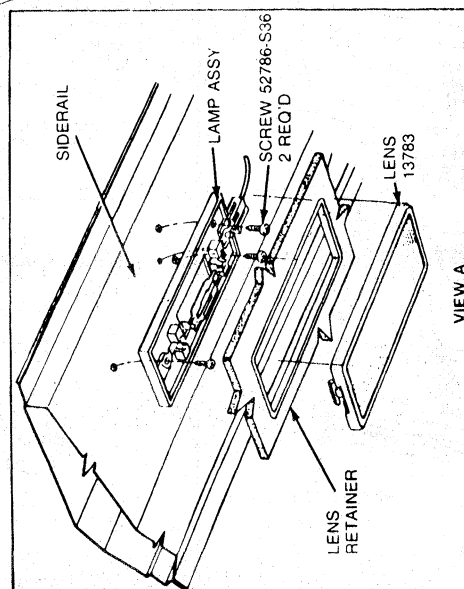
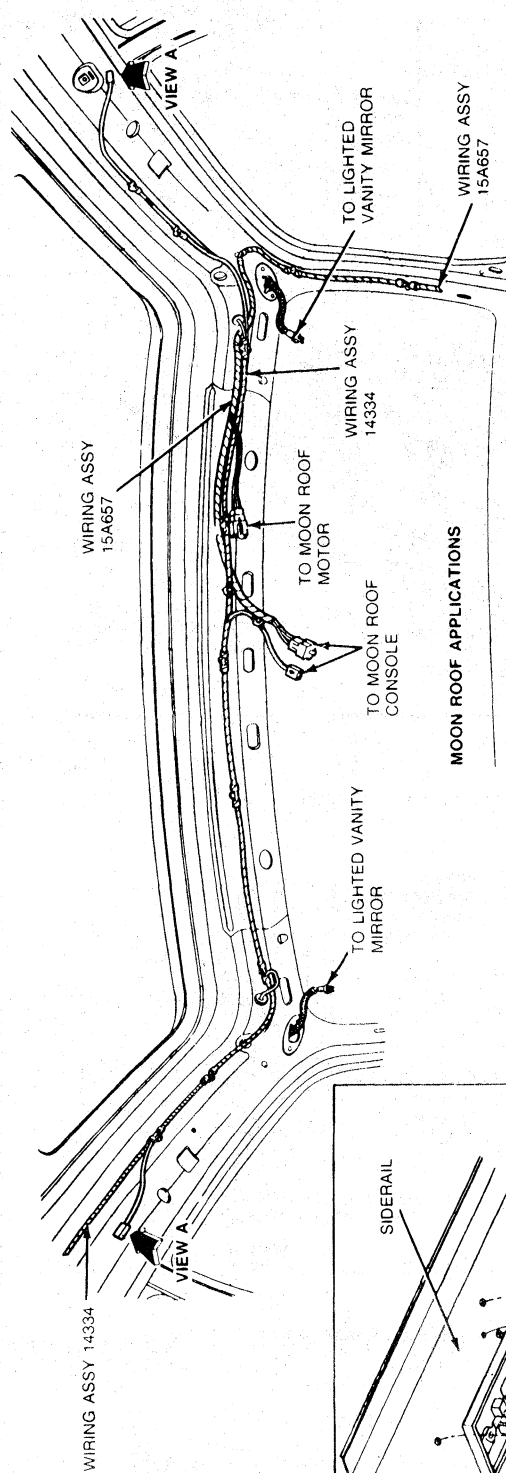
## REMOVAL AND INSTALLATION (Continued)

## Package Tray



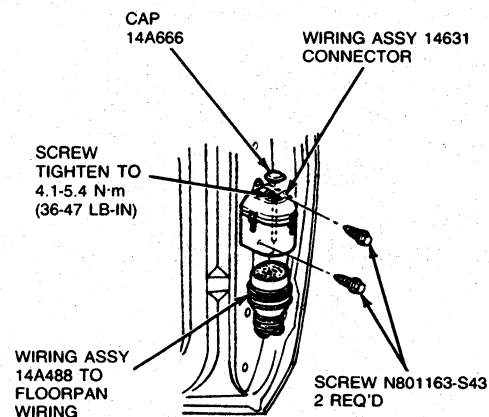
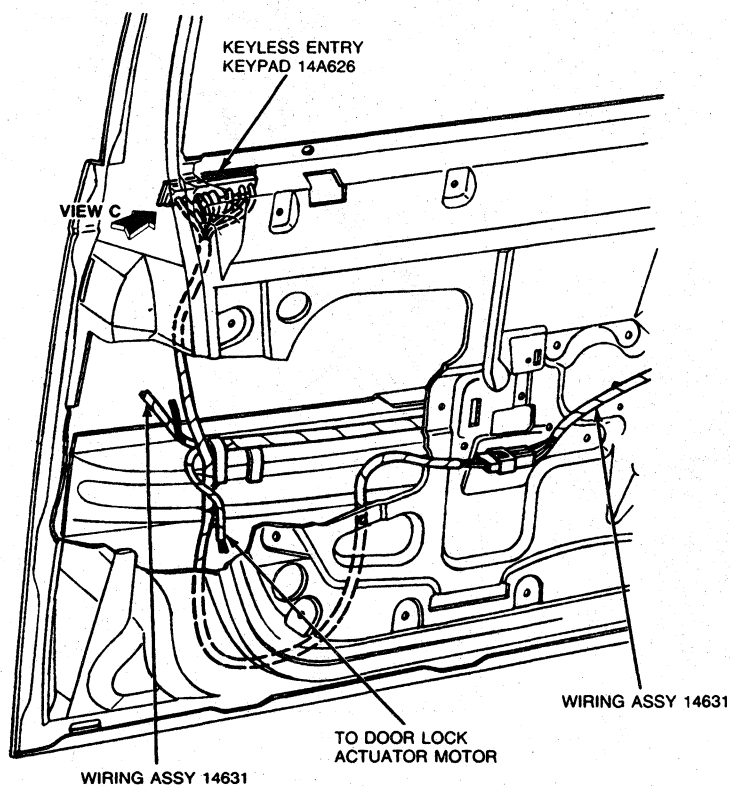
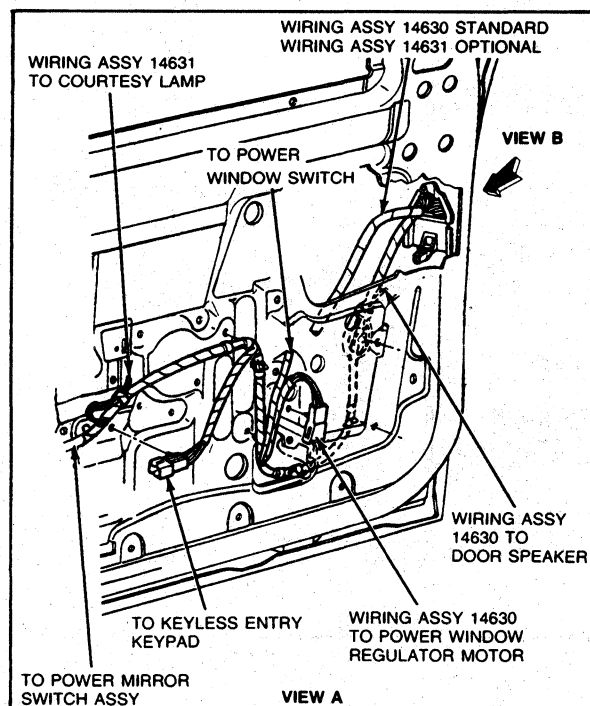
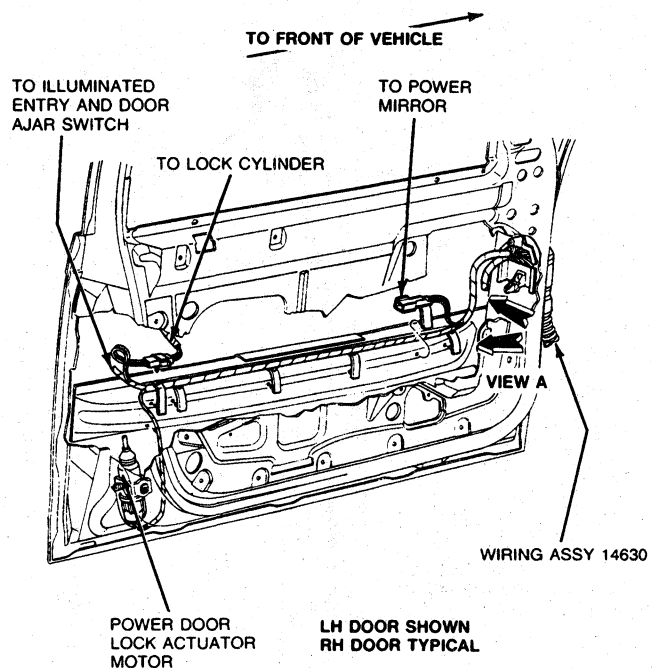
## REMOVAL AND INSTALLATION (Continued)

## Roof



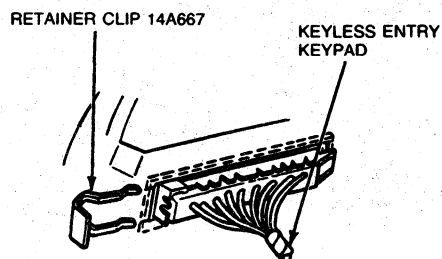
## REMOVAL AND INSTALLATION (Continued)

## Door, Front



FOR MODELS WITH POWER WINDOWS  
W/O KEYLESS ENTRY

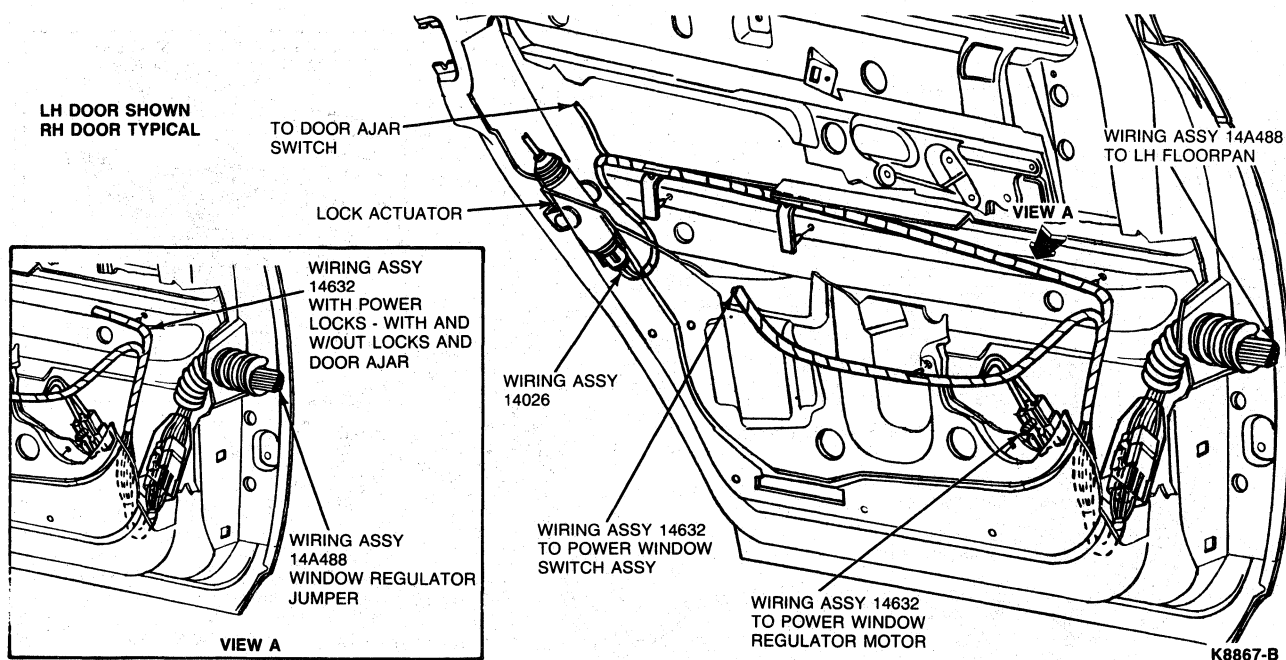
VIEW B



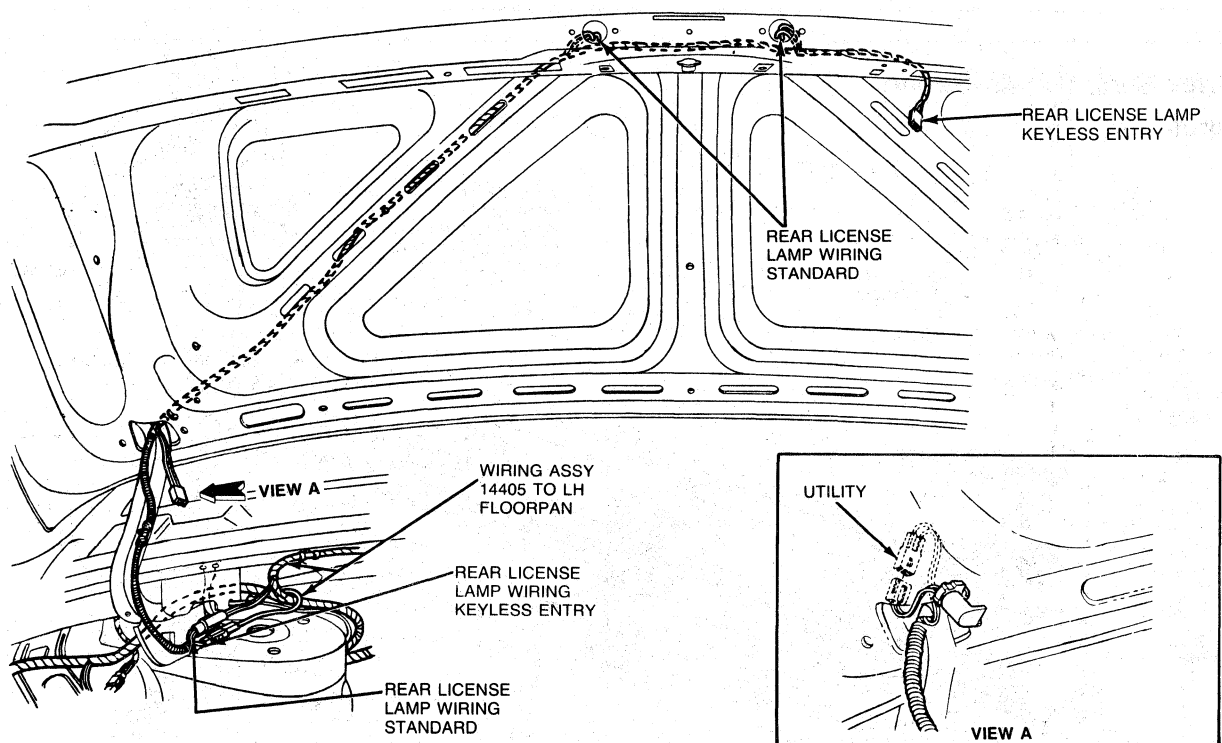
VIEW C

## REMOVAL AND INSTALLATION (Continued)

## Door, Rear

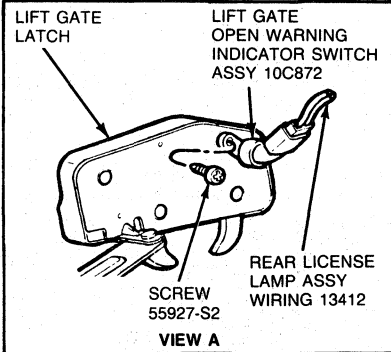


## Deck Lid

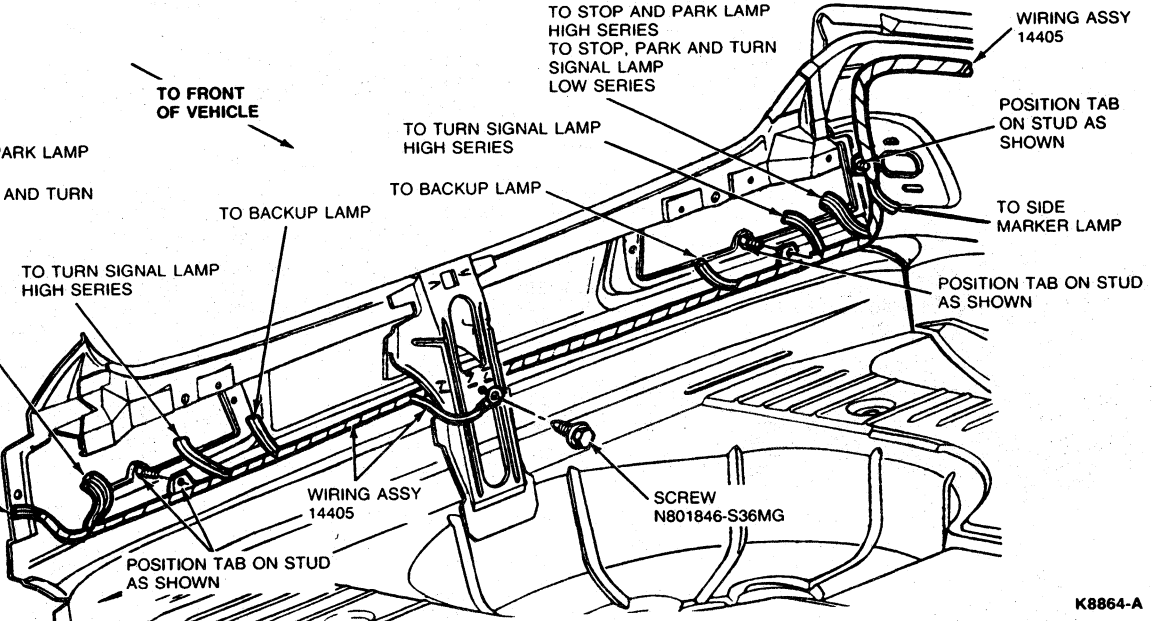


## REMOVAL AND INSTALLATION (Continued)

## Lift Gate



### Lower Back Panel—Sedan Taurus

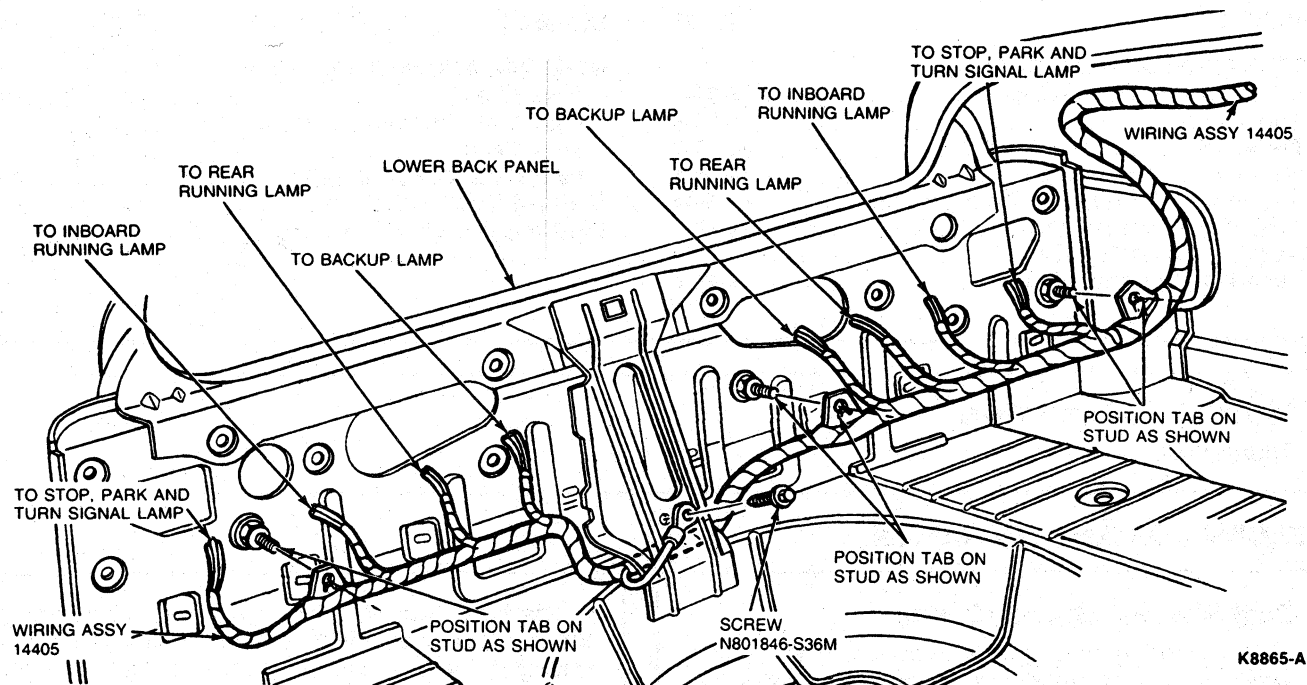




## REMOVAL AND INSTALLATION (Continued)

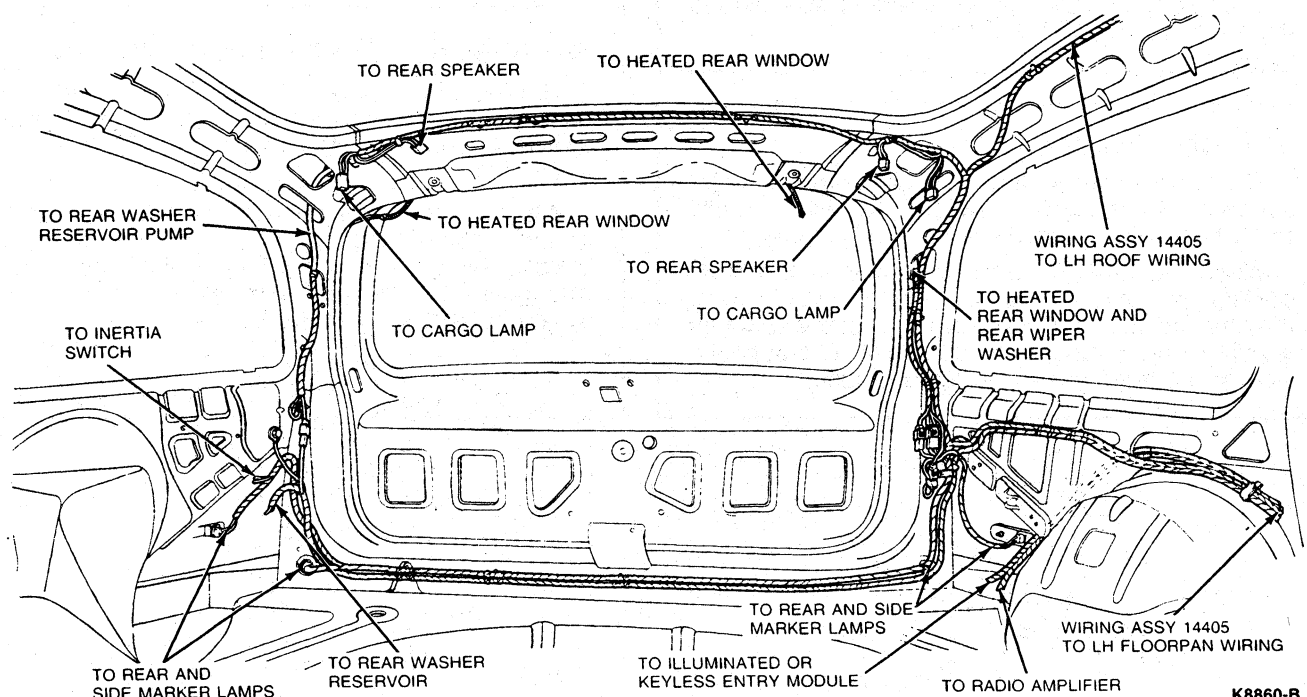
## Lower Back Panel—Sedan

## Sable



## Rear Quarter Back Panel

## Wagon



# SECTION 34-50 Fuses and Circuit Breakers

SUBJECT	PAGE	SUBJECT	PAGE
<b>DESCRIPTION AND OPERATION</b>		<b>REMOVAL AND INSTALLATION</b>	
Dual Warning Buzzer/Chime .....	34-50-1	Fuse Link .....	34-50-7
Fuse Links .....	34-50-5	Fuse Link, Charging System .....	34-50-6
Fuses and Circuit Breakers .....	34-50-3	Fuse Panel .....	34-50-5
Headlamps ON Warning .....	34-50-1	Fuses and Circuit Breakers .....	34-50-5
Key in Ignition Warning Buzzer/Chime .....	34-50-1	<b>SPECIAL SERVICE TOOLS</b> .....	34-50-8
Seat Belt Warning Lamp .....	34-50-1	<b>VEHICLE APPLICATION</b> .....	34-50-1
<b>DIAGNOSIS AND TESTING</b>			
Fuse Link Continuity Test .....	34-50-5		

## VEHICLE APPLICATION

Taurus/Sable.

## DESCRIPTION AND OPERATION

### Dual Warning Buzzer/Chime

The warning buzzer is standard on all Taurus vehicles without the electronic cluster. Chimes are standard on all Sable vehicles and Taurus vehicles with electronic clusters.

The key warning buzzer/chime and the seat belt timer buzzer/chime are combined in one package. The dual buzzer/chime assembly is located behind the instrument panel near the LH side of the radio.

The headlamps ON warning system also operates the key warning buzzer/chime.

The timer buzzer/chime goes to ground through the seat belt switch 85 circuit. When the seat belt is engaged, the timer buzzer ground circuit is opened.

### Headlamps ON Warning

When the ignition switch is turned off and the LH door is opened with the headlamps on, power is fed to the buzzer/chime through Circuit 257.

### Seat Belt Warning Lamp

The warning lamp glows for approximately eight seconds after the ignition switch is turned to the ON or RUN position, regardless of seat belt usage.

When the ignition switch is turned to the RUN position, power is supplied through the 640 circuit, to the timer buzzer/chime and one side of the seat belt warning lamp through the 450 circuit. The opposite side of the lamp goes directly to ground.

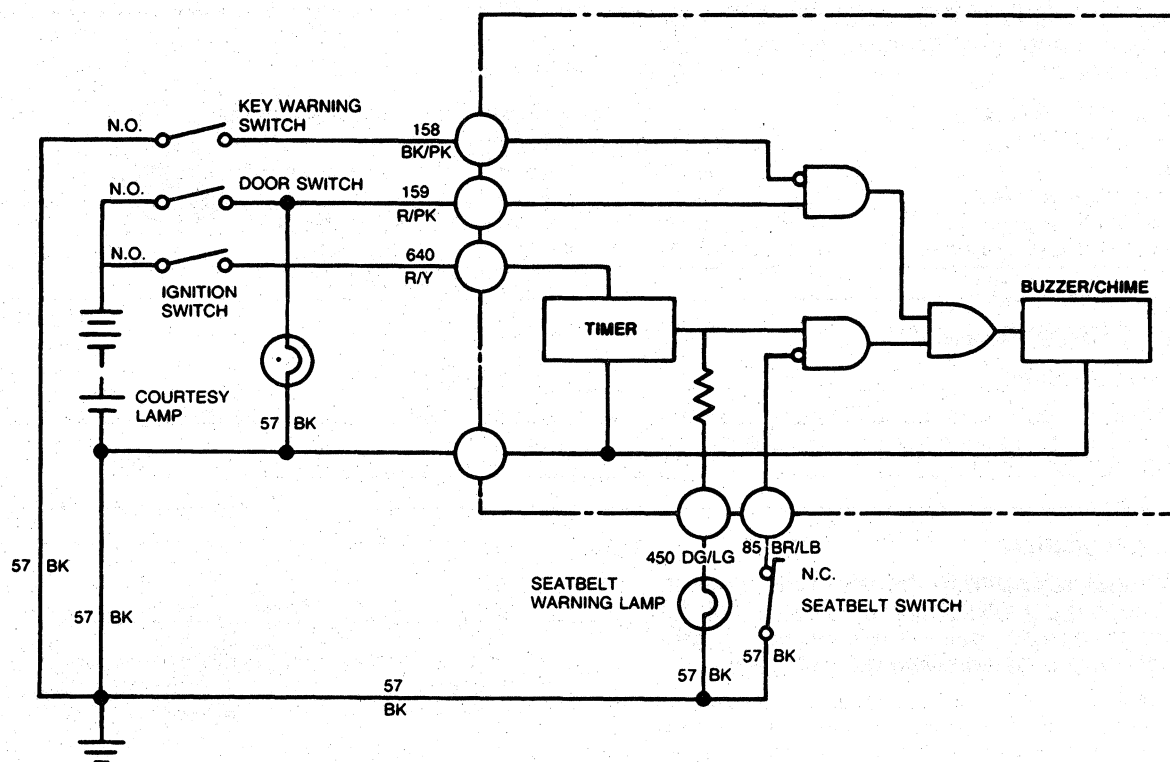
### Key in Ignition Warning Buzzer/Chime

The warning buzzer/chime sounds when the driver's door is open with the key in the ignition switch. It sounds until the door is closed or the key is removed.

When key is in ignition switch and driver's door is opened, power is supplied through 159 circuit to buzzer/chime and one side of the key switch through the 158 circuit. The opposite side of the key switch goes directly to ground.

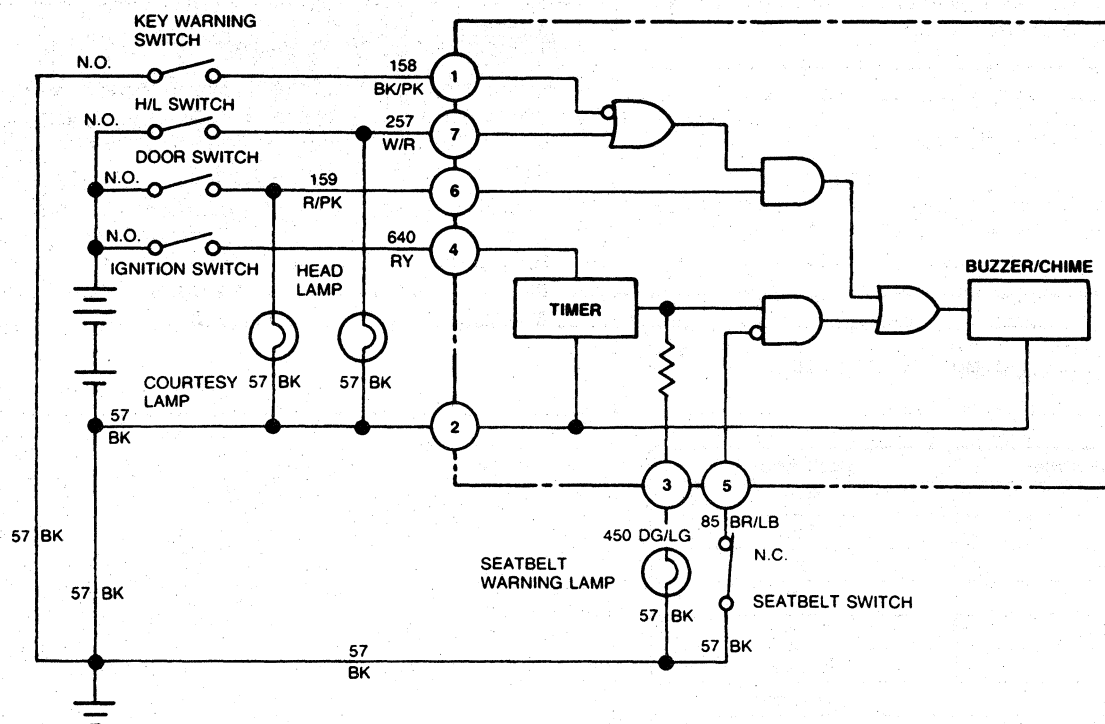
## DESCRIPTION AND OPERATION (Continued)

## Without "Headlamps ON" Warning



K8694-A

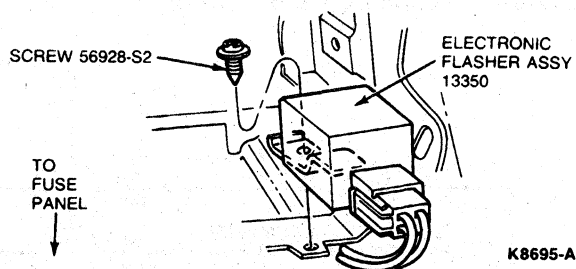
## With "Headlamps ON" Warning



K8693-A

**DESCRIPTION AND OPERATION (Continued)****Flasher Location**

An electronic combination turn signal and emergency warning flasher is secured to the lower LH instrument panel reinforcement by one screw (above fuse panel).

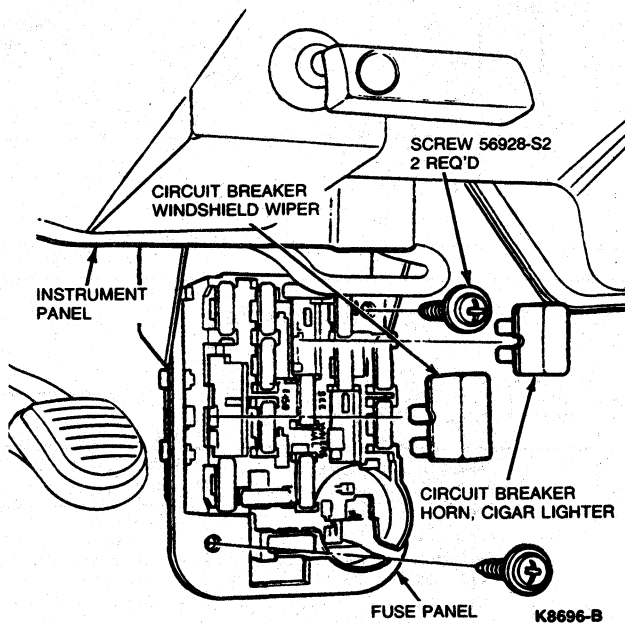
**Fuses and Circuit Breakers****Location and Values**

A combination fuse and circuit breaker panel contains most of the fuses and circuit breakers used

in the system. The panel illustration is shown on the next page.

**Fuse Panel Location**

The fuse panel is located to the left of the steering column, and is hung from the instrument panel. To expose the fuse panel, pull the release bar up with right hand and pull panel down with left hand.

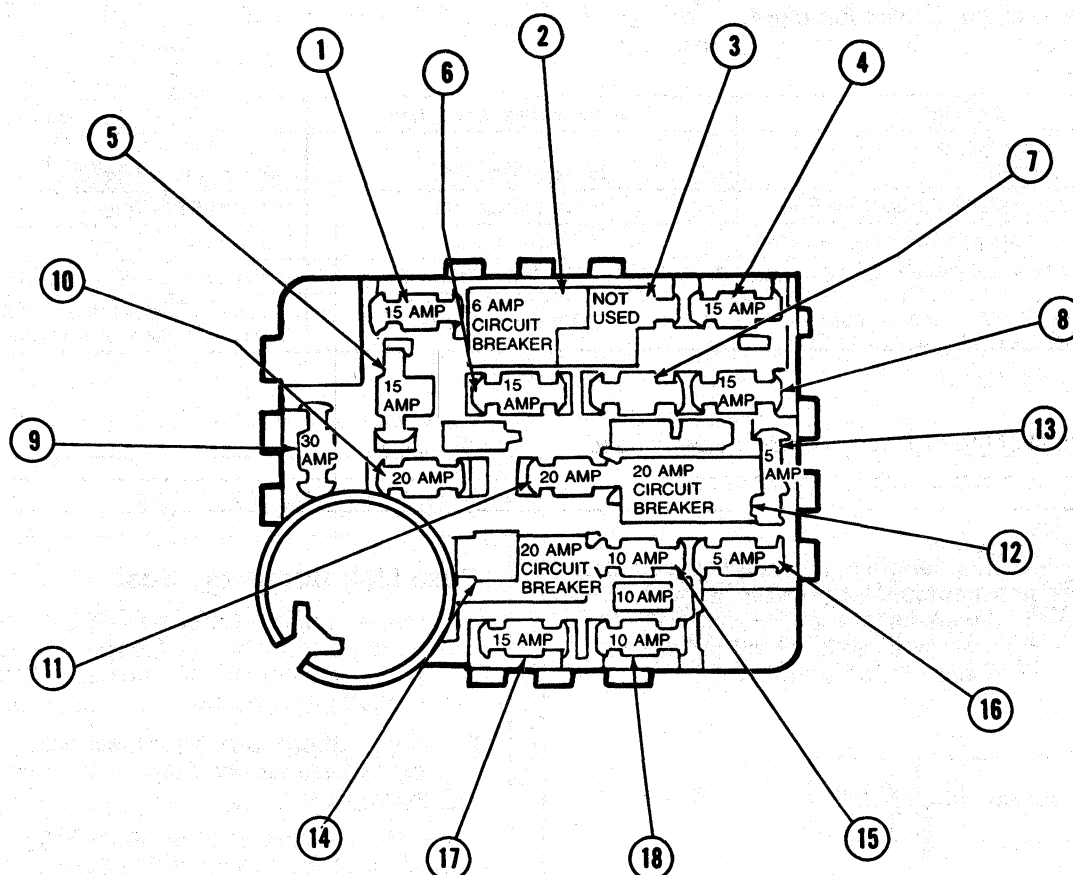


The fuses are color-coded by amp rating.

Fuse Value Amps	Color Code
4	Pink
5	Tan
10	Red
15	Light Blue
20	Yellow
25	Natural
30	Light Green

CK6459-A

## DESCRIPTION AND OPERATION (Continued)



CAVITY NUMBER	CIRCUIT PROTECTED	CAVITY NUMBER	CIRCUIT PROTECTED
1	HI-MOUNT STOPLAMP, STOPLAMPS, FRONT AND REAR TURN SIGNALS, INSTRUMENT PANEL TURN INDICATOR LAMPS	9	BLOWER MOTOR, BLOWER SPEED CONTROLLER (EATC)
2	WINDSHIELD WIPER MOTOR, INTERMITTENT WIPER MODULE, WINDSHIELD WASHER MOTOR	10	FLASH-TO-PASS, HIGH BEAM HEADLAMPS AND INDICATOR LAMP
3	NOT USED	11	RADIO, PREMIUM SOUND AMPLIFIER, POWER ANTENNA MOTOR
4	FRONT PARK, SIDE MARKER AND TAIL LAMPS, "HEADLAMPS-ON" WARNING BUZZER/CHIME, FRONT LASER LAMP (SABLE).	12	CIGAR LIGHTERS, HORN RELAY, HORNS
5	ELECTRONIC CLUSTER, HEATED BACKLIGHT SWITCH, ELECTRONIC FLASHER, BACKUP LAMPS, HEATED E G O , ILLUMINATED/KEYLESS ENTRY MODULE	13	CLUSTER ILLUMINATION, RADIO DISPLAY, ASH TRAY ILLUM., EATC CONTROL DISPLAY, HEATED BACKLIGHT SWITCH ILLUM., HEATED WINDSHIELD SWITCH ILLUM., REAR WIPER SWITCH ILLUM., HEADLAMP SWITCH ILLUM., CLOCK DISPLAY, P R N D L ILLUMINATION
6	REAR WINDOW WIPER AND WASHER MOTORS (WAGONS), DIAGNOSTIC WARNING LAMP MODULE, WARNING CHIME, HEADLAMP SWITCH ILLUMINATION (SABLE), CLOCK ILLUMINATION, RADIO ILLUMINATION, EATC CONTROL ILLUMINATION, POWER WINDOW RELAY	14	NOT USED
7	NOT USED	15	LICENSE LAMPS, SIDE MARKER AND TAIL LAMPS
8	CLOCK, RADIO MEMORY, GLOVE COMPT. LAMP, LUGGAGE COMPT. LAMP, INST. PANEL COURTESY LAMPS, INTERIOR LAMPS, ILLUMINATED/KEYLESS ENTRY MODULE, POWER MIRRORS	16	ELECTRONIC CLUSTER EATC CONTROL SWITCH
		17	EATC COMPRESSOR CLUTCH, EATC BLEND DOOR ACTUATOR, A/C COMPRESSOR CLUTCH
		18	AUTOLAMP MODULE, CLUSTER WARNING LAMPS, LOW OIL LEVEL RELAY, BUZZER/CHIME

**DESCRIPTION AND OPERATION (Continued)**

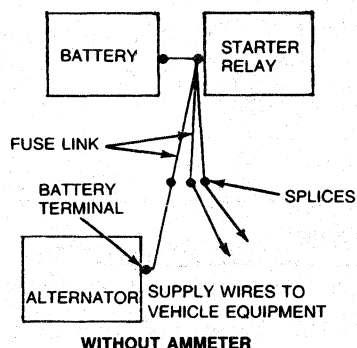
The locations and values of the fuses and circuit breakers not contained in the panels are shown in the following circuit protection chart.

Circuit(s)	Circuit Protection and Rating	Location
Ignition coil, Ignition Module, Cooling Fan Controller	20 Gauge Fuse Link	Left Hand Shock Tower
Battery Feed to Ignition Switch and Fuse Panel	16 Gauge Fuse Link	Left Hand Shock Tower
Battery Feed to Headlamp Switch and Fuse Panel	16 Gauge Fuse Link	Left Hand Shock Tower
Power Windows, Power Seats, Power Door Locks	20 AMP Circuit Breaker	Battery Terminal-Starter Motor Relay
Station Wagon Rear Window Wiper/Washer	4.5 AMP Circuit Breaker	Taurus — I/P Brace Left Side of Steering Column Sable — Left Hand I/P End Panel

CK8697-A

**Fuse Links**

A fuse link is a short length of insulated wire integral with the engine compartment wiring harness. It is several wire gauges smaller than the circuit which it protects and generally located in-line directly from the positive terminal of the battery.



Production fuse links are color-coded:

- 12-gauge: Grey.
- 14-gauge: Dark Green.
- 16-gauge: Black.
- 18-gauge: Brown.
- 20-gauge: Dark Blue.

NOTE: Replacement fuse link color coding may vary from production fuse link color coding.

When heavy current flows, such as when a booster battery is connected incorrectly or when a short to ground occurs in the wiring harness, the fuse link burns out and protects the alternator or wiring.

A burned out fuse link may have bare wire ends protruding from the insulation, or it may have only expanded or bubbled insulation with illegible identification. When it is hard to determine if the fuse link is burned out, perform the continuity test.

**DIAGNOSIS AND TESTING****Fuse Link Continuity Test**

1. Make certain that battery is OK, then turn on headlamps or any accessory. If headlamps or an accessory do not operate, a fuse link is probably burned out.
2. When there are two fuse links, use same procedure as in Step 1 to test each link separately.

To test fuse link that protects alternator, make certain that battery is OK, then check with a voltmeter or 12-volt test lamp for voltage at the BAT terminal of the alternator. No voltage indicates that alternator fuse link is probably burned out.

**REMOVAL AND INSTALLATION****Fuses and Circuit Breakers**

To check or replace a mini-fuse or circuit breaker:

1. Locate and remove the malfunctioning fuse or circuit breaker by pulling it out of its cavity (no special tools required).
2. Replace the blown fuse or circuit breaker with one of proper amp rating for the circuit by pushing straight in until the fuse or circuit breaker seats itself fully in the cavity.

**Fuse Panel**

The fuse panel is a part of the instrument panel-to-dash panel (14401) wiring harness. The fuse panel cannot be replaced separately from harness.

To remove the wiring harness, of which the fuse panel is a part, refer to the applicable Section in Group 34.

## REMOVAL AND INSTALLATION (Continued)

### Fuse Link, Charging System

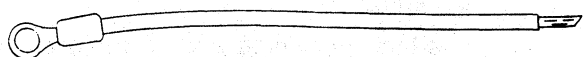
If it becomes necessary to replace a fuse link in a wiring assembly, make sure the replacement fuse link is a duplicate of one removed with respect to gauge, length and insulation. Original and Ford replacement fuse links have insulation that is flame proof. Do not fabricate a fuse link from ordinary wire because the insulation may not be flame proof.

If a circuit protected by a fuse link becomes inoperative, inspect for a blown fuse link. If the fuse link wire insulation is burned or opened, disconnect the feed as close as possible behind the splice in the harness. If the damaged fuse link is between two splices (weld points in the harness), cut out the damaged portion as close as possible to the weld points.

To replace the fuse link, proceed as follows:

1. Some fuse links shown have an eyelet terminal for an 8mm (5/16-inch) stud on one end.

**WIRING ASSEMBLY — FUSE LINK  
(WITH EYELET TERMINAL AND ONE END STRIPPED)**



D3AZ-14A526-D — NO. 14 GAUGE WIRE — APPROX. 230mm (9 INCHES) LENGTH (GREEN INSULATION) AS REQ'D

D3AZ-14A526-E — NO. 16 GAUGE WIRE — APPROX. 230mm (9 INCHES) LENGTH (ORANGE INSULATION) AS REQ'D

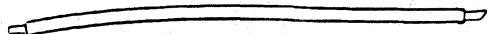
D3AZ-14A526-F — NO. 18 GAUGE WIRE — APPROX. 230mm (9 INCHES) LENGTH (RED INSULATION) AS REQ'D

D3AZ-14A526-G — NO. 20 GAUGE WIRE — APPROX. 230mm (9 INCHES) LENGTH (BLUE INSULATION) AS REQ'D

K8502-A

When an eyelet terminal is not required, use one of fuse links with insulation stripped from both ends.

**WIRING ASSEMBLY — FUSE LINK  
(WITH INSULATION STRIPPED BOTH ENDS)**



D3AZ-14A526-H — NO. 14 GAUGE WIRE — APPROX. 230mm (9 INCHES) LENGTH (GREEN INSULATION)

D3AZ-14A526-J — NO. 16 GAUGE WIRE — APPROX. 230mm (9 INCHES) LENGTH (ORANGE INSULATION) AS REQ'D

D3AZ-14A526-K — NO. 17 GAUGE WIRE — APPROX. 230mm (9 INCHES) LENGTH (YELLOW INSULATION) AS REQ'D (SPECIAL USED WITH AIR CONDITIONING SYSTEM)

D3AZ-14A526-L — NO. 18 GAUGE WIRE — APPROX. 230mm (9 INCHES) LENGTH (RED INSULATION) AS REQ'D

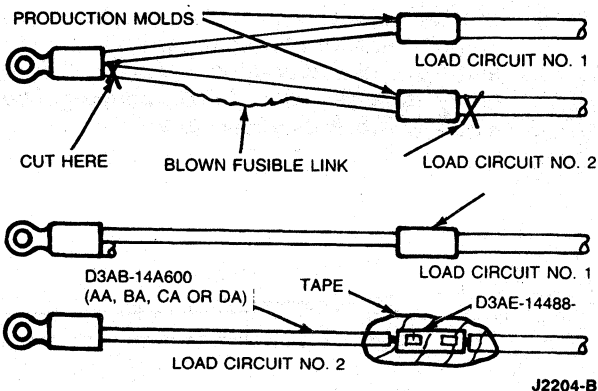
D3AZ-14A526-M — NO. 20 GAUGE WIRE — APPROX. 230mm (9 INCHES) LENGTH (BLUE INSULATION) AS REQ'D

K8503-A

2. Disconnect battery ground cable.
3. Disconnect fuse link and/or fuse link eyelet terminal from battery terminal of starter relay. On some vehicle applications, fuse link is looped outside of wire harness.
4. Cut fuse link and splice(s) from wire(s) to which it is attached.

Disconnect the feed wire part of the wiring and cut out the damaged portion as close as possible behind the splice in the harness. If the damaged fuse link is between two splices (weld points in the harness), cut out the damaged portion as close as possible to the weld points.

5. To service two-link group when only one link has blown and other link is not damaged:
  - a. Cut out blown fusible link (two places).
  - b. Position correct eyelet type service fusible link with bare end to butt connector and crimp to wire end. Use Wire Crimping Tool B9A-17018-A or equivalent.



6. Splice and solder new fuse link to wire(s) from which old link was cut. Use rosin core solder. Wrap splice(s) completely with vinyl electrical tape.
7. Securely connect eyelet terminals (if any) to battery stud on starter relay.
8. Install repaired wiring as before, using existing clips, if provided.
9. Connect battery ground cable.

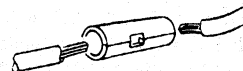
## REMOVAL AND INSTALLATION (Continued)

## Fuse Link

To service any blown fuse link use the following procedure:

1. Determine which circuit is damaged, its location and cause of open fuse link. If damaged fuse link is one of three fed by common 10- or 12-gauge feed wire, determine specific affected circuit.
2. Disconnect negative battery cable.
3. Cut damaged fuse link from wiring harness and discard it. If fuse link is one of three circuits fed by single feed wire, cut it out of harness at each splice end and discard.
4. Identify and procure proper fuse link and butt connectors for attaching fuse link to harness.
5. To service any fuse link in a 3-link group with one feed:
  - a. After cutting open link out of harness, cut each of remaining undamaged fuse links close to feed wire weld.
  - b. Strip approximately 12.70mm (1/2 inch) of insulation from detached ends of two good fuse links. Then insert two wire ends into one end of Butt Connector D3AZ-14488-Y or equivalent, and carefully push one stripped end of replacement fuse link into same end of butt connector. Crimp all three firmly together using Wire Crimping Tool T67S-17018-A or equivalent.

## BUTT CONNECTOR — WIRING SPLICE



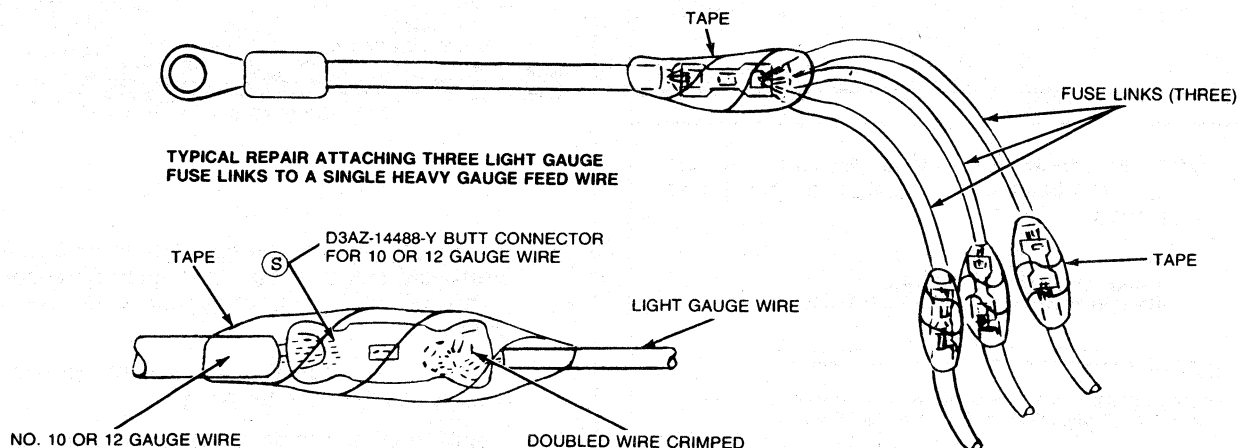
D3AZ-14488-Y — FOR NO. 10 AND 12 GAUGE WIRE (LOAD CIRCUIT) AS REQ'D.

D3AZ-14488-Z — FOR NO. 14 AND 16 GAUGE WIRE (LOAD CIRCUIT) AS REQ'D.

J2324-B

NOTE: Care must be taken when fitting the three fuse links into the butt connector as the internal diameter is a snug fit for three wires. Use Wire Crimping Tool T67S-17018-A or equivalent, as pliers, side cutters, etc. will not apply the proper crimp to retain the wires and withstand a pull test.

- c. After crimping butt connector to three fuse links, cut weld portion from feed wire and strip approximately 12.70mm (1/2 inch) of insulation from cut end. Insert stripped end into open end of butt connector and crimp very firmly.
- d. To attach remaining end of replacement fuse link, strip approximately 12.70mm (1/2 inch) of insulation from wire end of circuit from which the blown fuse link was removed, and firmly crimp a Butt Connector D3AZ-14488-Z or equivalent to stripped wire. Then insert end of replacement link into other end of butt connector and crimp firmly.



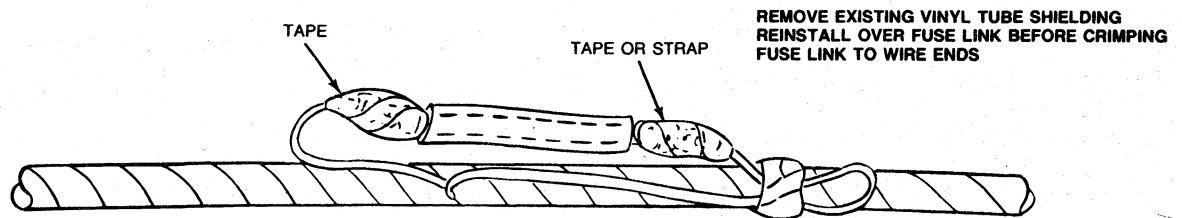
K8504-B



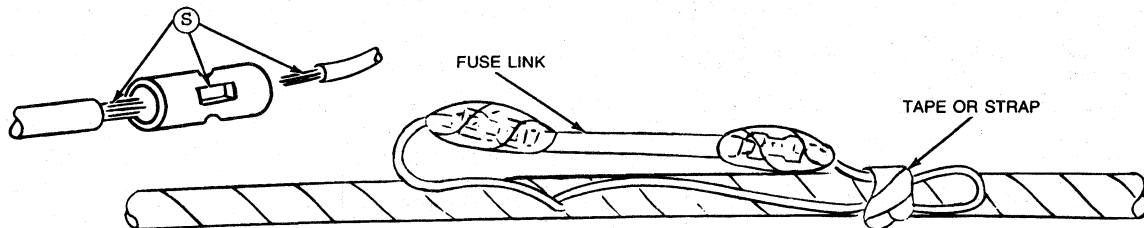
## REMOVAL AND INSTALLATION (Continued)

- e. Using rosin core solder with consistency of 60 percent tin and 40 percent lead, solder connectors and wires at repairs and insulate with electrical tape.
6. To replace any fuse link on a single circuit in a harness, cut out damaged portion, strip

approximately 12.70mm (1/2 inch) of insulation from two wire ends. Attach appropriate replacement fuse link to stripped wire ends with two proper size butt connectors. Solder connectors and wires and insulate with electrical tape, as in Step 5.



TYPICAL REPAIR USING THE SPECIAL NO. 17 GAUGE 230mm (9 INCHES) LONG-YELLOW FUSE LINK REQUIRED FOR THE A/C CIRCUITS (TWO) NO. 687E AND NO. 261A LOCATED IN THE ENGINE COMPARTMENT



TYPICAL REPAIR FOR ANY IN-LINE FUSE LINK USING THE SPECIFIED GAUGE FUSE LINK FOR THE SPECIFIED CIRCUIT

K8506-B

7. To service any fuse link which has an eyelet terminal on one end such as the charging circuit, cut off open fuse link behind weld, strip approximately 12.70mm (1/2 inch) of insulation from cut end and attach appropriate new eyelet

fuse link to cut stripped wire with an appropriate size butt connector. Solder connectors and wires at point of service and insulate with electrical tape, as in Step 5.



TYPICAL REPAIR USING THE EYELET TERMINAL FUSE LINK OF THE SPECIFIED GAUGE FOR ATTACHMENT TO A CIRCUIT WIRE END

J2323-B

8. Connect negative battery cable and test system for proper operation.

**DO NOT MISTAKE A RESISTOR WIRE FOR A FUSE LINK.** The resistor wire is generally longer and has print stating: "Resistor—do not cut or splice."

When attaching a single number 16-, 17-, 18- or 20-gauge fuse link to a heavy gauge wire, always double the stripped wire end of the fuse link before inserting and crimping it into the butt connector for positive wire retention.

## SPECIAL SERVICE TOOLS

Tool Number	Description
T67S-17018-A	Wire Crimping Tool

CK8447-A



# AUXILIARY EQUIPMENT

# GROUP 35

(17000 & 18000)

SECTION TITLE	PAGE	SECTION TITLE	PAGE
ANTENNAS .....	35-10-1	SPEAKERS .....	35-30-1
ASH RECEPTACLES AND CIGAR LIGHTER .....	35-40-1	WINDSHIELD WASHERS .....	35-70-1
HORNS .....	35-80-1	WINDSHIELD WIPERS—ELECTRIC .....	35-60-1
PREMIUM SOUND .....	35-09-1		
RADIO AND STEREO TAPE PLAYER— ELECTRONIC .....	35-03-1		

## SECTION 35-03 Radio and Stereo Tape Player— Electronic

SUBJECT	PAGE	SUBJECT	PAGE
CLEANING		DIAGNOSIS	
Cassette Tape Player .....	35-03-3	Diagnosis Charts .....	35-03-6
DESCRIPTION AND OPERATION		Radio Reception .....	35-03-4
Cassette Tape Player .....	35-03-3	Road Tests .....	35-03-3
Operating Precautions .....	35-03-3	REMOVAL AND INSTALLATION	
Control Functions .....	35-03-2	Radio and/or Tape Player .....	35-03-3
Operating Instructions .....	35-03-1	VEHICLE APPLICATION .....	35-03-1

### VEHICLE APPLICATION

Taurus/Sable.

### DESCRIPTION AND OPERATION

#### Operating Instructions

The electronic AM/FM stereo radio includes advanced features and performance characteristics for best radio listening enjoyment. The optional cassette tape with Dolby® noise reduction will further increase your listening enjoyment by playing your favorite cassette tapes.

Each of these radios is electronically tuned with such precision that fine tuning is not required. All these radios have identical tuning and sound adjustment controls.

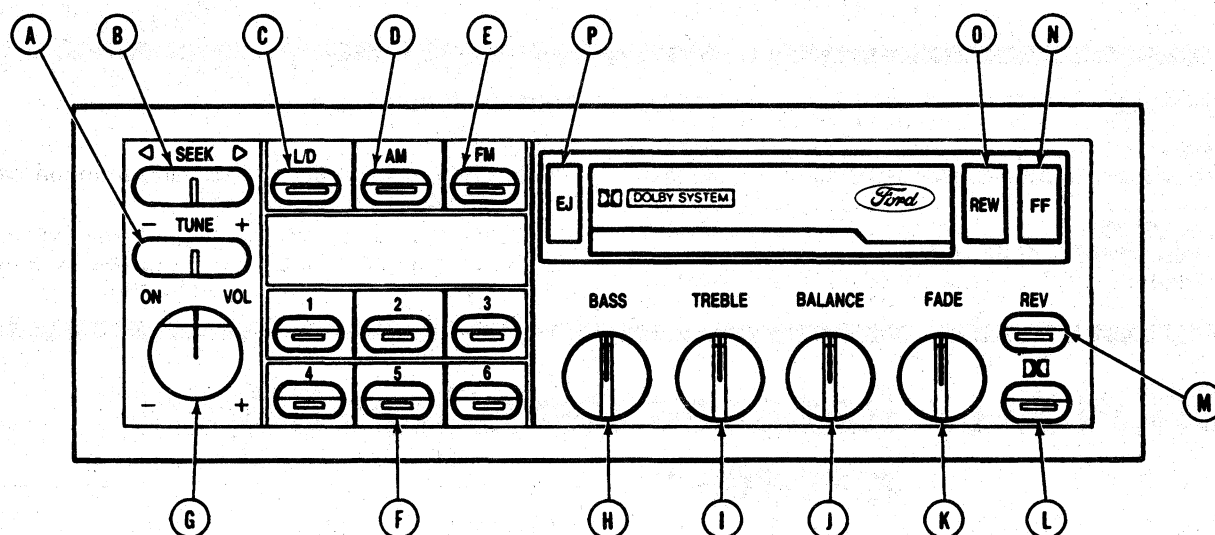
**WARNING: USE ONLY PROPERLY INSTALLED FCC APPROVED RADIO TRANSMITTING EQUIPMENT. USE OF OTHER TRANSMITTING EQUIPMENT MAY CAUSE THE VEHICLE TO MALFUNCTION OR STALL. IF THE ENGINE STALLS, POWER BRAKE AND POWER STEERING ASSIST WILL STOP. CONSULT YOUR AUTHORIZED DEALER BEFORE INSTALLING ANY RADIO TRANSMITTER.**

## DESCRIPTION AND OPERATION (Continued)

## Control Functions

## Electronic Search Radio (ESR)

The Electronic Search Radio (ESR) contains some features which may not be familiar to the user. These instructions will explain the features. There are three different radios; Cassette (shown) (control for other radios typical), MPX stereo radio (non-cassette) and Low power cassette.



K8914-A

The features described are identical on all the radios (where applicable).

- A. **TUNE** up or down to the next channel (0.2 mHz in FM, 10 kHz in AM).
- B. **SEEK** up or down to the next listenable station.
- C. **LOCAL/DISTANT** toggles between Local and Distant mode. Only displays LOC in Local mode (Distant mode not displayed). Local mode is for use in metropolitan areas and only on strong signal stations.
- D. Pushing AM enables AM mode. AM will be displayed. 6 AM memories.
- E. Pushing FM enables FM mode. Pushing FM again will toggle between FM1 and FM2. 6 FM memories in FM1 and another 6 in FM2. FM1 or FM2 will be displayed.
- F. To store a station, depress **MEMORY** button and hold for 2 seconds. (Sound will disappear and come back after 2 seconds). To recall a station, depress MEMORY button and release.

- G. **VOLUME/ON-OFF**: Push to turn on, push again to turn off. Turn control clockwise to increase volume.
- H. **BASS**: Rotate clockwise for more bass and counterclockwise for less bass.
- I. **TREBLE**: Rotate clockwise for more treble and counterclockwise for less treble.
- J. **BALANCE**: Adjusts sound between left side and right side of vehicle.
- K. **FADE**: Adjusts sound between front and rear of vehicle.
- L. **DOLBY**: Press for playing tapes recorded using the Dolby® System. Press again to deactivate.
- M. **REVERSE**: Press to change direction of cassette tape.
- N. **FAST FORWARD**: Press to fast advance the program being played.
- O. **FAST REWIND**: Press to change direction of tape and fast advance.
- P. **EJECT**: Press to eject cassette.

**DESCRIPTION AND OPERATION (Continued)****Cassette Tape Player**

Insert the tape cassette, open edge to the right, to play (radio on, ignition in RUN or ACC). Adjust volume, tone and speaker balance as for radio programs. At the end of the tape, the cassette automatically reverses and plays the other side of the tape. At any time the tape transport mechanism can be changed to play the other side of the tape by pressing the REVERSE button.

The Dolby® System is a noise reduction system manufactured under license from Dolby Laboratories. Dolby® and the double-D symbol are trademarks of Dolby Laboratories Licensing Corporation.

**NOTE:** Before turning off the radio or the ignition, always eject any cassette being played. Leaving the tape mechanism stopped while a tape is engaged can result in damage to the tape, pinch roller, or capstan.

**Operating Precautions**

When inserting a tape cassette into the tape slot, it should be firmly pushed in and down to ensure that it is properly seated. To play a full tape, insert the cassette so the empty hub of the cassette goes into the slot first.

Do not leave a tape cassette engaged in the tape player slot when not in use. Remove it completely to permit the slot door to close and keep out airborne dirt. Disengaging the cassette from the tape playback head in this manner will also prevent a flat spot from developing on the capstan roller.

Take care to protect the open edge of the cassette from damage, dirt, oil and grease. When not in use, store cassettes in their protective cases with hub locks in place. Otherwise, there will be a risk of having the tape loosen on its hubs, which could cause the tape to spill or jam in the player. If a cassette is found with loose tape, ensure it is rewound firmly around the hubs before using it. Never try to open a cassette or try to pull the tape out of it.

**Cassette Irregularities**

Cassette tapes can vary in performance and size, resulting in occasional problems with certain specific cassettes.

If any one cassette gives continual trouble because of this, it is best to discontinue use.

For best results, use cassette tapes with no more than 90 minutes of playing time. The thinness of the tapes used in C120 and C180 cassettes makes the tape more likely to stretch and break. A stretched tape will result in poor sound quality.

**Temperature Extremes**

Do not expose tape cassettes to intense sunlight or other temperature extremes. If they do become exposed to high or low temperatures, allow each cassette to reach a moderate temperature before playing. During cold weather, it is advisable to take cassettes indoors overnight to protect them.

In extremely cold weather, the tape player may need a few minutes to warm up before delivering full sound quality.

**REMOVAL AND INSTALLATION****Radio and/or Tape Player**

Location of radio fuses are shown in Section 34-50.

**Removal**

1. Disconnect battery ground cable.
2. Remove center instrument trim panel.
3. Remove four screws retaining radio and mounting bracket to instrument panel.
4. Push radio to front and raise back end of radio slightly so rear support bracket clears clip in instrument panel. Pull radio out of instrument panel slowly.
5. Disconnect wiring connectors and antenna cable.

**Installation**

1. Connect wiring connectors and antenna cable to radio.
2. Slide radio into instrument panel keeping rear of radio slightly raised to engage rear mounting bracket to clip in instrument panel.
3. Install four retaining screws. Tighten to 1.5-1.9 N·m (14-16 lb-in).
4. Install center instrument trim panel.
5. Connect battery ground cable. Test radio and/or tape player for operation.

**CLEANING****Cassette Tape Player****Head**

The playback head, capstans and pinch rollers may accumulate an oxide residue as the tape passes through the components while playing. Depending on the quality used, more or less oxide will accumulate. Oxide accumulation can cause weak or wavering sound and damage to the cassette tape and/or player.

It is recommended for best performance that the tape player be cleaned after every 10 to 12 hours of playing time with a Ford Cassette Cleaning Cartridge or equivalent.

**CAUTION: The use of other cassette cleaners is not recommended; damage to the cassette player could result.**

**DIAGNOSIS****Road Tests**

Internal diagnosis examination of the radio should be left to the authorized radio service center. However, the automotive technician should be able to analyze and isolate radio reception conditions to the proper area or component causing the condition. All radio conditions can be isolated to one of four general areas. The trouble will be found in the antenna system, radio chassis (receiver), speaker system, or radio noise suppression equipment.

**DIAGNOSIS (Continued)****Radio Reception****Tuning**

Fine tuning is not required for the electronic radio.

FM multiplex has a range of about 32 km (20 miles) before reception noises are heard. This means that in problem areas with tall buildings or hills it is necessary to select the strongest possible station. The electronic radio automatically tunes to the center of any given station, eliminating the need for manual fine tuning.

**Tone Control**

Favoring the rear speakers in noisy areas will help to reduce noise.

**Antennas and Mobility**

Although an automobile radio will give outstanding mobile reception, it cannot provide the continuous reception of that enjoyed in the home radio. The home receiver is not limited by the vehicle operating characteristics and certain geographical effects as is the mobile unit. For example, for the best FM reception, the automobile antenna should be designed similar to a TV antenna and pointed in the direction of the station. The best AM antenna is a long piece of wire; the higher the wire the better the reception. However, because of design necessity, the automobile antenna is restricted in size, height, direction and must receive both AM and FM stations. This means that a limited amount of the station's signal reaches the vehicle radio. In addition, the vehicle and its radio are portable. This mobility and reduced signal pickup results in FM flutter. This is normal.

**Interfering Noise**

The vehicle ignition system is a source of radio interference. This high voltage switching system produces a radio frequency electromagnetic field that radiates at AM, FM and CB frequencies. Although components have been designed into the vehicle to maximize this problem, the noise is more noticeable if the radio is tuned slightly off channel when listening to FM programs. Vehicle electrical accessories and owner add-on accessories may also contribute to radio interference. Furthermore, there are many noise sources which are external to the vehicle. These include power lines, communication systems, ignition system or other vehicles.

Noise or static may result from many causes. Two of the most common sources of radio noise are listed below.

**Ignition Noise**

The most effective method of evaluating ignition noise is to compare the radio performance with engine on, versus engine off. If ignition noise is present with engine running:

- Ensure that the spark plug wires are the suppressor type and that the spark plugs are the correct resistor type.
- Ensure that the carbon center insert in distributor cap is secure.
- Check distributor cap and rotor electrodes for silicone grease as this may cause ignition noise on FM or CB. This noise is characterized by a "motor boat" type sound on weak to moderate strength stations. The noise can only be eliminated by replacing the distributor cap and rotor with a cap and rotor that does not have grease.

NOTE: Silicone grease must not be removed from vehicles equipped with electronic engine controls (EEC-IV).

**Missing or Faulty Noise Suppression Component**

- Noise suppression components may be malfunctioning or missing.
- Check bond strap grounding effectiveness by wedging a large file between metal parts to ensure proper ground, such as between the tailpipe and body, or between the fender and frame, while the radio is playing and the engine is running. Listen for a decrease in the objectionable radio noise. If a reduction in radio noise is noted, first try tightening body and exhaust system clamps and brackets. Then, if necessary, install a new bond strap between the two metal parts to ensure proper ground.

**FM Flutter**

FLUTTER can best be described as repeated pops and hissing bursts heard in the speaker, during an otherwise good broadcast. Usually this condition exists while traveling in the fringe area of the station. Flutter will become more severe beyond approximately 40 km (25 miles) of the station. The signal loss becomes greater away from the station, until finally noise takes over and you can no longer receive the station. Flutter may also be noticed near the station because of the line-of-sight characteristics of FM waves. This condition can happen when a building or large structure is between the radio receiver and the station being received. Some of the FM signal bends around the building, but certain spots have almost no signal. Some of these signal losses are only a few inches wide and if the vehicle is parked in one of these dead spots, only noise from the speaker will be heard. As you move out of the shadow of the structure, the station will return to normal. Flutter will not occur on AM because the AM radio waves are much longer than FM waves.

**DIAGNOSIS (Continued)****FM Multi-Path Cancellation**

Another effect caused by the line-of-sight characteristic is called CANCELLATION. This condition exists when the radio waves are reflected from objects or structures. The noise produced by cancellation are similar to flutter, with the addition of distortion in the program. A more familiar description of cancellation is its similarity to the multiple ghosts and picture jumping that occur on television when a low flying plane passes. The same condition exists in the vehicle, except that the vehicle is moving and the reflecting structure is stationary. The reflected signal cancels the normal signal, causing the antenna to pick up noise and distortion. Cancellation effects are most prominent in metropolitan areas, but can also become quite severe in hilly terrain and depressed roadways.

**FM Strong Signal Capture and AM Overloading**

FM strong signal capture is an unusual condition that occurs when traveling in the vicinity of a broadcast tower. If listening to a weak FM station, when passing the broadcast tower, a stronger station occurs without changing the radio dial. When passing the tower, the station may switch back and forth a few times before returning to the station originally tuned. When several broadcast towers are present (common in metropolitan areas) several stations may OVERLOAD the receiver resulting in considerable station changing, mixing and distortion. Fortunately this condition is localized and will not harm the receiver. Some overloading may also be noticed on AM, but usually to a lesser degree.

**Receiving FM Multiplex**

Because more data is carried in the FM multiplex waves than in the monaural FM broadcasts, flutter, cancellation and capture are even more noticeable. The FM multiplex noise free broadcast range is approximately 8 km (5 miles) less than that received with the monaural FM radio.

The AM/FM, FM multiplex radio may never encounter any of these troublesome conditions as they are more prominent in metropolitan areas, hilly terrain and depressed roadways. However, when diagnosing FM multiplex, it is recommended to accurately tune to the strongest FM multiplex station.

**Stereo Indicator Lamp Inoperative or Flickering (AM and FM Reception Are OK)**

- Verify that customer is listening to stereo stations.
- A weak or distant signal may cause stereo indicator lamp to flicker. Tune radio to nearby FM stereo station. If reception is good, but stereo indicator lamp is still intermittent, remove radio chassis for service.
- Intermittent FM stereo indicator lamp operation is sometimes caused by damaged AM/FM bandswitch. If normal operation can be restored by switching back and forth from AM to FM several times, radio should be removed for service, and this condition should be noted on service tag.

**Tape Player Will Not Accept Cartridge, Eats Tape, Plays Too Fast or Too Slow, Etc. (AM and FM Operating Properly)**

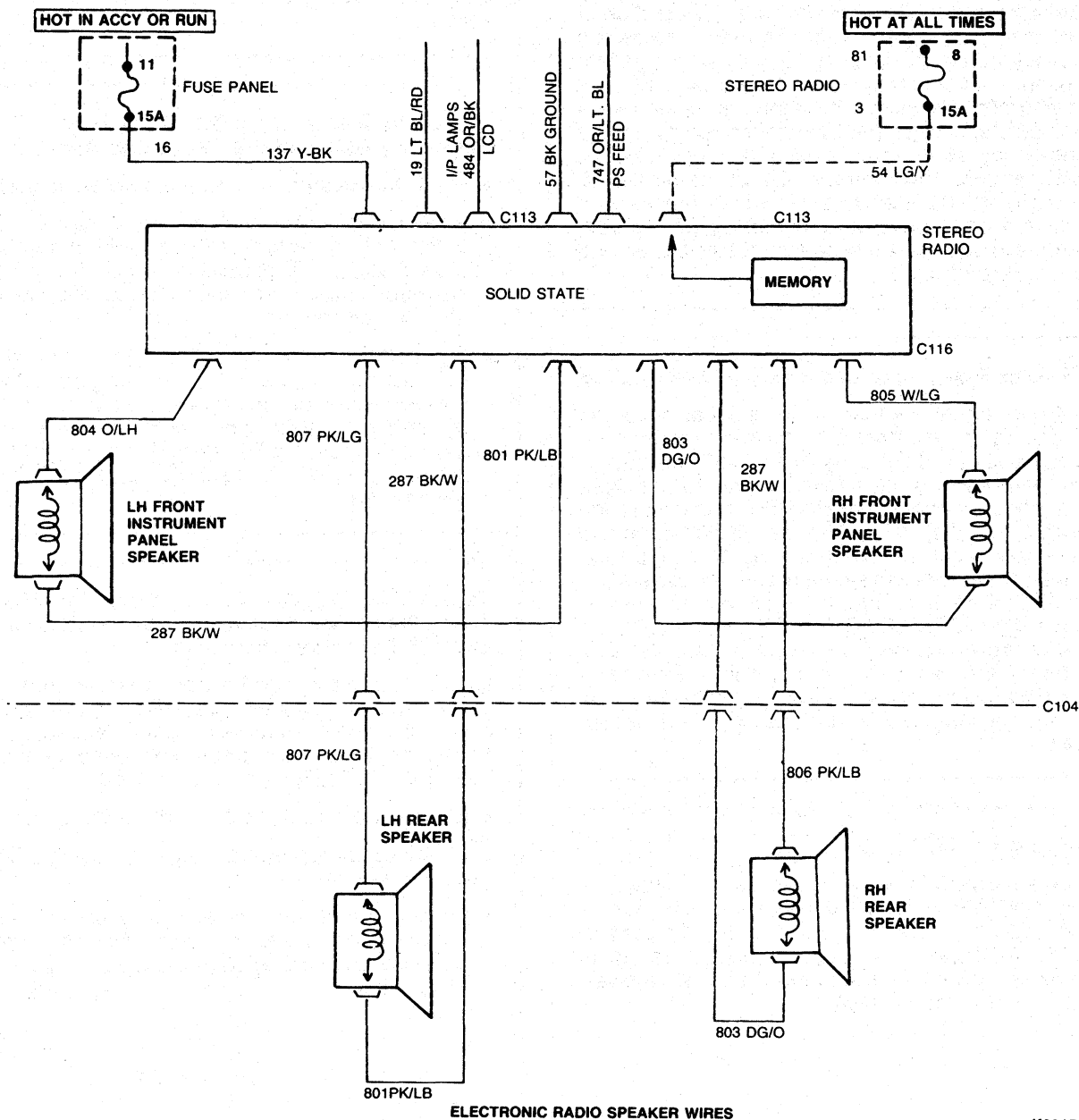
NOTE: Complaints about poor performance while using tapes usually indicates a dirty head in the tape deck. Poor fidelity of tape, low tape volume, garbled sound on tape, poor treble response or muffled sound are indications of a dirty head.

- Ensure tape cassette has not come to the end.
- Check operation of tape player by using a known good cassette.
- If condition is not corrected by substitution of known good cassette, radio chassis must be removed and sent to an authorized service facility for service.

## DIAGNOSIS (Continued)

## Diagnosis Charts

Use the wiring diagram and diagnosis charts to isolate malfunction in the electronic radio.



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## DIAGNOSIS (Continued)

## NOISY AM RECEPTION — ENGINE RUNNING, VEHICLE IN/NOT IN MOTION

TEST STEP		RESULT	ACTION TO TAKE
<b>A0</b>	VERIFY CONDITION BY OPERATING THE RADIO WHILE THE ENGINE IS RUNNING, WITH THE VEHICLE IN OR NOT IN MOTION		
<b>A1</b>	CHECK ANTENNA CABLE CONNECTIONS		
	<ul style="list-style-type: none"> <li>• Check antenna cable connections.</li> <li>• Connections must be clean and secure.</li> </ul>	<del>OK</del> ► OK ►	CLEAN and/or SECURE antenna cable connections as required. GO to A2.
<b>A2</b>	CHECK ANTENNA MOUNTING		
	<ul style="list-style-type: none"> <li>• Check to make sure antenna is securely mounted to body at ground points.</li> </ul>	<del>OK</del> ► <del>OK</del> ►	CLEAN and/or SECURE connections as required. GO to A3.
<b>A3</b>	CHECK SUPPRESSION EQUIPMENT		
	<ul style="list-style-type: none"> <li>• Check for presence of all required suppression equipment, body grounding strap usage, security, cleanliness and metal-to-metal connection. Refer to Shop Manual for location(s).</li> </ul>	<del>OK</del> ► OK ►	INSTALL missing or damaged equipment and/or CLEAN connections as required. GO to A4.
<b>A4</b>	CHECK MOUNTING AND CONNECTING WIRES OF FOLLOWING COMPONENTS		
	<ul style="list-style-type: none"> <li>• Check the mounting and connecting wires of the voltage regulator capacitor and alternator for secureness, cleanliness, metal-to-metal contact. (Refer to group 31 in this manual).</li> </ul> <p><b>IMPORTANT: The capacitor mounting points are used to complete the electrical circuit and must be mounted securely to clean surfaces.</b></p>	<del>OK</del> ► OK ►	CLEAN and/or SECURE connections as required. GO to A5.
<b>A5</b>	CHECK OPERATION OF THE FOLLOWING COMPONENTS		
	<ul style="list-style-type: none"> <li>• Check alternator by disconnecting wiring harness from voltage regulator.</li> <li>• Verify radio reception.</li> <li>• Check the operation of the voltage regulator capacitor.</li> </ul>	Noise eliminated Noise not eliminated	SERVICE or REPLACE damaged component as required. GO to A6.

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## DIAGNOSIS (Continued)

## NOISY AM RECEPTION — ENGINE RUNNING, VEHICLE IN/NOT IN MOTION — Continued

TEST STEP		RESULT	ACTION TO TAKE
<b>A6</b>	<b>CHECK SPARK PLUG WIRES</b>		
	<ul style="list-style-type: none"> <li>Check spark plug wires for proper routing, grounding and secureness of connections.</li> </ul>	<del>OK</del> ➤ OK ➤	REROUTE or REPLACE spark plug wires and secure connections as required. GO to A7.
<b>A7</b>	<b>CHECK IGNITION SYSTEM</b>		
	<ul style="list-style-type: none"> <li>Check ignition system for proper operation. (Use ignition system analyzer or check for open circuit spark plug wires using ohmmeter.) Also check spark plugs for cracked insulators.</li> </ul>	<del>OK</del> ➤ OK ➤	SERVICE or REPLACE components as required. GO to A8.
<b>A8</b>	<b>CHECK CHASSIS MOUNTING POINTS</b>		
	<ul style="list-style-type: none"> <li>Check all radio chassis mounting points for secureness, cleanliness and metal-to-metal contact.</li> </ul>	<del>OK</del> ➤ OK ➤	CLEAN and/or SECURE as required. GO to A9.
<b>A9</b>	<b>SUBSTITUTE ANTENNA</b>		
	<ul style="list-style-type: none"> <li>Substitute a known good antenna being sure to ground antenna body to an unpainted metal surface.</li> </ul>	Noise eliminated ➤ Noise not eliminated ➤	REPLACE antenna. GO to A10.
<b>A10</b>	<b>SUBSTITUTE RADIO</b>		
	<ul style="list-style-type: none"> <li>Substitute known good radio.</li> <li>Verify operation of radio.</li> </ul>	Noise eliminated ➤ Noise not eliminated ➤	Have radio unit serviced by authorized service center. GO to 11.
<b>A11</b>	<b>REPOSITION THE FOLLOWING COMPONENTS</b>		
	<ul style="list-style-type: none"> <li>Check to see if noise can be eliminated by repositioning antenna, speaker or radio power feed wires away from other wires and/or brackets.</li> <li>Verify operation of radio.</li> </ul>	Noise eliminated ➤ Noise not eliminated ➤	REPOSITION permanently by taping. GROUND various parts of the car to the frame using a jumper cable for example, engine, fenders, quarter panels, stone deflectors, air cleaner, body sheet metal. When noise is eliminated, provide permanent ground where required.

## DIAGNOSIS (Continued)

## NOISY FM RECEPTION — ENGINE RUNNING, VEHICLE NOT IN MOTION

TEST STEP		RESULT	ACTION TO TAKE
B0	VERIFY CONDITION BY OPERATING RADIO WITH ENGINE RUNNING AND VEHICLE NOT IN MOTION		
B1	DETERMINE IF PROBLEM IS WITH FM RECEPTION LIMITATION		
● If noise is on FM stereo, determine if customer concern is due to FM stereo reception limitation. Refer to normal operation description.			
		Yes	EXPLAIN and DEMONSTRATE to customer. Inform customer of methods for obtaining best reception.
		No	GO to B2.
B2	CHECK ANTENNA CABLE CONNECTIONS	 ➤  ➤	CLEAN and/or SECURE as required. GO to B3.
● Check antenna cable connections. Connections must be clean and secure.			
B3	CHECK ANTENNA MOUNTING	 ➤  ➤	CLEAN and/or SECURE as required. GO to B4.
● Check to make sure antenna is securely mounted to body and base screws are tight.			
B4	CHECK DISTRIBUTOR ROTOR CONTACT SPRING TENSION	 ➤  ➤	REPLACE rotor. GO to B5.
● Check for adequate distributor rotor contact spring tension. Height of spring should be .280 inch minimum from top of rotor. (Not applicable to EEC-equipped vehicles.)  ● EEC-equipped vehicles go to B6.			
B5	CHECK CARBON CENTER INSERT OF DISTRIBUTOR CAP	 ➤  ➤	REPLACE distributor cap. GO to B6.
● Check to see if carbon center insert in distributor cap is secure. (Not applicable to EEC-equipped vehicles.)			
B6	CHECK SPARK PLUG WIRES ROUTING	 ➤  ➤	REROUTE or SECURE connections as required. GO to B7.
● Check spark plug wires for proper routing and secureness of connections.			

## DIAGNOSIS (Continued)

## NOISY FM RECEPTION — ENGINE RUNNING, VEHICLE NOT IN MOTION (Cont'd.)

TEST STEP		RESULT	ACTION TO TAKE
<b>B7</b>	CHECK TYPE OF SPARK PLUG WIRES		
<ul style="list-style-type: none"><li>• Check if wires are suppressor type and if spark plugs are the correct type.</li></ul>		<div><div>⊗</div><div>▶</div></div>	REPLACE spark plug or wires with the correct type.
		<div><div>⊙</div><div>▶</div></div>	GO to <b>B8</b> .
<b>B8</b>	CHECK IGNITION SYSTEM		
<ul style="list-style-type: none"><li>• Check ignition system for proper operation. (Use ignition system analyzer or check for open circuit spark plug wires using ohmmeter.) Also, check spark plugs for cracked insulators.</li></ul>		<div><div>⊗</div><div>▶</div></div>	SERVICE or REPLACE components as required.
		<div><div>⊙</div><div>▶</div></div>	GO to <b>B9</b> .
<b>B9</b>	CHECK CHASSIS MOUNTING		
<ul style="list-style-type: none"><li>• Check all radio chassis mounting points for secureness, cleanliness and metal-to-metal contact.</li></ul>		<div><div>⊗</div><div>▶</div></div>	CLEAN and/or SECURE as required.
		<div><div>⊙</div><div>▶</div></div>	GO to <b>B10</b> .
<b>B10</b>	SUBSTITUTE ANTENNA		
<ul style="list-style-type: none"><li>• Substitute a known good antenna being sure to ground antenna base to an unpainted metal surface.</li><li>• Verify operation of radio.</li></ul>		Noise eliminated ▶	REPLACE antenna.
		Noise not eliminated ▶	GO to <b>B11</b> .
<b>B11</b>	CHECK ALTERNATOR		
<ul style="list-style-type: none"><li>• Check alternator by disconnecting wiring from voltage regulator.</li><li>• Verify operation of radio.</li></ul>		Noise eliminated ▶	CHECK alternator as directed in Shop Manual. SERVICE or REPLACE as required.
		Noise not eliminated ▶	GO to <b>B12</b> .
<b>B12</b>	SUBSTITUTE RADIO		
<ul style="list-style-type: none"><li>• Substitute known good radio.</li><li>• Verify operation of radio.</li></ul>		Noise eliminated ▶	Have radio SERVICED by an authorized service center.
		Noise not eliminated ▶	GO to <b>B13</b> .
<b>B13</b>	REPLACE DISTRIBUTOR CAP AND ROTOR		
<ul style="list-style-type: none"><li>• Replace distributor cap and rotor with new ungreased cap and rotor. (Do not replace on EEC-equipped vehicles.)</li><li>• Verify operation of radio.</li></ul>		Noise eliminated ▶	Distributor cap and/or rotor were damaged. RETURN to customer.
		Noise not eliminated ▶	CHECK to see if noise can be eliminated by repositioning antenna, speaker or radio power feed wires. If noise is eliminated, reposition permanently by taping.
NOTE: All surfaces used for grounding must be clean to ensure good electrical contact. Remove any dirt, rust, grease, paint, etc.			

## DIAGNOSIS (Continued)






## RADIO IS INOPERATIVE OR INTERMITTENT

TEST STEP		RESULT	ACTION TO TAKE
<b>C0</b>	VERIFY RADIO IS INOPERATIVE OR HAS INTERMITTENT OPERATION		
<b>C1</b>	CHECK RADIO OPERATION		
	<ul style="list-style-type: none"> <li>Check operation of radio to determine if radio is inoperative or intermittent.</li> </ul>	Radio inoperative Radio intermittent	GO to <b>C2</b> . GO to <b>C3</b> .
<b>C2</b>	CHECK FUSE		
	<ul style="list-style-type: none"> <li>Check fuse to see if it is blown.</li> </ul>	Fuse (OK) Fuse (X)	GO to <b>C3</b> . TURN OFF ignition switch and radio. REPLACE fuse. TURN ignition switch ON. RECHECK fuse. If fuse is bad GO to <b>C4</b> . If fuse is still OK, OPERATE radio and tape player (if so equipped). If fuse fails, have radio serviced by authorized service center. If fuse OK, radio system OK.  NOTE: For a repeated customer complaint, perform the above test while driving on rough road conditions to isolate the system exhibiting an intermittent short circuit condition.
<b>C3</b>	CHECK POWER FEED		
	<ul style="list-style-type: none"> <li>Check power feed for proper connections.</li> </ul>	(X) (OK)	CONNECT power feed properly. GO to <b>C5</b> .
<b>C4</b>	DETERMINE LOCATION OF GROUNDED POWER FEED		
	<ul style="list-style-type: none"> <li>Turn off ignition.</li> <li>Determine location of grounded power feed to radio.</li> </ul>	Grounded power feed found	SERVICE or REPLACE as required.

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## DIAGNOSIS (Continued)





## RADIO IS INOPERATIVE OR INTERMITTENT

TEST STEP		RESULT	ACTION TO TAKE
<b>C.5</b>	<b>CHECK FOR POWER TO RADIO</b>		
	<ul style="list-style-type: none"> <li>Check for power to radio using a test lamp or a voltmeter.</li> </ul>	No power	SERVICE harness as required.
		Power 	GO to C.6.
<b>C.6</b>	<b>CHECK SPEAKERS TO SEE IF PROBLEM IS PRESENT ON ALL SPEAKERS</b>		
	<ul style="list-style-type: none"> <li>With radio operating, check if problem is present on all speakers.</li> </ul>	Problem present on all speakers	GO to C.7.
		Problem is not present on all speakers	GO to C.8.
<b>C.7</b>	<b>CHECK ANTENNA SYSTEM</b>		
	<ul style="list-style-type: none"> <li>Check antenna system using appropriate diagnostic chart.</li> </ul>		CONNECT, SERVICE or REPLACE antenna components as required.
			GO to C.8.
<b>C.8</b>	<b>CHECK RADIO CHASSIS</b>		
	<ul style="list-style-type: none"> <li>Check radio chassis.</li> <li>Using a known good speaker substitute bad speaker and connect directly to radio chassis.</li> <li>Verify operation of radio.</li> </ul>		HAVE radio chassis SERVICED by authorized service center.
			REPLACE speaker or CONNECT, SERVICE or REPLACE speaker wiring as required.

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## DIAGNOSIS (Continued)













## RADIO HAS WEAK RECEPTION

TEST STEP		RESULT	ACTION TO TAKE
<b>D0</b>	VERIFY RADIO HAS WEAK RECEPTION		
<b>D1</b>	CHECK ANTENNA CONNECTIONS		
<ul style="list-style-type: none"> <li>Check antenna connections.</li> </ul>			CLEAN and/or TIGHTEN antenna connections as required.
			GO to <b>D2</b> .
<b>D2</b>	CHECK ANTENNA SYSTEM		
<ul style="list-style-type: none"> <li>Check antenna system using appropriate diagnostic procedure. (Refer to Sections 35-10 or 35-21.)</li> </ul>			SERVICE antenna as required.
			GO to <b>D3</b> .
<b>D3</b>	CHECK RECEPTION OF RADIO ON AM & FM		
<ul style="list-style-type: none"> <li>Check for poor reception on both AM and FM.</li> </ul>		Reception weak on AM only	VERIFY radio reception. If reception is OK, return radio to service. If reception is still weak, have radio chassis SERVICED by an authorized service center.
		Reception weak on FM or both AM/FM	Have radio SERVICED by authorized service center.

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## DIAGNOSIS (Continued)

## ALL ELECTRONIC RADIO CONTROL FUNCTIONAL TEST











TEST STEP		RESULT	ACTION TO TAKE
<b>E.0</b>	TEST FUNCTIONS OF ALL ELECTRONIC RADIO		
<b>E.1</b>	VERIFY OPERATION OF RADIO		
	Turn ignition to ON or ACC. Turn radio on. • Verify that radio is on by observing that display has lit up.	 ►	GO to E.2.
		 ►	GO to E.3.
<b>E.2</b>	VERIFY SOUND FROM SPEAKERS		
	• Verify that sound is coming from speakers.	 ►	GO to E.17.
		 ►	GO to radio inoperative procedure.
<b>E.3</b>	AM INDICATOR TEST		
	• Push the AM button, and observe that "AM" on the RH side of the display is lit.	AM indicator  ►	GO to E.4.
		AM indicator  ►	REMOVE radio for service.
<b>E.4</b>	UP TEST		
	• Depress "seek-up" or "tune-up" button and verify that number on display increases.	UP function  ►	REMOVE radio for service.
		UP function  ►	GO to E.5.
<b>E.5</b>	DOWN CHECK		
	• Depress "seek-down" or "tune-down" button and verify that number on display decreases.	DOWN function  ►	REMOVE radio for service.
		DOWN function  ►	GO to E.6.
<b>E.6</b>	STATION RECALL MEMORY TEST		
	• Depress seek or tune to select the desired station. When the station is tuned, depress and hold a memory button. When the memory button is depressed, the station's sound will be interrupted. GO for approximately 2 seconds. When the station's sound returns, the button is "set" and may be released. This process is repeated for each of the memory buttons. Turn radio OFF and then ON. Depress each station recall button and verify that the stations indicated are the same as the stations stored above. Refer to procedures under Control Functions for setting stations.	Memory test  ►	REMOVE radio for service.
		Memory test  ►	GO to E.7.

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## DIAGNOSIS (Continued)

## ALL ELECTRONIC RADIO CONTROL FUNCTIONAL TEST — Continued

TEST STEP		RESULT	ACTION TO TAKE
<b>E.7</b>	<b>FM INDICATOR CHECK</b>		
<ul style="list-style-type: none"> <li>Push the "FM" button and observe that FM on the right side of the display is lit.</li> </ul>		FM indicator 	REMOVE radio for service.
		FM indicator 	PERFORM the following tests described earlier on the FM band — 1. Up test — E.4 2. Down check — E.5 3. Station recall memory check — E.6 Then proceed to <b>E.18</b> .
<b>E.8</b>	<b>FM STEREO INDICATOR TEST</b>		
<ul style="list-style-type: none"> <li>Tune radio to a known FM stereo station and observe that the stereo indicator lamp is on.</li> </ul>		Stereo indicator 	REMOVE radio for service.
		Stereo indicator 	GO to <b>E.9</b> .
<b>E.9</b>	<b>VOLUME CONTROL TEST</b>		
<ul style="list-style-type: none"> <li>Tune radio to a local station. Rotate volume control to the right and verify that an increase in the sound level occurs. Rotate volume control to left and verify a decrease in the sound level.</li> </ul>		Volume 	CHECK speaker connection and perform speaker test. REPEAT volume car test. If volume still is not OK, REMOVE radio to service. If volume OK, GO to <b>E.10</b> .
		Volume 	GO to <b>E.10</b> .
<b>E.10</b>	<b>TONE CONTROL TEST</b>		
<ul style="list-style-type: none"> <li>Rotate bass control to right and verify that a change in the pitch of the sound occurs.</li> <li>Rotate treble control to right and verify that a change in the pitch of the sound occurs.</li> </ul>		Tone 	REMOVE radio for service.
		Tone 	GO to <b>E.11</b> .
<b>E.11</b>	<b>BALANCE CONTROL TEST</b>		
<ul style="list-style-type: none"> <li>Rotate button (L or R) balance control at speaker from left to right to verify that sound moves from left speakers to right speakers.</li> </ul>		Balance 	CHECK speakers and speaker connections. REPEAT balance control test. If balance still is not OK — REMOVE radio for service. If balance OK, GO to <b>E.12</b> .
		Balance 	GO to <b>E.12</b> .

## DIAGNOSIS (Continued)





## ALL ELECTRONIC RADIO CONTROL FUNCTIONAL TEST — Continued

TEST STEP		RESULT	ACTION TO TAKE
<b>E.12</b>	<b>FADER CONTROL TEST</b>		
<ul style="list-style-type: none"> <li>Rotate fader control at speaker button (marked for B) from left to right and verify that sound moves from the front speakers to the rear speakers.</li> </ul>		Fader 	CHECK speakers and speaker connections. REPEAT fader control test. If fader is not OK, REMOVE radio for service. If fader is OK, GO to E.13.
		Fader 	GO to E.13.
<b>E.13</b>	<b>SEEK TEST</b>		
<ul style="list-style-type: none"> <li>Depress seek button and verify that radio stops on next station.</li> </ul>		Seek does not stop	TURN radio OFF and then back ON to determine if seeking stops. If seek does not stop, REMOVE radio for service. If seek does stop, GO to E.14.
		Seek does stop	GO to E.14.
<b>E.14</b>	<b>SEEK SCAN TEST (Continued)</b>		
<ul style="list-style-type: none"> <li>Tune radio on AM band (should be done outside of any building). Press scan button and count the number of listenable stations that can be tuned. Compare this to a vehicle with a known, good radio system.</li> </ul>		Normal number of stations not received	PERFORM antenna system check in Section 35-10 and repeat scan test. If still not receiving normal number of stations — REMOVE radio from vehicle and have serviced. If normal number of stations received GO to E.15.
		Normal number of stations received	GO to E.15.
<b>E.15</b>	<b>DISPLAY TEST</b>		
<ul style="list-style-type: none"> <li>Tune radio to 1000 AM and verify that the display is correct and that "AM" is displayed on right side of display.</li> </ul>		Display 	REMOVE radio for service.
		Display 	GO to E.16.

CK8925-A

## DIAGNOSIS (Continued)

## ALL ELECTRONIC RADIO CONTROL FUNCTIONAL TEST — Continued

TEST STEP		RESULT	ACTION TO TAKE
<b>E.16</b>	<b>DISPLAY TEST (Continued)</b>		
<ul style="list-style-type: none"> <li>• Tune radio to 88.9 FM and verify that the display is correct and that the "FM" is illuminated on the right side of the display.</li> </ul>		Display 	REMOVE radio for service.
		Display 	GO to E.17
<b>E.17</b>	<b>DISPLAY TEST (Continued)</b>		
<ul style="list-style-type: none"> <li>• Tune radio to FM stereo station and verify that the "ST" indicator on the right side of the display is on.</li> </ul>		Display 	REMOVE radio for service.
		Display 	End of electronic radio controls function test. If other problems exist, i.e., poor reception or noisy reception, see appropriate diagnostic procedures.

CK8926-A

## SECTION 35-09 Premium Sound

SUBJECT	PAGE	SUBJECT	PAGE
DESCRIPTION		REMOVAL AND INSTALLATION	
Premium Sound .....	35-09-1	Premium Sound Amplifier .....	35-09-3
DIAGNOSIS AND TESTING .....	35-09-3	Station Wagon .....	35-09-3
OPERATION		VEHICLE APPLICATION .....	35-09-1
Premium Sound .....	35-09-3		

### VEHICLE APPLICATION

Taurus/Sable.

### DESCRIPTION

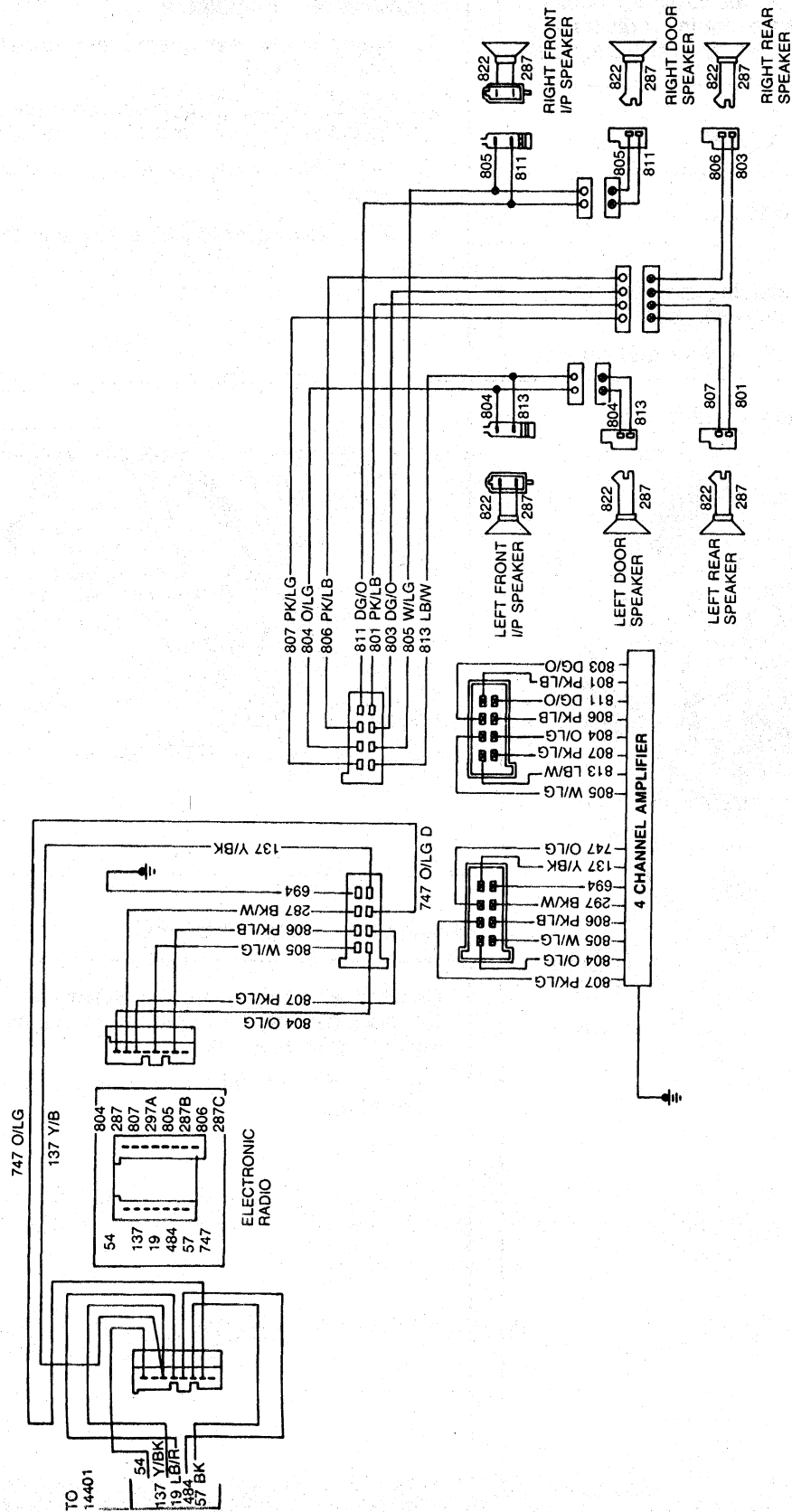
#### Premium Sound

The premium sound system is available with all electronic radios. The premium sound system contains a 4-channel stereo amplifier. The amplifier is capable of producing 20 watts per channel. The system has six speakers (two high frequency instrument panel speakers in addition to the two front door and two rear speakers). The instrument panel speakers are used for high frequency reproduction (tweeters). The door speakers are

used for reproduction of the low and midrange frequencies, providing a full range in front of the vehicle. These speakers have large magnets and compliant edges. The rear speakers have large magnets and compliant cone edges. The rear speakers are installed in the same rear locations using the same hardware as standard speakers. The premium sound amplifier is used to drive the speakers at all times.

## DESCRIPTION (Continued)

## Wiring Diagram



L4906-B

## OPERATION

### Premium Sound

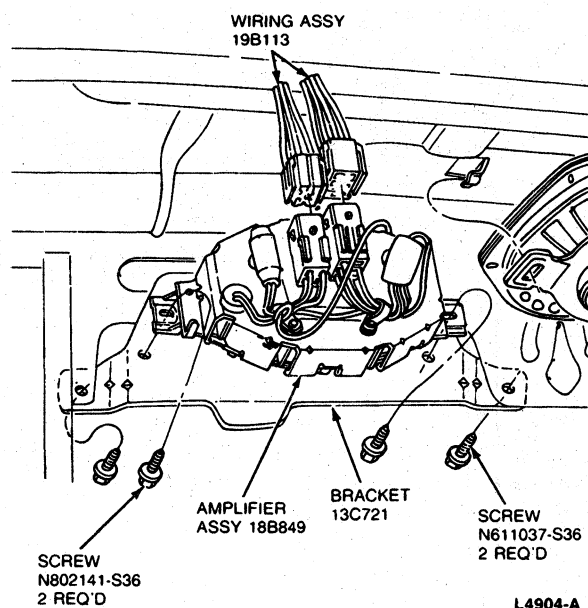
Adjust the volume control on the radio for desired sound level. The radio fader control adjusts the sound balance between the front and rear speakers.

## REMOVAL AND INSTALLATION

### Premium Sound Amplifier

#### Removal and Installation

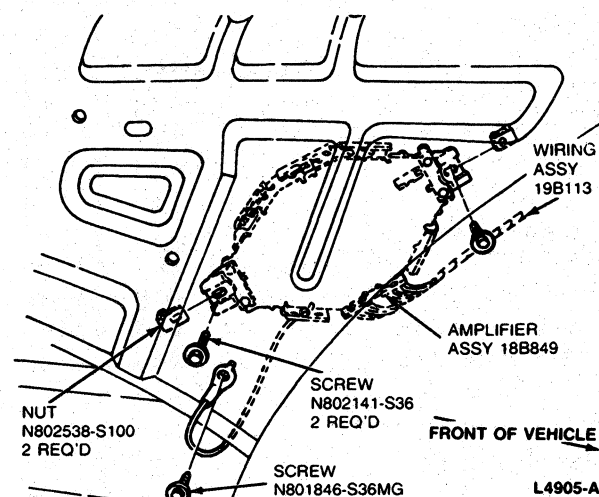
1. Remove two screws retaining amplifier to rear of package tray in luggage compartment.
2. Disconnect electrical connectors and remove amplifier.
3. To install, reverse Steps 1 and 2.



### Station Wagon

#### Removal and Installation

1. Remove LH rear quarter trim panel. Refer to Section 45-03.
2. Reach into upper quarter panel area and hold amplifier while removing two mounting screws.
3. Disconnect electrical connectors and remove amplifier.
4. To install, reverse Steps 1, 2 and 3.



## DIAGNOSIS AND TESTING

Use the wiring diagram, the Bypassing Tests, and the diagnosis charts to isolate malfunctions in the various radio systems.

Refer to Section 34-50 for rating and location of radio fuses.



## DIAGNOSIS AND TESTING (Continued)

**PREMIUM SOUND  
NO RADIO SOUND FROM ONE OR MORE SPEAKERS  
(RADIO TURNED ON, PREMIUM SOUND IS OFF)**

TEST STEP	RESULT	ACTION TO TAKE
<b>A0</b>	<b>DURING CHECK THERE IS NO SOUND FROM ONE OR MORE SPEAKERS WHILE RADIO IS TURNED ON AND THE PREMIUM SOUND IS OFF</b>	
<b>A1</b>	<b>BYPASS PREMIUM SOUND CONTROL</b>	
	<ul style="list-style-type: none"> <li>• Bypass premium sound control circuits for the inoperative speakers as follows:               <ol style="list-style-type: none"> <li>1. Disconnect connectors between radio and premium sound amplifier and between speakers and premium sound amplifier.</li> <li>2. Connect jumper wires from radio to wiring harness for damaged speaker.</li> <li>3. Use the premium sound bypassing test charts for locations of jumpers and the premium sound wiring diagram for color codes/component connections.</li> </ol> </li> </ul>	<div> <div> <div>OK</div> <div>▶</div> </div>           GO to A3.         </div> <div> <div> <div><del>OK</del></div> <div>▶</div> </div>           GO to A2.         </div>
<b>A2</b>	<b>CHECK OPERATION OF THE RADIO SPEAKER</b>	
	<ul style="list-style-type: none"> <li>• Check operation of the radio speaker, and vehicle wiring as follows:               <ol style="list-style-type: none"> <li>1. Connect jumper wire from a radio speaker harness that is working properly to the damaged speaker harness.</li> </ol> </li> </ul>	<div> <div> <div>OK</div> <div>▶</div> </div>           Radio damaged. SEND to authorized service station for service.         </div> <div> <div> <div><del>OK</del></div> <div>▶</div> </div>           Vehicle wiring or speaker is damaged. Follow standard procedure for diagnosis and service of damage.         </div>
<b>A3</b>	<b>CHECK CONTROL CIRCUITS</b>	
	<ul style="list-style-type: none"> <li>• Check power and control to amplifier as follows:               <ol style="list-style-type: none"> <li>1. Connect all connectors of radio and premium sound system.</li> <li>2. Turn ignition to ACC and turn radio on.</li> <li>3. Check for battery voltage at the amplifier at Circuit 747 O/LB and at Circuit 137 Y/BK hash wire.</li> </ol> </li> </ul>	<div> <div>           Battery voltage continuity           <div> <div>OK</div> <div>▶</div> </div>           REPLACE premium sound amplifier.         </div> <div> <div>           Battery voltage continuity           <div> <div><del>OK</del></div> <div>▶</div> </div>           Vehicle wiring is damaged. Follow standard procedure for diagnosis and service of damaged wiring.         </div> </div> </div>

CK6472-C







## DIAGNOSIS AND TESTING (Continued)

**PREMIUM SOUND**  
**NO PREMIUM SOUND FROM ONE OR MORE PREMIUM SOUND SPEAKERS, PREMIUM SOUND ON**

TEST STEP		RESULT	ACTION TO TAKE
<b>B0</b>	DURING RADIO CHECK, NO SOUND RECEIVED FROM ONE OR MORE SPEAKERS WITH PREMIUM SOUND ON		
<b>B1</b>	VERIFY CONDITION AT EACH SPEAKER		
	<ul style="list-style-type: none"> <li>Check for sound at each speaker.</li> </ul>	No premium sound any speaker Premium sound OK at one or more speakers	GO to <b>B2</b> . GO to <b>B3</b> .
<b>B2</b>	CHECK FOR POWER TO CONTROL ASSEMBLY		
	<ul style="list-style-type: none"> <li>Check power and control circuits to amplifier as follows:               <ol style="list-style-type: none"> <li>Connect <b>all</b> connectors of radio and premium sound system.</li> <li>Turn ignition to ACC and turn radio on.</li> <li>Check for battery voltage at the amplifier at Circuit 747 O/LB and at Circuit 137 Y/BK.</li> </ol> </li> </ul>	No power Power	Vehicle wiring is damaged. FOLLOW standard procedure for diagnosis and service damage. GO to <b>B5</b> .
<b>B3</b>	CHECK CONTINUITY OF INOPERATIVE SPEAKER(S)		
	<ol style="list-style-type: none"> <li>Disconnect premium sound amplifier from radio, and speaker(s).</li> <li>Check continuity of inoperative speaker wiring harness from amplifier.</li> </ol>	<del>OK</del> OK	CHECK for broken wires or connector pins. SERVICE or REPLACE control assembly as necessary. GO to <b>B4</b> .
<b>B4</b>	CHECK FOR SHORT AT SPEAKER		
	<ul style="list-style-type: none"> <li>Check for short between inoperative speaker wires at the speaker connector.</li> </ul>	<del>OK</del> OK	CHECK terminals at connector for solder bridge, stray wire strands, or bent terminals. SERVICE or REPLACE as necessary. GO to <b>B6</b> .
<b>B5</b>	CHECK CONNECTOR AT AMPLIFIER		
	<ul style="list-style-type: none"> <li>Check amplifier wiring for damage.</li> <li>Check connector at amplifier for broken pins or wires or for shorts caused by stray wire strands between pins.</li> </ul>	<del>OK</del> OK	SERVICE open or shorted circuits as required. Amplifier is damaged. SEND to authorized service station for service.





## DIAGNOSIS AND TESTING (Continued)

**PREMIUM SOUND**  
**NO PREMIUM SOUND FROM ONE OR MORE PREMIUM SOUND SPEAKERS PREMIUM SOUND ON**  
**(NORMAL SOUND FROM ALL SPEAKERS WITH PREMIUM SOUND OFF) — Continued**

TEST STEP		RESULT	ACTION TO TAKE
<b>B6</b>	<b>CHECK RADIO-TO-AMPLIFIER HARNESS</b>		
	<ul style="list-style-type: none"> <li>• Check radio-to-amplifier wiring harness for damage and connectors for broken terminal pins, solder bridge or stray wire strands.</li> <li>• Check continuity of each lead with ohmmeter.</li> <li>• Check for shorts between leads with ohmmeter.</li> </ul>	<p align="center"> ➔</p> <p align="center"> ➔</p>	<p>GO to <b>B7</b>.</p> <p>SERVICE harness as necessary.</p>
<b>B7</b>	<b>CHECK WIRING AND CONNECTORS ON AMPLIFIERS</b>		
	<ul style="list-style-type: none"> <li>• Check wiring on amplifier for damage.</li> <li>• Check connectors on amplifier for broken pins, solder bridge, or shorts caused by stray wire strands.</li> </ul>	<p align="center"> ➔</p> <p align="center"> ➔</p>	<p>Amplifier is damaged. RETURN to authorized service station for service.</p> <p>SERVICE open or shorted circuits as necessary.</p>

CL4909-A

**PREMIUM SOUND**  
**DISTORTED SOUND FROM ONE OR MORE SPEAKERS, RADIO ON AND PREMIUM SOUND OFF**  
**OR PREMIUM SOUND ON**

TEST STEP		RESULT	ACTION TO TAKE
<b>C0</b>	<b>DURING CHECK OF RADIO WITH PREMIUM SOUND OFF, DISTORTION FROM ONE OR MORE SPEAKERS</b>		
<b>C1</b>	<b>CHECK FOR:</b>		
	<ul style="list-style-type: none"> <li>• Loose trim panels, grilles, or attachments which might cause rattles in the area of the speaker which is distorted.</li> <li>• Pinched or broken wires on or near the premium sound control assembly.</li> <li>• Pinched or broken wires elsewhere in the vehicle wiring to the speaker.</li> </ul> <p><b>NOTE: In premium sound installations, neither wire to the speaker can be grounded. Ground of either wire will cause distortion.</b></p>	<p align="center"> ➔</p> <p align="center"> ➔</p>	<p>SERVICE and/or REPLACE as necessary.</p> <p>GO to <b>C2</b>.</p>
<b>C2</b>	<b>CONNECT A TEST SPEAKER</b>		
	<ul style="list-style-type: none"> <li>• Connect a test speaker to the wiring for the distorted speaker.</li> </ul>	<p align="center"> ➔</p> <p align="center"> ➔</p>	<p>CONDUCT test for "NO" premium sound from one or more speakers.</p> <p>Speaker is damaged. REPLACE speaker.</p>

CK5702-B

# SECTION 35-10 Antennas

SUBJECT	PAGE	SUBJECT	PAGE
<b>REMOVAL AND INSTALLATION</b>		<b>TESTING (Cont'd.)</b>	
Antenna Switch, Power .....	35-10-4	Antenna with Cable and Mast .....	35-10-1
Antennas—Manual and Power .....	35-10-2	<b>VEHICLE APPLICATION</b> .....	35-10-1
<b>TESTING</b>			
Antenna Cable and Base .....	35-10-1		

## VEHICLE APPLICATION

Taurus/Sable.

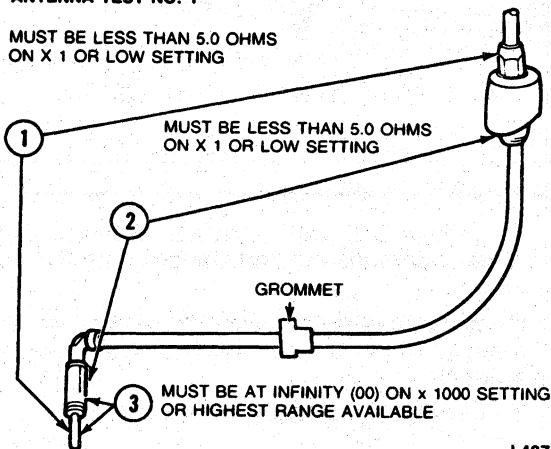
## TESTING

### Antenna with Cable and Mast

With antenna cable installed on vehicle and cable unplugged from radio, check resistance with ohmmeter test probes contacting antenna at indicated points. If results are satisfactory, antenna assembly is in good condition. If not, check antenna cable and base separately.

#### ANTENNA TEST NO. 1

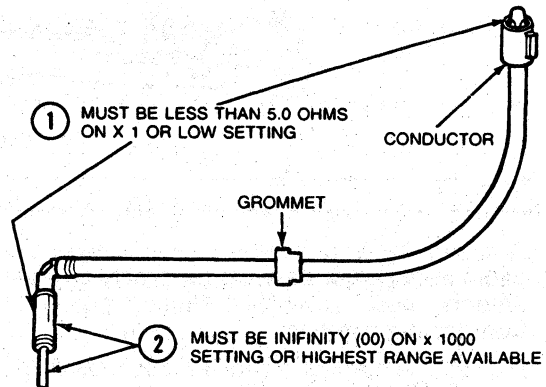
MUST BE LESS THAN 5.0 OHMS  
ON X 1 OR LOW SETTING



L4874-A

### Antenna Cable and Base

With antenna cable unplugged from radio, check resistance at indicated points on cable. If results are satisfactory, cable is in good condition. If not, replace with new cable.



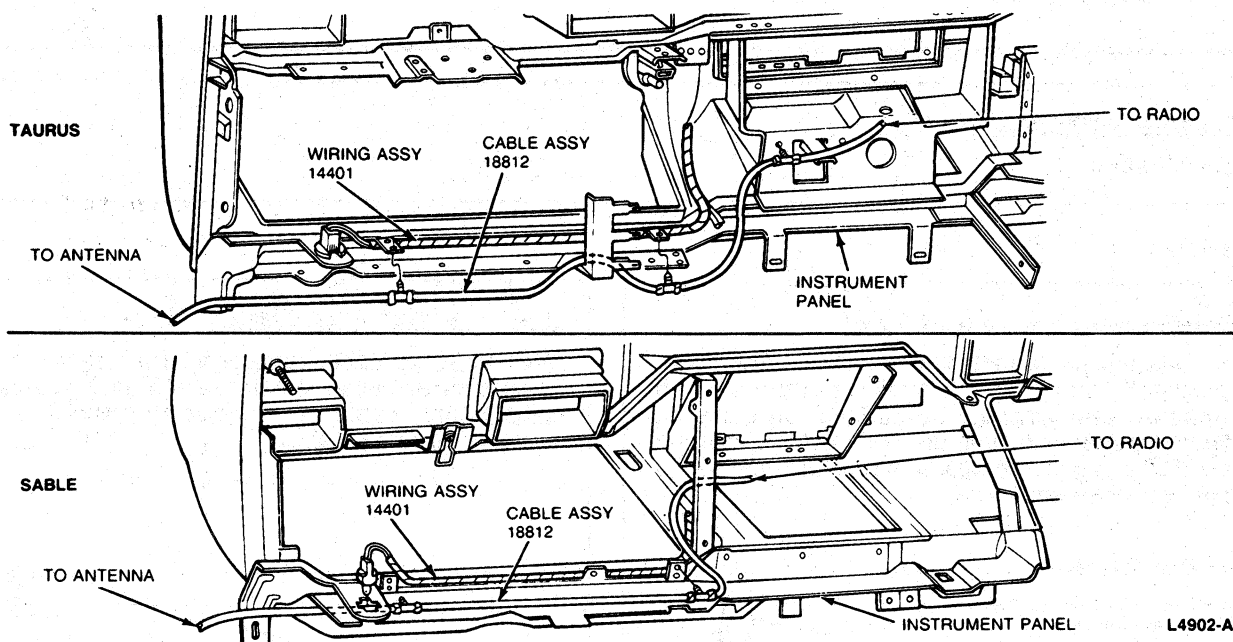
L4875-A

## REMOVAL AND INSTALLATION

### Antennas—Manual and Power

#### Removal and Installation

1. Push in on sides of glove compartment door and place door in hinged downward position.
2. Disconnect antenna lead from RH rear of radio receiver and remove cable from heater or A/C cable retaining clips.



3. Remove RH front fender liner. Unplug coaxial cable from power antenna assembly or manual antenna base assembly. Unplug power lead from power antenna.

NOTE: The manual antenna mast is detachable from the base and cable assembly.

4. Under RH front fender, pull antenna cable through hole in door hinge pillar and remove antenna cable assembly from wheel well area.

5. To remove manual or power antenna base, remove antenna nut and stanchion on RH front fender.

6. Remove lower antenna base screw and remove either manual antenna base or power antenna.

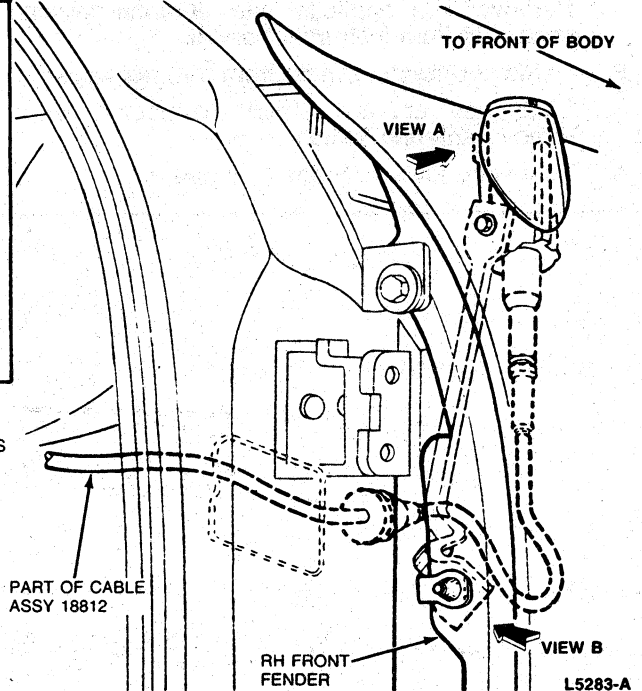
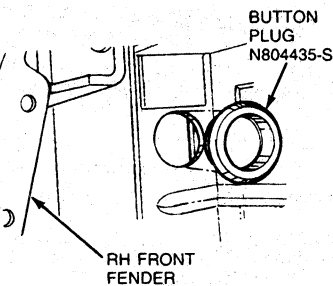
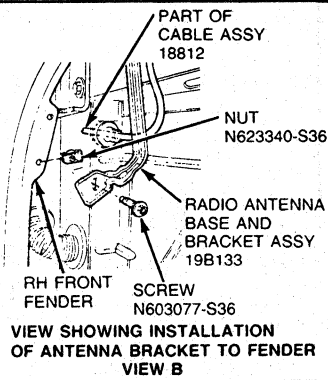
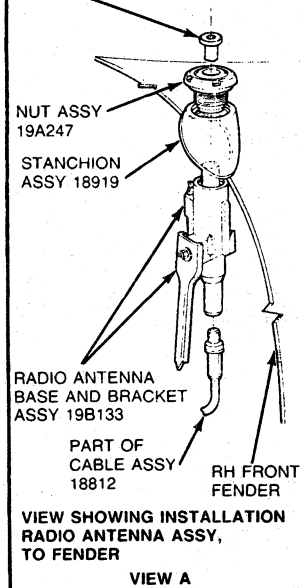
7. To install, reverse Steps 1 through 6.

L4902-A

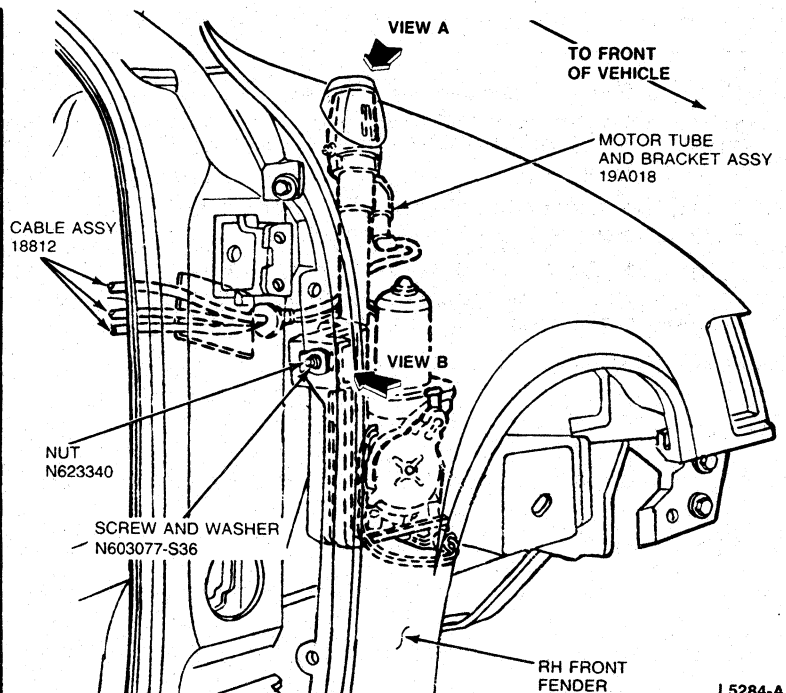
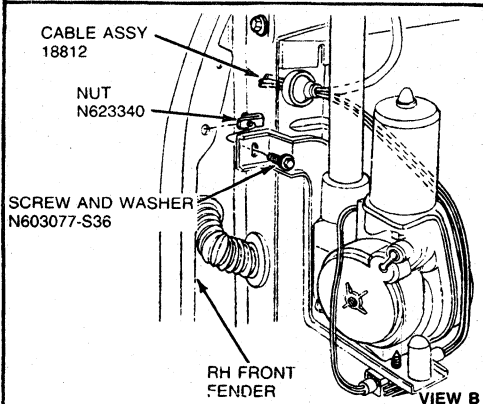
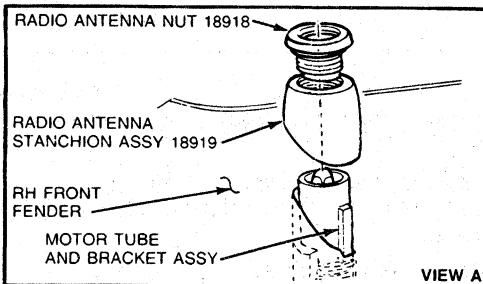
## REMOVAL AND INSTALLATION (Continued)

## Power Antenna

NOTE: INSERT TO BE REMOVED BY DEALER PRIOR TO INSTALLATION OF ANTENNA KIT 18813



## Manual Antenna



**REMOVAL AND INSTALLATION (Continued)****Antenna Switch, Power****Removal and Installation**

1. Remove trim applique and antenna switch assembly from instrument panel.
2. Remove antenna switch from trim applique.
3. Disengage antenna switch connectors and remove antenna switch.
4. To install, reverse Steps 1, 2 and 3.

# SECTION 35-30 Speakers

SUBJECT	PAGE	SUBJECT	PAGE
DESCRIPTION .....	35-30-1	REMOVAL AND INSTALLATION (Cont'd.)	
DIAGNOSIS		Speakers, Instrument Panel Mounted .....	35-30-2
Poor Sound Quality .....	35-30-5	Speakers, Rear Seat .....	35-30-2
REMOVAL AND INSTALLATION		VEHICLE APPLICATION .....	35-30-1
Speakers, Door Mounted .....	35-30-1		

## VEHICLE APPLICATION

Taurus/Sable.

## DESCRIPTION

All vehicles are equipped with standard or premium sound speakers. All standard speakers have "3.2 ohms" printed on the magnet. Premium sound

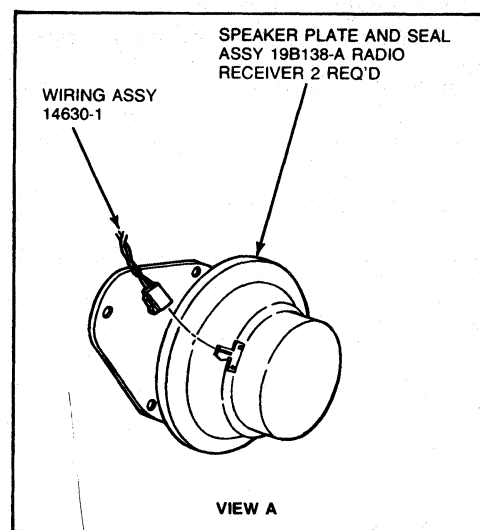
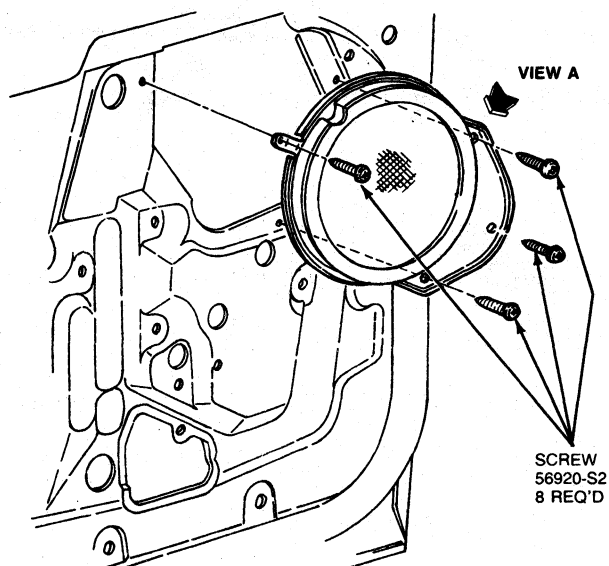
speakers are printed with "6 ohms." Speakers used in premium sound installations are removed and installed in the same manner as standard speakers.

## REMOVAL AND INSTALLATION

### Speakers, Door Mounted

#### Removal and Installation

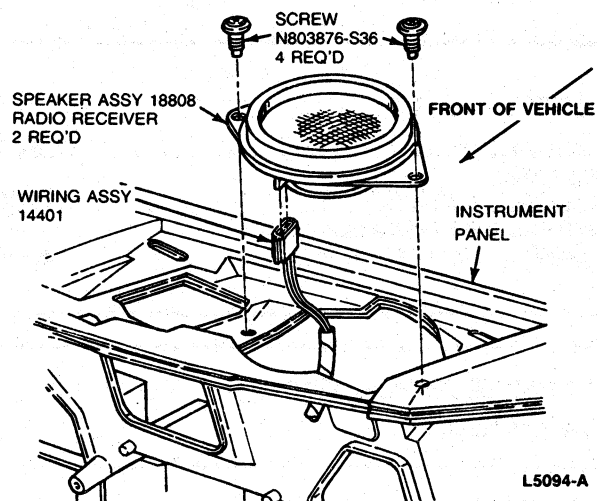
1. Remove inner door trim panel. Refer to Section 45-03.
2. Remove three screws retaining speaker to bracket assembly.
3. Pull speaker away from bracket far enough to disengage speaker wires and remove speaker.
4. To install, reverse Steps 1, 2 and 3.



L5093-B

**REMOVAL AND INSTALLATION (Continued)****Speakers, Instrument Panel Mounted****Removal and Installation**

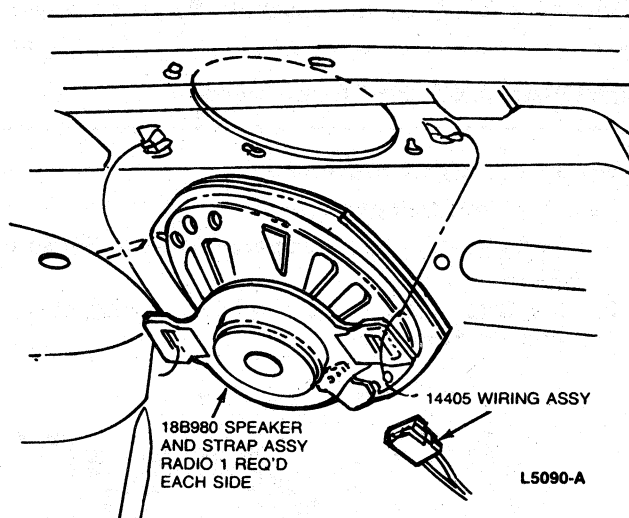
1. Remove speaker grille from instrument panel.
2. Remove two speaker mounting screws.
3. Disengage speaker wire and remove speaker.
4. To install, reverse Steps 1, 2 and 3.

**Speakers, Rear Seat****Low Series—Sedan****Removal**

1. From within luggage compartment, disconnect speaker harness from speaker.
2. Pull one end of speaker rubber retaining strap to disengage from tab on package tray and remove speaker.

**Installation**

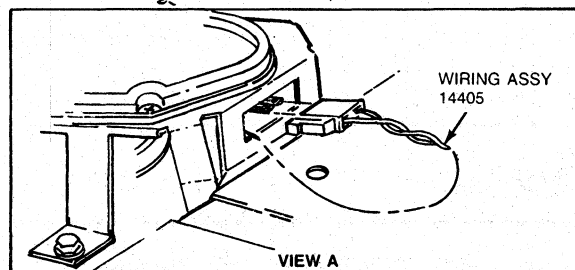
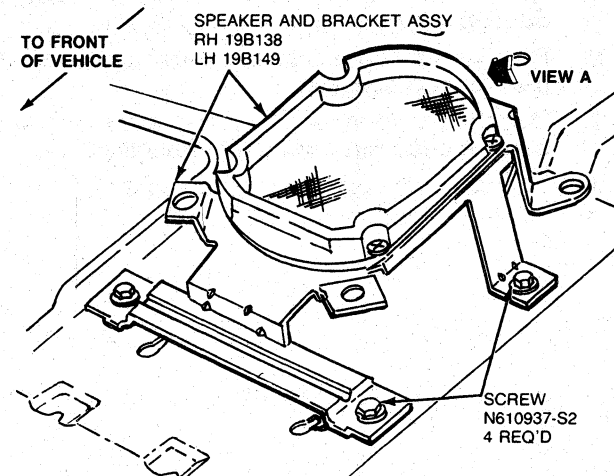
1. Position speaker and strap assembly in place with one end of strap over tab on package tray. Pull opposite end of strap to index over other tab securing assembly.
2. Connect speaker wiring and check operation.



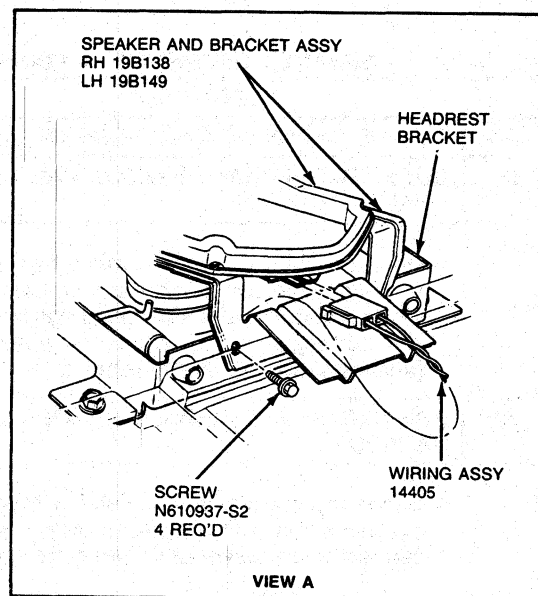
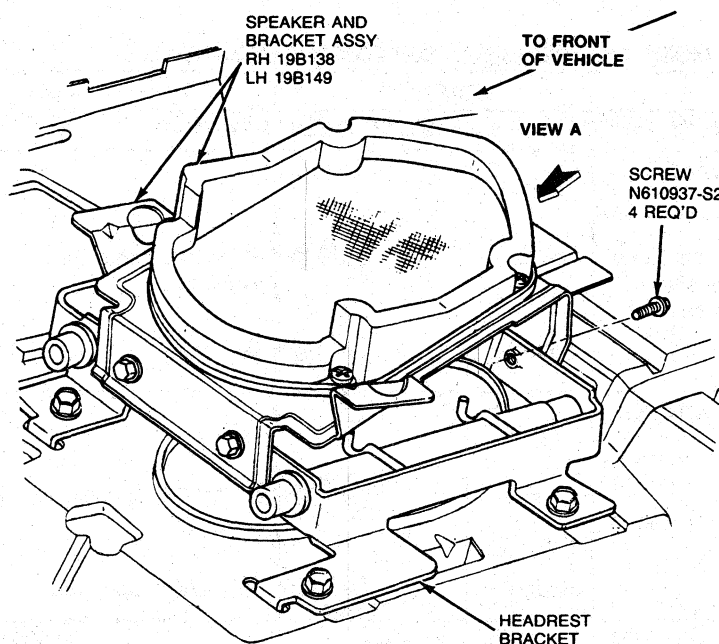


**REMOVAL AND INSTALLATION (Continued)****Hi-Series—Sedan****Removal and Installation**

1. Remove speaker grille from package tray.
2. Remove four speaker attaching screws.
3. Lift speaker and disengage speaker wire.
4. To install, reverse Steps 1, 2 and 3.

**Taurus**

L5091-B

**Sable**

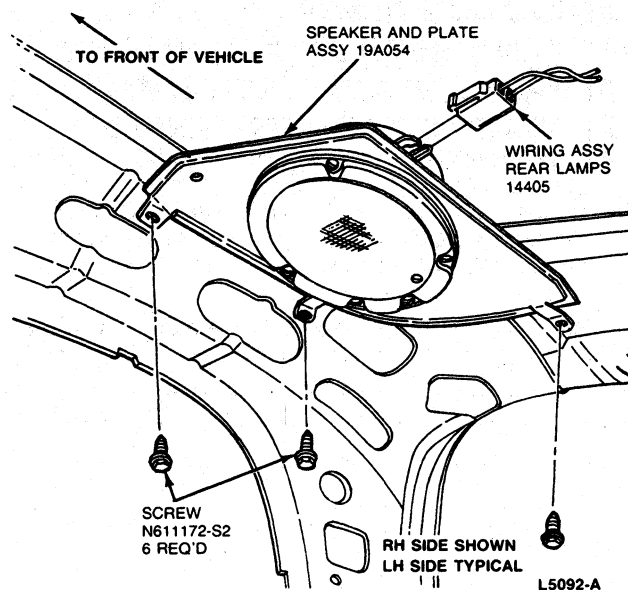
L5285-A

## REMOVAL AND INSTALLATION (Continued)

## Station Wagon

## Removal and Installation

1. Remove rear corner upper finish panel. Refer to Section 45-03.
2. Remove three screws retaining speaker bracket and speaker.
3. Disconnect speaker wires and slide speaker bracket edge out from under headliner.
4. To install, reverse Steps 1, 2 and 3.



## DIAGNOSIS

NOTE: Stereo radios have both speakers on one side of the vehicle (RH or LH) powered by the same circuitry as in conventional radios. Electronic radio rear speakers are powered separately from the front speakers. Therefore, if only one speaker is inoperative, the radio chassis is not damaged. For vehicles with Premium Sound, refer to Section 35-09.

## SPEAKER DIAGNOSIS\* — ONE OR MORE SPEAKERS DISTORTED OR INOPERATIVE

TEST STEP		RESULT		ACTION TO TAKE
A0	DURING CHECK OF RADIO ONE OR MORE SPEAKERS ARE DISTORTED OR INOPERATIVE			
A1	SUBSTITUTE SPEAKER AND BYPASS SPEAKER WIRING HARNESS			
	<ul style="list-style-type: none"><li>● Unplug radio from speaker wiring harness. Set radio balance and fader controls to their center position. Using a speaker of known good quality, jumper the pins corresponding to the suspect speaker of the radio connector to the test speaker.</li></ul>	Sound		REMOVE radio for service.
		Sound		GO to A2.
A2	SUBSTITUTE SPEAKER USING SPEAKER WIRING HARNESS			
	<ul style="list-style-type: none"><li>● Reconnect radio to speaker wiring. Disconnect suspect speaker from speaker wiring harness and connect test speaker of known good quality.</li></ul>	Sound		SERVICE speaker wiring harness.
		Sound		REPLACE speaker.

\*If equipped with premium sound system, refer to Section 35-09, for speaker diagnosis.

CK5491-C

**DIAGNOSIS (Continued)****Poor Sound Quality**

- Experience has shown that rattles and buzzes are most often caused by loose speakers or speaker mountings, speaker grilles or trim panels. Check for tightness of mountings and trim pieces.
- Distortion can be caused by the speaker, radio chassis or wiring. If the fault is in the radio chassis, both speakers on the same side of the vehicle will exhibit poor quality (except electronic radios). Distortion caused by damaged wiring is most often accompanied by lower than normal sound output.
- Buzzes, rattles, or distorted or weak sound from package tray speakers are often caused by bent

package tray sheet metal around the speaker opening, or missing or loose attaching hardware or speaker covers. Bent sheet metal should be straightened and the speaker installed. Loose attaching hardware should be hand tightened plus approximately one full turn. Be careful not to over-tighten hardware as this may bend or deform speaker basket causing buzzes or distorted sound.

**NOTE:** Shorted wiring does not always result in a completely dead speaker. If diagnosis indicated condition is associated with speaker or wiring, refer to Section 35-01.

# SECTION 35-40 Ash Receptacles and Cigar Lighter

SUBJECT	PAGE	SUBJECT	PAGE
DESCRIPTION AND OPERATION .....	35-40-1	REMOVAL AND INSTALLATION (Cont'd.)	
DIAGNOSIS .....	35-40-1	Cigar Lighter .....	35-40-2
REMOVAL AND INSTALLATION		VEHICLE APPLICATION .....	35-40-1
Ash Receptacle and Retainer Assembly .....	35-40-2		

## VEHICLE APPLICATION

Taurus/Sable.

## DESCRIPTION AND OPERATION





The cigar lighter element has a low resistance heating coil which operates similar to the coil used in a portable heater.

When the element is pushed completely in, the circuit is closed and current flows through the

heating coil to the ground. When sufficient heat is generated, the element will overcome the spring pressure of the bimetal retaining fingers and be released.

## DIAGNOSIS

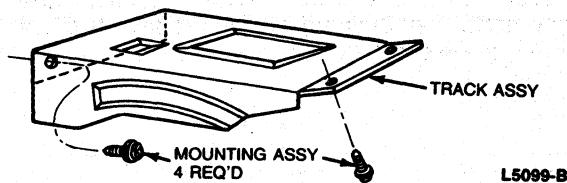
### CIGAR LIGHTER INOPERATIVE

TEST STEP		RESULT	ACTION TO TAKE
<b>A1</b>	<b>INSPECT LIGHTER</b>		REPLACE element or socket as required.
			GO to A2.
<b>A2</b>	<b>CHECK FOR VOLTAGE</b>		SERVICE ground circuit as required.
			CHECK feed circuit for an open or blown fuse. REPLACE or SERVICE as required.

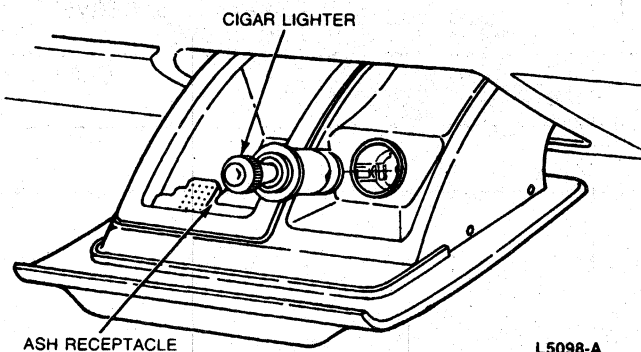
CK5490-B

**REMOVAL AND INSTALLATION****Ash Receptacle and Retainer Assembly  
Instrument Panel Mounted****Taurus****Removal and Installation**

1. To remove ash receptacle, grasp both sides and lift.
2. To remove ash receptacle retainer, depress spring stop and pull rearward, and disconnect lamp and lighter harness.
3. To remove ash receptacle track assembly, remove ash receptacle and receptacle retainer, then remove four retainer mounting screws.
4. Disconnect wiring harness.
5. To install, reverse Steps 1, 2 and 3.

**Sable****Removal and Installation**

1. To remove ash receptacle, grasp either side with thumb and forefinger and lift out toward rear of vehicle.
2. To remove ash receptacle retainer assembly, depress spring stop (above lighter) and pull toward rear of vehicle.
3. To install, reverse Steps 1 and 2.

**Rear Compartment****Removal and Installation**

1. Remove ash receptacle by depressing spring stop and pulling receptacle up and out.
2. To remove ash receptacle retainer, remove ash receptacle, and four screws retaining receptacle retainer to quarter trim panel and remove retainer. Remove wiring harness.
3. To install, reverse Steps 1 and 2.

**Cigar Lighter****Instrument Panel****Removal**

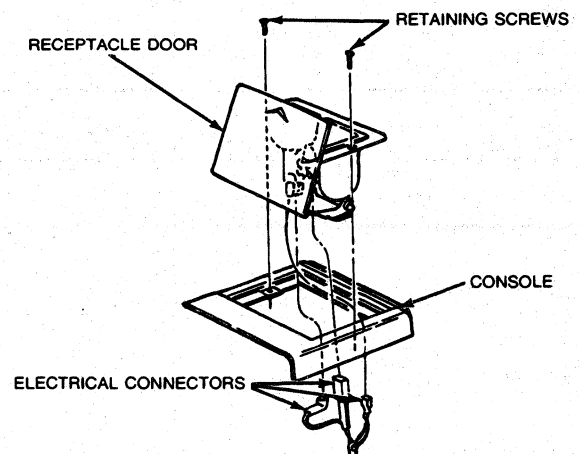
1. Disconnect battery ground cable.
2. Remove cigar lighter knob and element assembly.
3. Remove cigar lighter lead wire. (Remove ash receptacle, if necessary), and ground wire, if any.
4. Remove cigar lighter socket retainer and remove socket.

**Installation**

1. Install cigar lighter socket retainer and tighten.
2. Install cigar lighter lead and ground wire, if so equipped.
3. Install ash receptacle, if removed.
4. Install knob and element assembly.
5. Connect battery ground cable and test cigar lighter for proper operation.

**Console****Removal and Installation**

1. Open ash receptacle door and remove two screws that retain receptacle to console.
2. Close ash receptacle door and lift receptacle assembly out of console.
3. Disconnect electrical connectors.
4. To install, reverse Steps 1, 2 and 3.



# SECTION 35-60 Windshield Wipers—Electric

SUBJECT	PAGE	SUBJECT	PAGE
<b>ADJUSTMENTS</b>		<b>REMOVAL AND INSTALLATION (Cont'd.)</b>	
Arm and Blade Assembly .....	35-60-7	Wiper Blade, Rear .....	35-60-16
<b>DESCRIPTION AND OPERATION</b>		Wiper Motor, Front .....	35-60-11
Windshield Wiper System, Front .....	35-60-1	Wiper Switch, Front .....	35-60-12
Wiper System and Switch, Rear .....	35-60-4	Wiper/Washer Switch, Rear .....	35-60-12
Wiper/Washer Switch, Front .....	35-60-1	<b>SPECIAL SERVICE TOOLS</b> .....	35-60-18
<b>DIAGNOSIS</b> .....	35-60-7	<b>SPECIFICATIONS</b> .....	35-60-18
<b>REMOVAL AND INSTALLATION</b>		<b>TESTING</b>	
Arm Assembly, Front .....	35-60-13	Circuit Breaker .....	35-60-6
Blade Assembly, Front .....	35-60-13	Windshield Wiper Interval Governor Test ....	35-60-6
Governor, Interval .....	35-60-12	Wiper Motor Current Draw, Front .....	35-60-5
Output Arm and Windlatch .....	35-60-16	Wiper Switch Continuity Test, Front .....	35-60-6
Pivot Shafts and Wiper Linkage, Front .....	35-60-15	Wiper Switch Continuity Test, Rear .....	35-60-6
Removal .....	35-60-15	<b>VEHICLE APPLICATION</b> .....	35-60-1
Wiper Arm and Blade Assembly, Rear .....	35-60-15		

## VEHICLE APPLICATION

Taurus/Sable.

## DESCRIPTION AND OPERATION

### Windshield Wiper System, Front

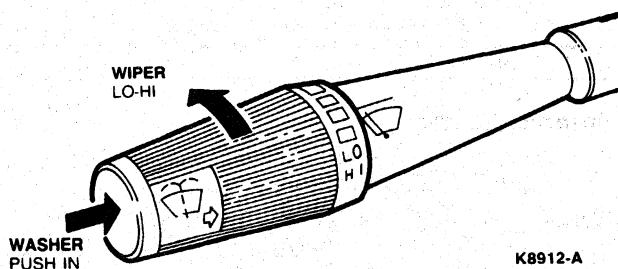
The two-speed, permanent-magnet, three brush electric windshield wiper motor has a brush rigging that permits selection of low or high speed. When the control selector is in LOW position, the common brush and the blue/orange wire brush are used, and the motor operates at low speed. When the control selector is in HI position, the grounded brush and the white wire brush are used. Current bypasses a portion of the armature winding, causing the motor to run faster. When the control selector is moved to the OFF position, the motor will continue at low speed until the motor switch outer contacts open, signaling the motor to PARK and activating the depressed PARK mechanism which is part of the output arm.

### Wiper/Washer Switch, Front

The standard and interval wiper systems feature a rotary actuated switch which is part of the turn signal lever of the multifunction switch. The washer switch is a push-type and also is part of the multifunction switch.

#### Standard System

1. For wipe, rotate actuator located at end of turn signal lever. Actuator has three positions: OFF, LOW, and HI.



K8912-A



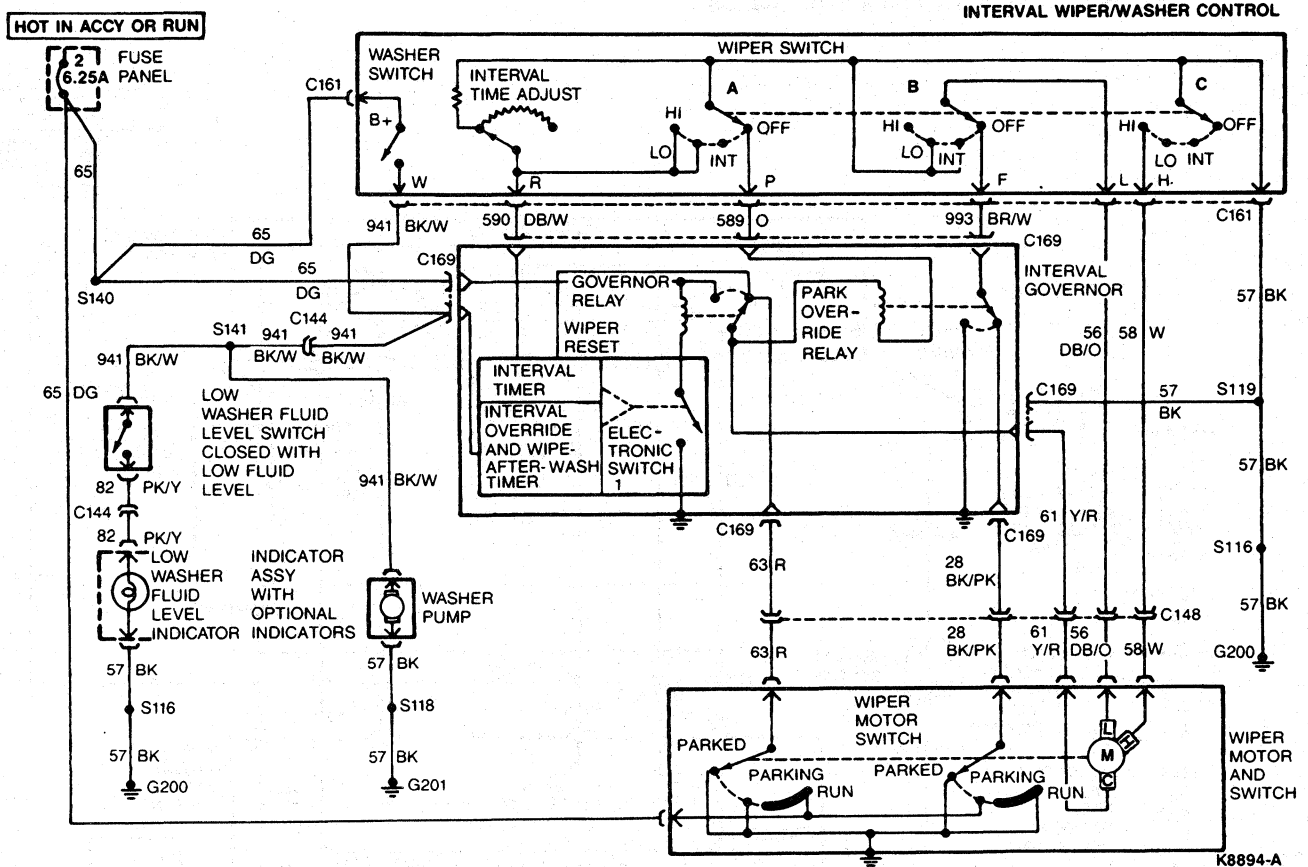
## DESCRIPTION AND OPERATION (Continued)

To operate the washer, push the knob of the lever toward center of steering column.

If wiper control switch is in OFF or INT position, wipers will run as long as knob is pushed in. When knob is released, the washers will stop immediately,

but the wipers will run for one to four cycles, then return to OFF or INTERVAL operation.

If the wiper control switch is in LOW or HI position, washers operate with no change in wiper operation.

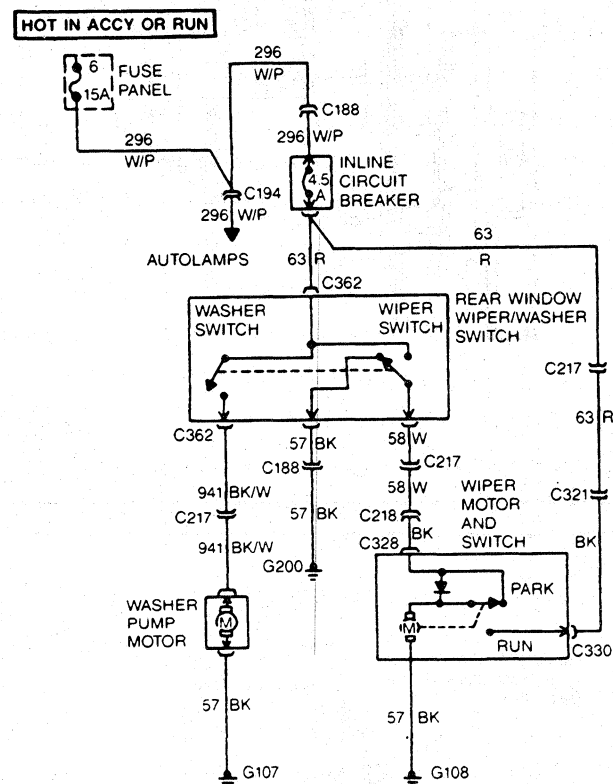




## DESCRIPTION AND OPERATION (Continued)

## Wiper System and Switch, Rear

Main components of the system are: a single motor assembly mounted inside the lift gate, and an instrument panel-mounted control switch powered through an in-line circuit breaker.



## TESTING

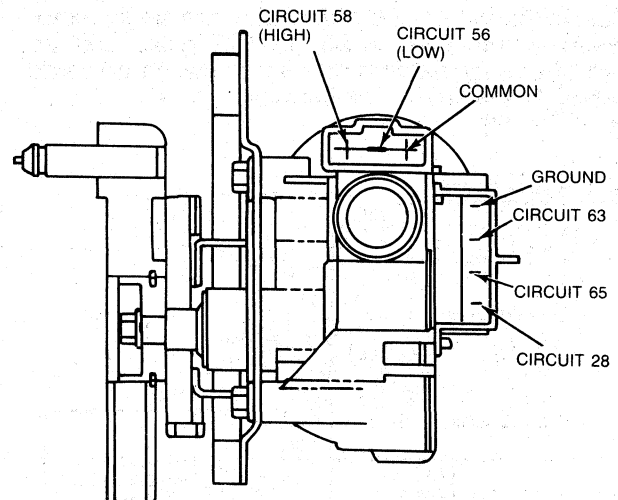
The ignition switch must be in RUN for all tests. Verify proper operation of wiper system in LOW. With system operating in LOW, turn wiper system switch to OFF when wiper blades are in vertical (straight-up) position. Wipers should complete cycle and depress park (below windshield). If the wiper blades do not park, refer to appropriate condition of system below and test and service as indicated.

- Motor stops when wiper switch is turned to OFF. (Does not complete cycle).
- 1. Remove motor park switch connector and check for battery voltage, using Rotunda 014-00407, Digital Volt-Ohmmeter or equivalent, on circuit 65 (dark green). If battery voltage is not present, service circuit as required. If voltage is present, Go to Step 2.

2. Check motor ground wiring at switch connector.
  3. With both wiper motor connectors disconnected, use an ohmmeter, such as Rotunda 014-00407, Digital Volt-Ohmmeter, or equivalent, to verify continuity (less than one ohm) between circuits 28 and 56 in the wiring harness. If continuity is not present, trace and service as required. If continuity is OK, leave connectors disconnected and Go to Step 4.
  4. Check for continuity to ground terminal on gear cover at circuit terminal 28 on wiper motor. If open, service wiper motor park switch. If ground is present, leave connectors disconnected and Go to Step 5.
  5. Verify continuity (less than one ohm resistance) between circuits 61 and 63 in the wiring harness. If continuity is not present, trace and service as required. If lack of continuity is traced to interval governor, check wiper switch for continuity. Refer to Section 32-42. Replace switch if continuity is not present. If continuity is present in switch, and lack of continuity has been traced to interval governor, replace governor. If continuity between circuits 61 and 63 is OK, leave connectors disconnected and Go to Step 6.
  6. Check for continuity between circuit terminals 63 and 65 on wiper motor. If open, replace motor.
- Wiper blades go into depressed park (below windshield), but wiper motor keeps running. Replace motor.
  - Wiper blades stall or jam (motor starts running in reverse direction) while going from park to depressed park (below windshield).
1. Check linkage and service as required. If OK, Go to Step 2.
  2. Service wiper motor arm and windlatch assembly.
- Wiper blades complete cycle, but continue to wipe for part of another cycle and park on windshield, or
  - Wiper blades run continuously in OFF or INTERVAL, or
  - Wiper blades run to bottom of windshield and stop, but will not depress park below windshield.
1. Perform wiper switch continuity test. Refer to Section 32-42. If continuity test fails, replace switch. If continuity test is OK on standard wiper system, replace motor. If continuity test is OK on interval wiper system, Go to Step 2.

**TESTING (Continued)**

2. Check wash circuit 941 for no voltage. If any voltage is present, service as required. If no voltage is present, Go to Step 3.
3. Disconnect connectors at wiper motor and check for continuity between circuits 61 and 63 going to interval governor. If open, replace governor. If continuity is present, replace motor.



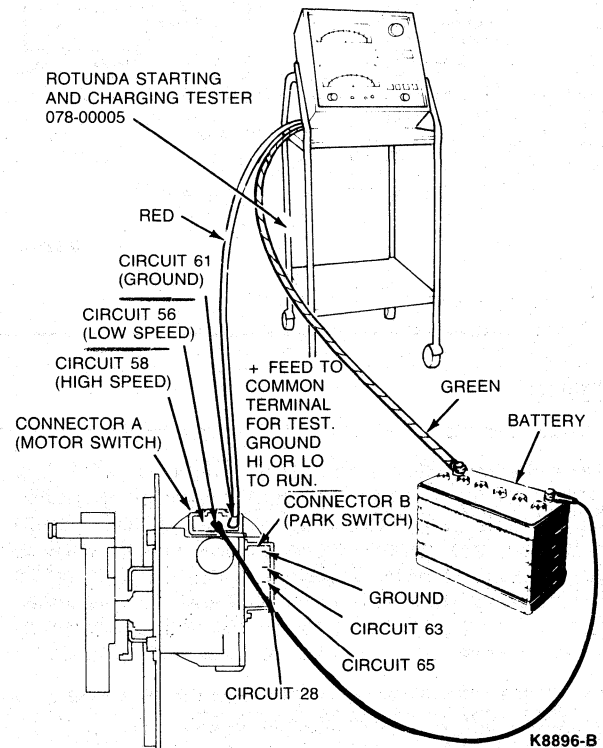
L5317-A

**Wiper Motor Current Draw, Front**

**NOTE:** Electric wiper motors contain permanent magnets made of ceramic. This is a hard glass-like material that can shatter or crack if the motor receives a severe physical shock.

Do not handle any windshield wiper motor abusively when diagnosing wiper operations, because it will damage the magnets and make the motor inoperative. Rough handling of new replacement motors may also damage the magnets.

Disconnect the linkage from the motor and disconnect the electrical plug to test the motor on the vehicle. Connect the green lead from the test equipment, such as Rotunda 078-00005, Start and Charging Tester or equivalent, to the battery positive (plus) post. Connect the positive (red) lead from the tester to the common brush terminal. Attach a ground first to the low-speed connection and then to the high-speed connection at the connector plug as shown. In either case, the current draw should not exceed 3 amperes.



**TESTING (Continued)****Circuit Breaker**

The 8.25 amp circuit breaker is located in the fuse panel. Two separate tests are necessary to check for correct circuit breaker operation. Remove the circuit breaker from the fuse panel. Connect the tester leads to the circuit breaker.

**Test 1**

1. Before connecting the circuit breaker to the volt-amp tester, touch the tester leads together and adjust the current draw, until it equals the circuit breaker rating.
2. Connect the breaker to the tester. Leave the breaker connected to the tester for 10 minutes. Hold the current reading on the ammeter at the rated current. If the circuit breaker opens during the 10 minutes, replace the circuit breaker.

**Test 2**

1. Touch the tester leads together and adjust the current draw until it is twice the rated current.
2. Connect the breaker. Hold the current reading on the ammeter at twice the rated current. The current reading on the ammeter should drop to zero within 30 seconds. If it takes longer than 30 seconds for the circuit breaker to open (current reading drops to zero), replace the circuit breaker.

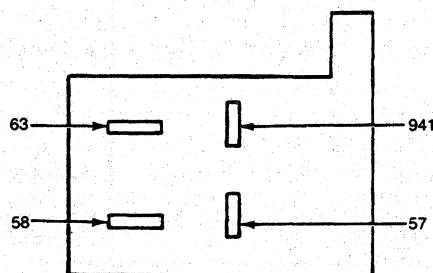
**Wiper Switch Continuity Test, Front**

Refer to Section 32-42.

**Wiper Switch Continuity Test, Rear**

Check the continuity between the switch terminals. Either a self-powered test lamp or an ohmmeter can be used to test rear switch.

To detect marginal operation of the switch, move the switch lever while each reading is being taken. If the switch does not exhibit continuity or if poor continuity exists in any switch position, replace the switch.



SWITCH POSITIONS	SWITCH TERMINALS
OFF	57 AND 58
ON	63 AND 58
WASH	941 AND 63

K8888-A

**Windshield Wiper Interval Governor Test**

If interval operation is unsatisfactory, first check the motor current draw and the control switch and all connecting wires for continuity. If the motor, switch

and connecting wires are OK, replace the electronic governor.

**DIAGNOSIS**

Refer to the following diagnosis chart to diagnosis problems in the windshield wiper/washer system.

**ELECTRICAL — WIPERS AND WASHERS**

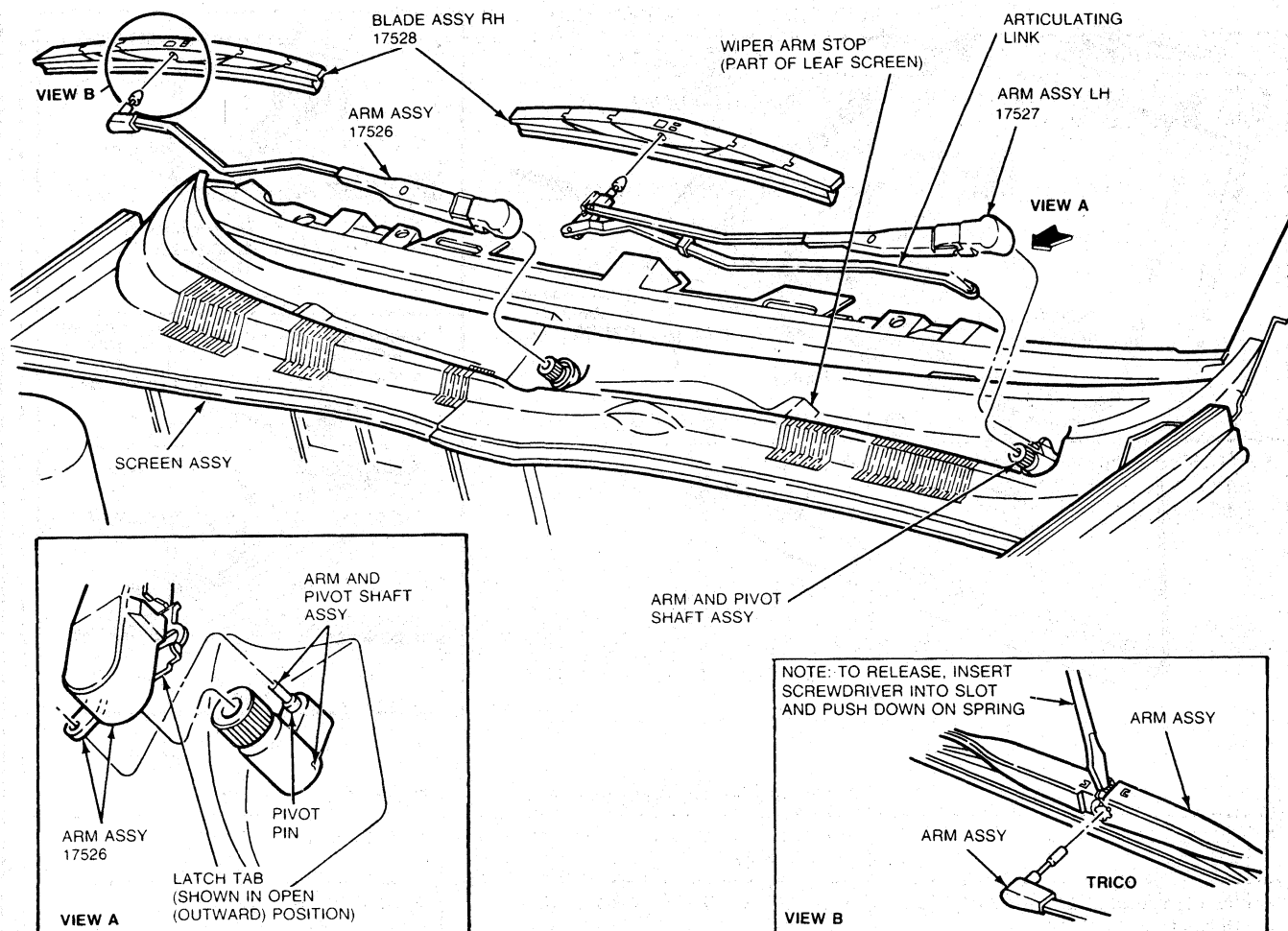
<b>CONDITION (IGNITION ON)</b>	<b>POSSIBLE SOURCE</b>	<b>ACTION</b>
<ul style="list-style-type: none"> <li>Windshield wipers inoperative in ALL switch positions.</li> </ul>	<p><b>NOTE:</b> Check in sequence.</p> <ul style="list-style-type: none"> <li>Open circuit breaker.</li> <li>Poor ground at wiper motor.</li> <li>Switch.</li> <li>Bent or damaged motor linkage.</li> <li>Motor.</li> <li>Open wire or connector.</li> </ul>	<ul style="list-style-type: none"> <li>Check and replace if required.</li> <li>Jumper motor ground terminal to vehicle body. If motor now works service ground.</li> <li>Test switch.</li> <li>Service as required.</li> <li>Perform motor current draw test.</li> <li>Service as required.</li> </ul>
<ul style="list-style-type: none"> <li>Windshield wipers inoperative or erratic in LOW or INTERVAL (HIGH ok).</li> </ul>	<ul style="list-style-type: none"> <li>Switch.</li> <li>Motor.</li> <li>Open wiring.</li> <li>Poor interval governor ground.</li> <li>Inoperative interval governor.</li> </ul>	<ul style="list-style-type: none"> <li>Test switch.</li> <li>Perform motor current draw test for low speed.</li> <li>Check circuit No. 58 (White).</li> <li>Check circuit No. 61 (yellow-red).</li> <li>Service as required (tighten attaching screws).</li> <li>Check circuit No. 57 (BL).</li> <li>Replace governor.</li> </ul>
<ul style="list-style-type: none"> <li>Wipers won't stop in OFF or INTERVAL</li> </ul>	<ul style="list-style-type: none"> <li>Motor, switch, wiring or governor assembly.</li> </ul>	<ul style="list-style-type: none"> <li>Perform parking test.</li> </ul>
<ul style="list-style-type: none"> <li>Interval systems only: No wipe(s) after wash.</li> </ul>	<ul style="list-style-type: none"> <li>Circuit No. 941 (BK/W) open.</li> <li>Governor inoperative.</li> </ul>	<ul style="list-style-type: none"> <li>Service as required.</li> <li>Replace governor.</li> </ul>
<ul style="list-style-type: none"> <li>Windshield washer does not operate.</li> </ul>	<ul style="list-style-type: none"> <li>Low fluid level.</li> <li>Split, loose, pinched or kinked hose.</li> <li>Open in wiring or switch.</li> <li>Washer Motor.</li> </ul>	<ul style="list-style-type: none"> <li>Fill as required.</li> <li>Inspect, service as required.</li> <li>Service as required.</li> <li>Replace motor, seal and impeller assembly.</li> </ul>

**CK9376-B****ADJUSTMENTS****Arm and Blade Assembly**

Remove the arm and blade assembly from the pivot shafts. Turn on the wiper switch, allow the motor to move the pivot shafts three or four cycles, and then turn off the wiper switch. This will place the pivot shafts in PARK position.

## ADJUSTMENTS (Continued)

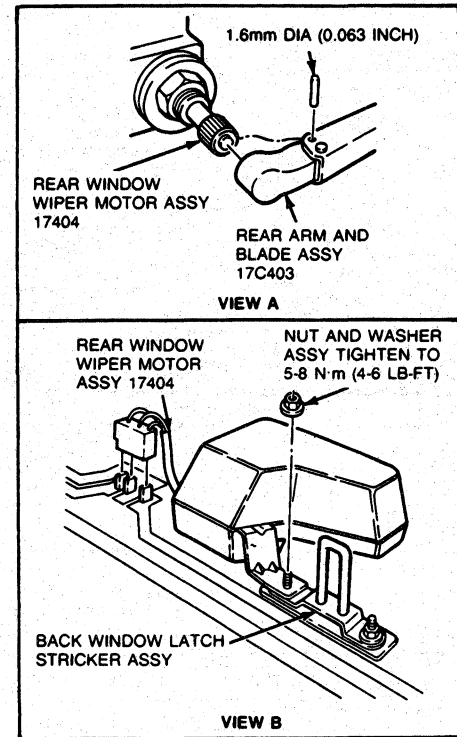
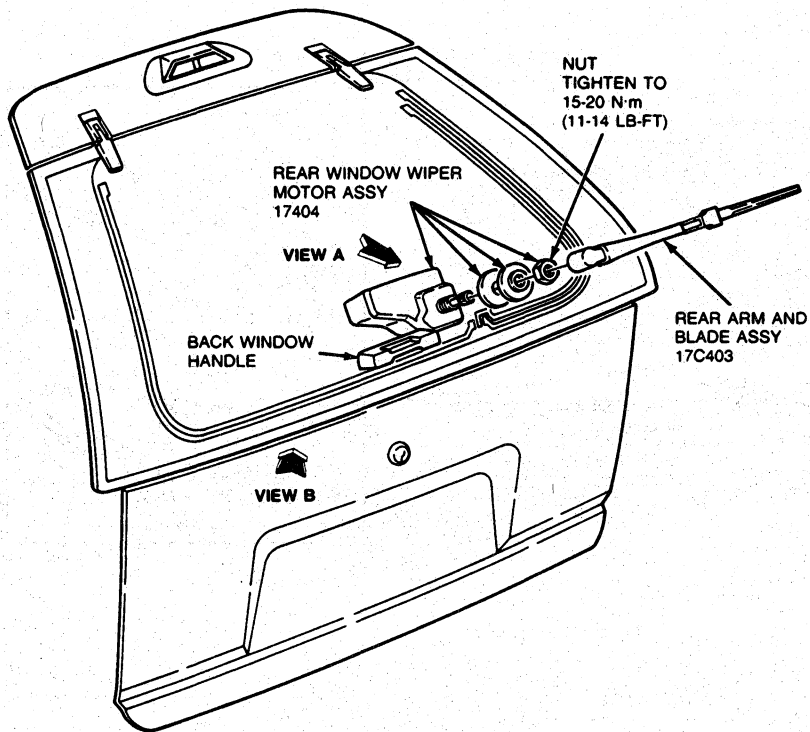
## Arm and Blade Assembly, Front



K8519-B

## ADJUSTMENTS (Continued)

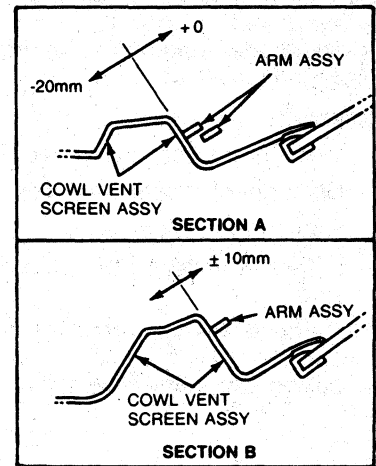
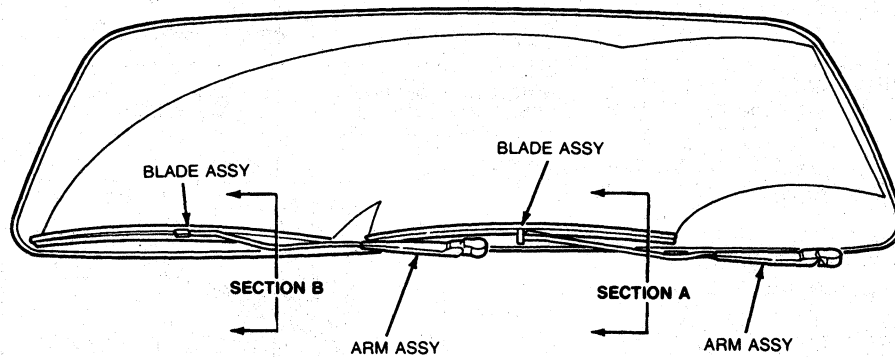
## Arm and Blade Assembly, Rear



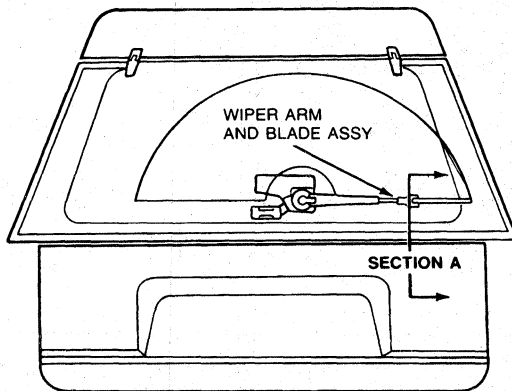
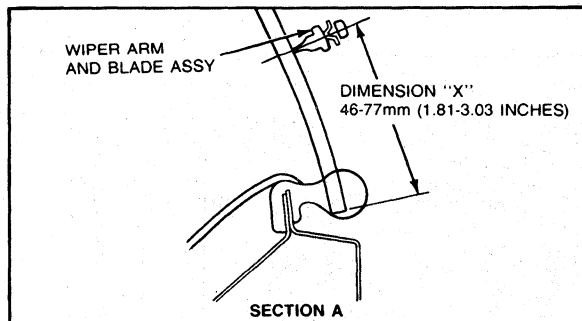
K8520-A

**ADJUSTMENTS (Continued)**

Install the arm blade assemblies on the pivot shafts to Dimension X.

**Front**

K8521-A

**Rear**

K8897-A

## REMOVAL AND INSTALLATION

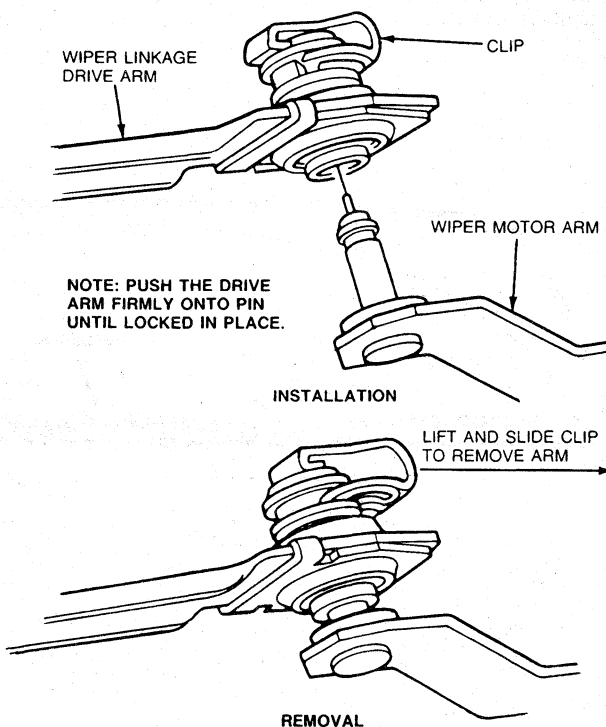
### Wiper Motor, Front

When installing the drive arm to a new motor, follow the instructions included in the new motor kit.

The internal permanent magnets used in the wiper motor are a ceramic (glass-like) material. Care must be exercised in handling the motor to avoid damaging the magnets. The motor must not be struck or tapped with a hammer or other object.

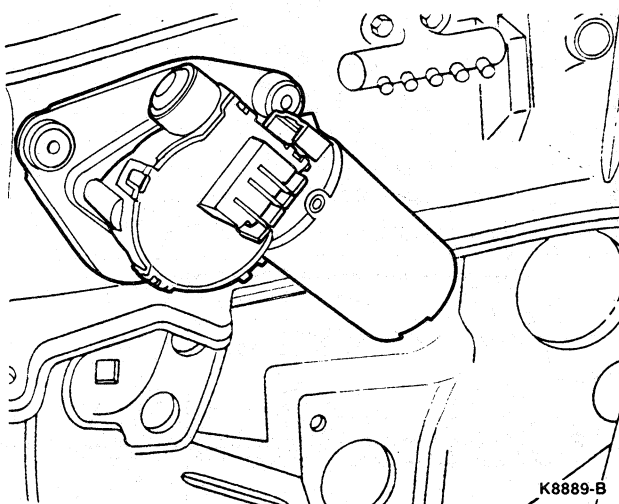
#### Removal

1. Open hood and disconnect battery cables.
2. Disconnect power lead from motor.
3. Remove LH wiper arm.
4. Lift water shield cover from cowl on passenger side.
5. Remove linkage retaining clip from operating arm on motor by lifting locking tab up and pulling clip away from pin.



K6518-C

6. Remove three attaching bolts from motor and bracket assembly and remove.



K8889-B

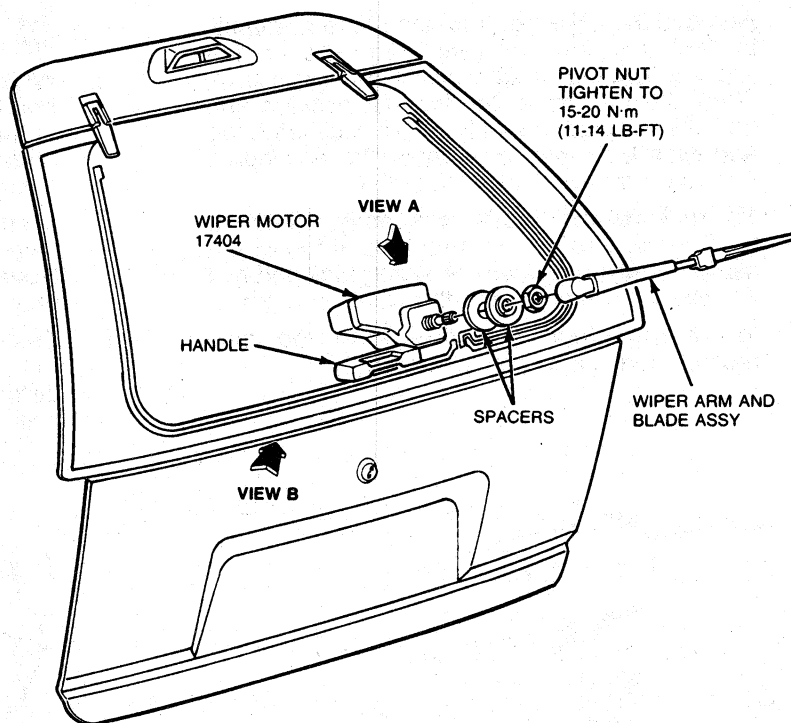
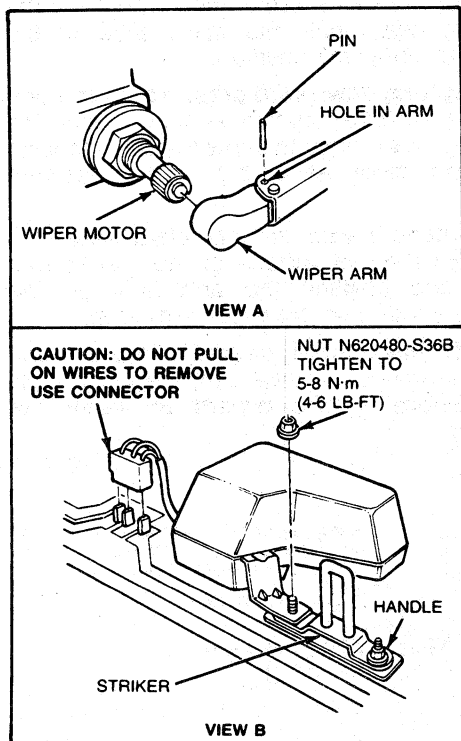
#### Installation

1. Position wiper motor assembly and install attaching bolts. Tighten to 7-9 N·m (60-85 lb-in).
2. Install retaining clip on linkage arm.
3. Install linkage on motor output arm. Ensure arm is securely attached to motor. Install linkage by pulling until clip snaps in place.
4. Install LH leaf screen.
5. Connect battery ground cable. Check wiper motor operation through all modes.
6. Install LH wiper blade to Dimension X shown in illustration under Adjustments.



**REMOVAL AND INSTALLATION (Continued)****Station Wagon—Rear****Removal and Installation**

1. Remove wiper arm and blade.
2. Remove pivot shaft attaching nut and spacers.
3. Disconnect electrical connector to wiper motor.  
Pull on connector only, not wires.
5. Remove nut retaining motor to handle and remove motor.
6. To install, reverse Steps 1 through 5.



K8891-A

**Wiper Switch, Front**

Refer to Section 32-42.

**Wiper/Washer Switch, Rear****Removal**

1. Remove four cluster opening finish panel retaining screws. Remove finish panel by rocking upper edge toward driver.
2. Disconnect wiring connector from rear washer switch.
3. Remove washer switch from instrument panel.  
NOTE: On Sable vehicles, switch is retained with two screws.

**Installation**

1. Push rear washer switch into cluster finish panel until it snaps into place. On Sable vehicles, install two retaining screws.
2. Connect wiring connector.
3. Install cluster opening finish panel and four retaining screws.

**Governor, Interval**

The interval governor is located on the LH side of the steering column support bracket.

**Removal**

1. Disconnect battery ground cable.
2. Disconnect connector.
3. Remove two attaching screws.

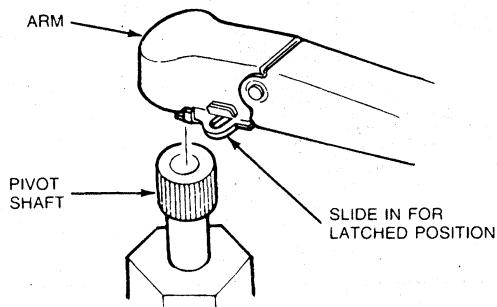
**Installation**

1. Position interval governor and install attaching screws.
2. Connect harness connector.
3. Connect battery ground cable. Check wiper system operation.

**REMOVAL AND INSTALLATION (Continued)****Arm Assembly, Front****Removal**

NOTE: To prevent glass and/or paint damage, do not pry arm from pivot with metal or sharp tool.

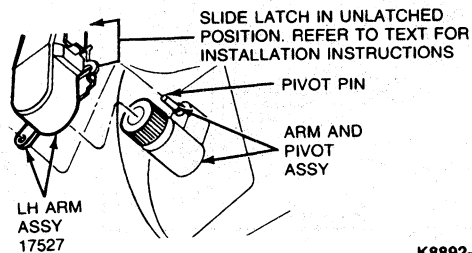
1. Turn wiper switch on. Allow motor to move the pivot shafts three or four cycles, then turn off the switch. This will place the pivot shafts in the PARK position.
2. Remove the LH wiper arm and blade assembly by first applying downward pressure on the wiper arm head, while holding the wiper arm. Then, lift the arm to the highest position and using finger pressure only, grasp slide latch tab and slide latch out from under the arm head. Remove arm and blade assembly.
3. To remove the blade assembly, insert a screwdriver into the slot provided at top of the blade frame, push down on spring lock and pull the blade assembly from the wiper arm pin.
4. Install the blade assembly onto the new replacement wiper arm assembly.



K6061-B

**Installation**

1. To install, position the arm's articulating link to the pivot pin and engage onto the pin.
2. Position the bottom surface of the wiper arm parallel with the top surface of the leaf screen louvers, ensuring the arm rests against the top surface of the leaf screen. Install the arm onto the pivot shaft with the latch slide in the unlatched (outward) position.
3. While applying downward pressure on the arm head, to ensure full seating, raise the other end of the arm sufficiently to allow the latch to slide under the pivot assembly to the latched position.
4. Lift the (latched) wiper arm and blade assembly away from the top surface of the leaf screen louvers and position the arm only on the rearward surface of the wiper arm stop.
5. Ensure the blade is fully seated on the arm and the arm is against (rearward of) the wiper stop, before operating the wipers to verify the correction.



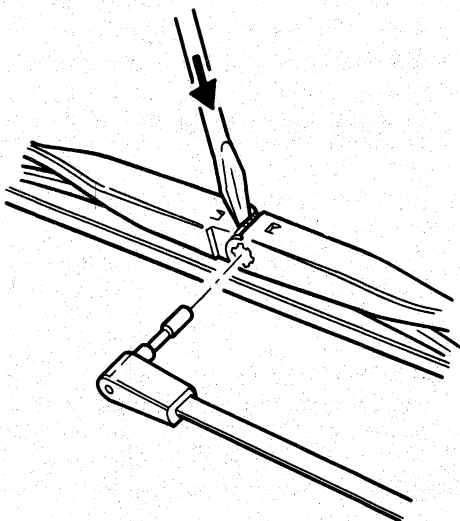
K8892-A

**Blade Assembly, Front**

To remove and install blade assembly, refer to the following illustrations.

## REMOVAL AND INSTALLATION (Continued)

## Trico

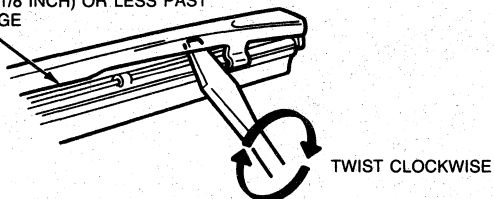


## BLADE REPLACEMENT

1. CYCLE ARM AND BLADE ASSEMBLY TO UP POSITION ON THE WINDSHIELD WHERE REMOVAL OF BLADE ASSEMBLY CAN BE PERFORMED WITHOUT DIFFICULTY. TURN IGNITION KEY OFF AT DESIRED POSITION.
2. TO REMOVE BLADE ASSEMBLY, INSERT SCREWDRIVER IN SLOT, PUSH DOWN ON SPRING LOCK AND PULL BLADE ASSEMBLY FROM PIN (VIEW A)
3. TO INSTALL, PUSH THE BLADE ASSEMBLY ON THE PIN SO THAT THE SPRING LOCK ENGAGES THE PIN (VIEW A). BE SURE THE BLADE ASSEMBLY IS SECURELY ATTACHED TO PIN.

VIEW A

NOTE: INSERT SCREWDRIVER  
3.2 mm (1/8 INCH) OR LESS PAST  
THIS EDGE

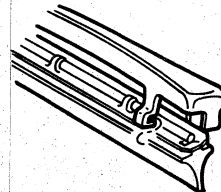


TWIST CLOCKWISE

## ELEMENT REPLACEMENT

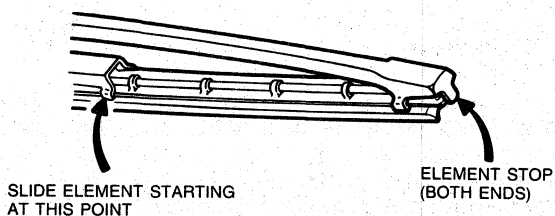
1. INSERT SCREWDRIVER BETWEEN THE EDGE OF THE SUPER STRUCTURE AND THE BLADE BACKING DRIP (VIEW B). TWIST SCREWDRIVER SLOWLY UNTIL ELEMENT CLEARS ONE SIDE OF THE SUPER STRUCTURE CLAW.
2. SLIDE THE ELEMENT INTO THE SUPER STRUCTURE CLAWS.

VIEW B



4. INSERT ELEMENT INTO ONE SIDE OF THE END CLAWS (VIEW D) AND WITH A ROCKING MOTION PUSH ELEMENT UPWARD UNTIL IT SNAPS IN (VIEW E).

VIEW D

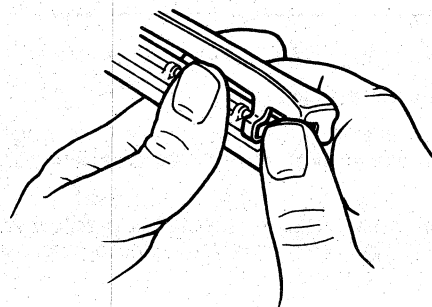


SLIDE ELEMENT STARTING  
AT THIS POINT

ELEMENT STOP  
(BOTH ENDS)

3. SLIDE THE ELEMENT INTO THE SUPER STRUCTURE CLAWS, STARTING WITH SECOND SET FROM EITHER END (VIEW C) AND CONTINUE TO SLIDE THE BLADE ELEMENT INTO ALL THE SUPER STRUCTURE CLAWS TO THE ELEMENT STOP (VIEW C).

VIEW C



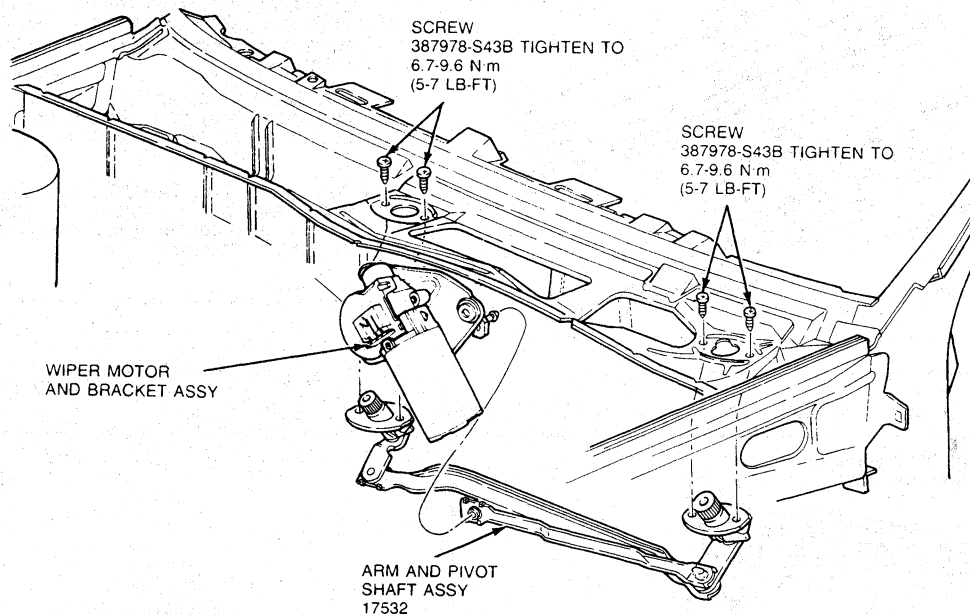
VIEW E

**REMOVAL AND INSTALLATION (Continued)****Pivot Shafts and Wiper Linkage, Front**

Wiper linkage is mounted below cowl top panel and can be reached by raising hood. Pivot shafts and linkage assemblies are connected together with non-removable plastic ball joints. LH and RH pivot shafts and linkage are serviced as one unit.

**Removal**

1. Raise hood. Disconnect battery ground cable.
2. Remove windshield wiper arm and blade assembly from pivot shafts as outlined.
3. Remove RH and LH leaf screens.
4. Disconnect linkage drive arm from motor crank pin after removing clip.



K8522-B

5. Remove screws attaching pivot assemblies to cowl. Remove linkage and pivots from cowl chamber.

**Installation**

1. Position pivot and linkage assembly in cowl and install retaining screws. Tighten screws to 7-9 N·m (60-85 lb-in).
2. Connect linkage arm to wiper motor. Ensure clip is on linkage and linkage arm is securely

attached to motor. Install linkage by pulling until clip snaps into place.

3. Install RH and LH leaf screens.
4. Connect battery ground cable. Check wiper operation through all modes.
5. Install and adjust wiper arm assemblies as outlined.
6. Attach wiper blades as outlined.

**Wiper Arm and Blade Assembly, Rear****Removal and Installation**

**NOTE:** To prevent glass and/or paint damage, do not pry arm from pivot with metal or sharp tool.

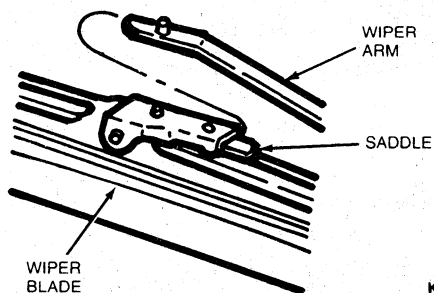
Raise arm away from glass and insert a 1.6mm (0.062-inch) pin in holes in retainer arm. Allow arm to move toward glass to relieve arm spring tension and lift arm off pivot shaft.

To install, push main arm head over pivot shaft. Ensure pivot shaft is in PARK, and that blade assembly dimension is positioned correctly. Hold main arm head on pivot shaft while raising blade end of wiper arm and remove 1.6mm (0.062-inch) pin. Then, lower blade to glass.

**REMOVAL AND INSTALLATION (Continued)****Wiper Blade, Rear****Removal and Installation**

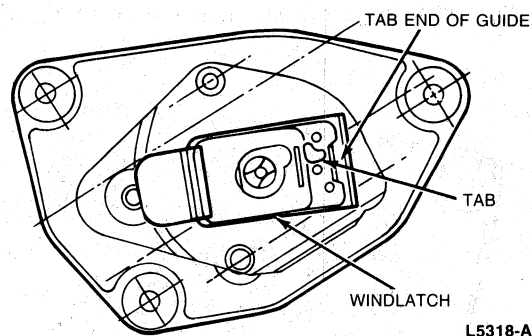
To remove blade, press down on arm to unlatch top stud and pull blade from arm.

To install blade, slide blade assembly onto arm. Ensure that top stud and bottom saddle are securely latched.



K7244-B

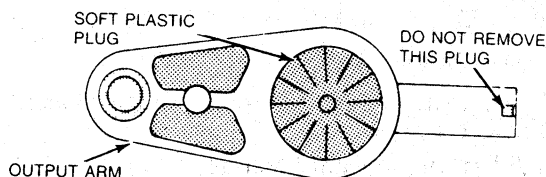
4. Note the correct positioning of the windlatch in its guide for proper assembly. Lift the plastic windlatch out of the integral cover and guide.



L5318-A

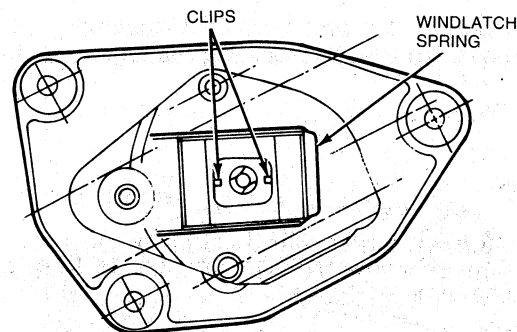
**Output Arm and Windlatch****Depressed Park****Removal**

1. With a sharp pointed tool, puncture and pry off the soft plastic plug from the upper surface of the arm.



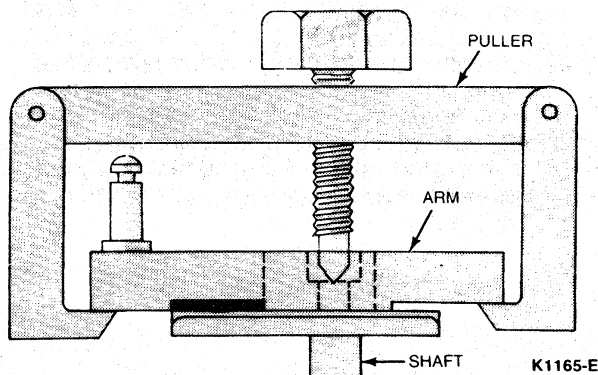
K1163-D

5. Unclip the windlatch spring from the guide and remove it.



L5319-A

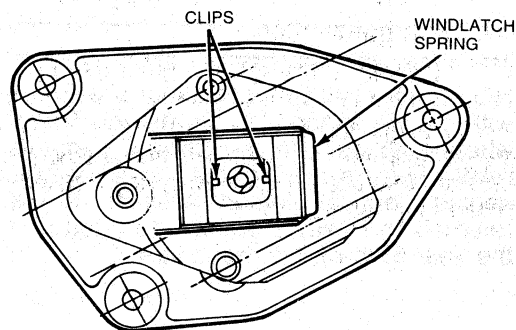
2. Remove the retaining bolt from the shaft. Do not rotate the shaft.
3. Remove the arm from the shaft with a suitable puller. Do not attempt to drift the arm from the shaft.



K1165-E

**Installation**

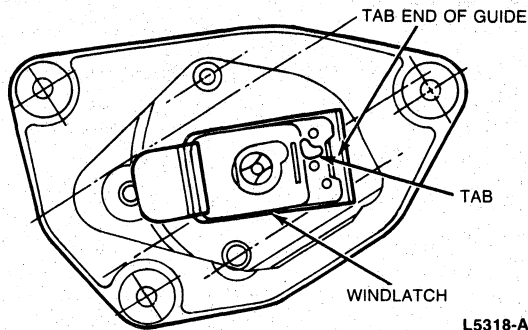
1. Snap the windlatch spring in place.



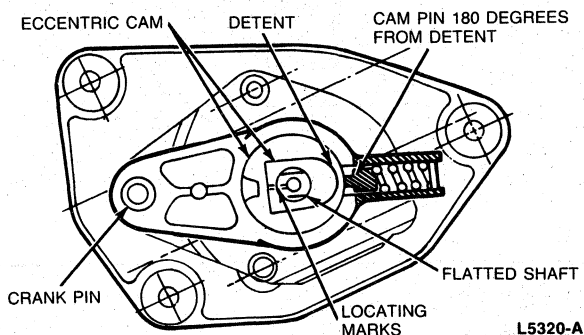
L5319-A

## REMOVAL AND INSTALLATION (Continued)

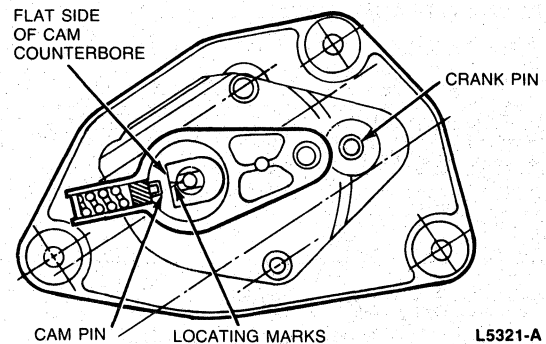
2. Parts in the kit are supplied with a special water wash resistant lubricant. Do not remove the lubricant and do not add any lubrication. Position the windlatch in the integral cover plate and guide as shown.



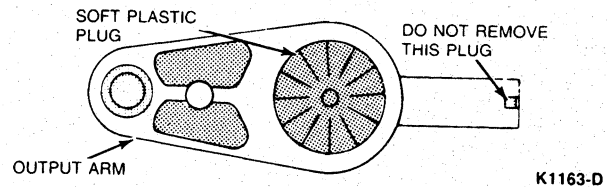
3. Position the arm and cam assembly on the shaft, so that the locating marks are aligned.



**NOTE:** The service replacement cam comes with the pin engaged in the detent. Therefore, when installed with the correct cam-to-shaft relationship (marks aligned), the arm will be 180 degrees out of parked position. It will be returned to PARK position when you perform the final Step of this procedure.



4. Draw the arm and cam assembly onto the output shaft with the retaining screw, applying 14-22 N·m (10-16 lb-ft) of torque. Before tightening the screw, slide the windlatch in its guide to ensure the upstanding tab clears the underside of the arm as it is being drawn onto the shaft.
5. Install a new soft plastic plug.



6. Ensure the output arm is in PARK position as outlined in the following procedure:
- Place motor on LH fender near dash panel.
  - Temporarily connect motor to its plugs.
  - Move the control switch lever in the vehicle to operate the motor. The output arm and cam will move together in a clockwise rotation.
  - Allow the arm and cam to move at least one full revolution, then move the control switch to OFF position. This will cause the motor output arm to proceed through the following cycle: rotate in the normal direction; reverse direction of rotation for approximately 10 to 15 degrees; stop rotating while the crankpin moves radially outward in a semi-circular motion and stop in the full PARK position.

**SPECIFICATIONS****ELECTRIC WINDSHIELD WIPER MOTOR AND SWITCH TEST CURRENT LIMITS**

Motor Type	Motor Current Draw Test	Circuit Breaker/Switch Test	
		Low Current	High Current
		Must Hold One Hour Minimum	Must Trip Within 30 Seconds
Front Wiper Motor	*3.5 amperes	8.25 amperes	16.5 amperes
Rear Wiper Motor	*1.5 amperes	4.5 amperes	9.0 amperes

\*Motor maximum current when operated without linkage attached.

CK8911-B

**SPECIAL SERVICE TOOLS****ROTUNDA EQUIPMENT**

Number	Description
014-00407	Digital Volt-Ohm Meter
078-00005	Starting and Charging Tester

CK9953-A

# SECTION 35-70 Windshield Washers

SUBJECT	PAGE	SUBJECT	PAGE
<b>DESCRIPTION AND OPERATION</b>		<b>REMOVAL AND INSTALLATION (Cont'd.)</b>	
Fluidic Washer System .....	35-70-2	Fluidic Washer Nozzle, Rear .....	35-70-6
Washer System .....	35-70-1	Motor, Seal and Impeller Assembly .....	35-70-3
Washer System, Rear .....	35-70-2	Washer Hose, Rear .....	35-70-4
Windshield Washer Low Fluid Warning		Washer Pump, Front .....	35-70-3
Indicator .....	35-70-2	Washer Pump, Rear .....	35-70-4
<b>DIAGNOSIS AND TESTING</b>		<b>SPECIAL SERVICE TOOLS</b> .....	35-70-8
Washer Pump Current Draw .....	35-70-6	<b>VEHICLE APPLICATION</b> .....	35-70-1
<b>REMOVAL AND INSTALLATION</b>			
Fluidic Washer Nozzle, Front .....	35-70-5		

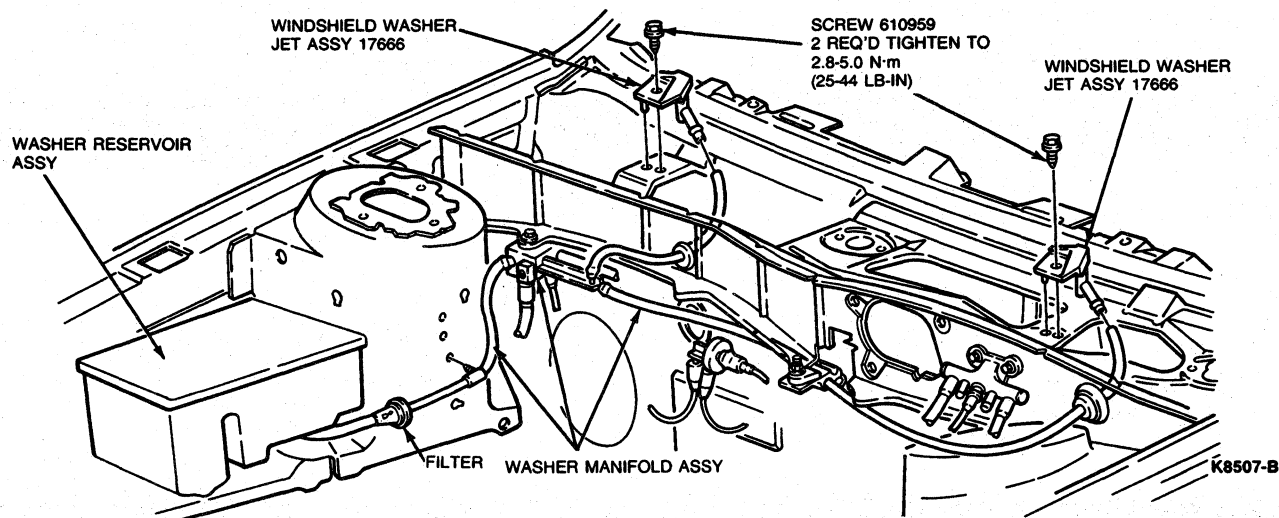
## VEHICLE APPLICATION

Taurus/Sable.

## DESCRIPTION AND OPERATION

### Washer System

The washer system uses two nozzles located on the cowl top panel. The control switch is steering column mounted. When activated, it energizes a washer pump mounted inside a cavity in the washer reservoir. The reservoir is mounted on the RH fender apron.

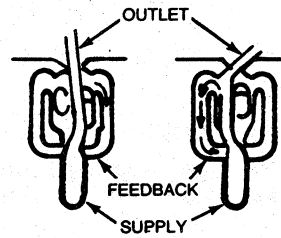




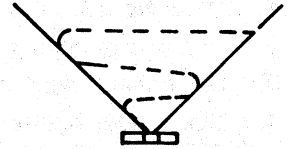
## DESCRIPTION AND OPERATION (Continued)

**Fluidic Washer System**

The front fluidic system nozzle expels what appears to be a wide fan-like spray pattern of large droplets of fluid on the windshield. However, it is actually a single oscillating jet stream. Care should be taken to only actuate the system momentarily because of the greater volume of fluid that is dispersed with this system.



FLOW TUBE FEEDBACK  
CAUSES OSCILLATION



SPRAY PATTERN OSCILLATION  
AT HIGH FREQUENCY APPEARS  
AS A SOLID FAN TO THE  
NAKED EYE

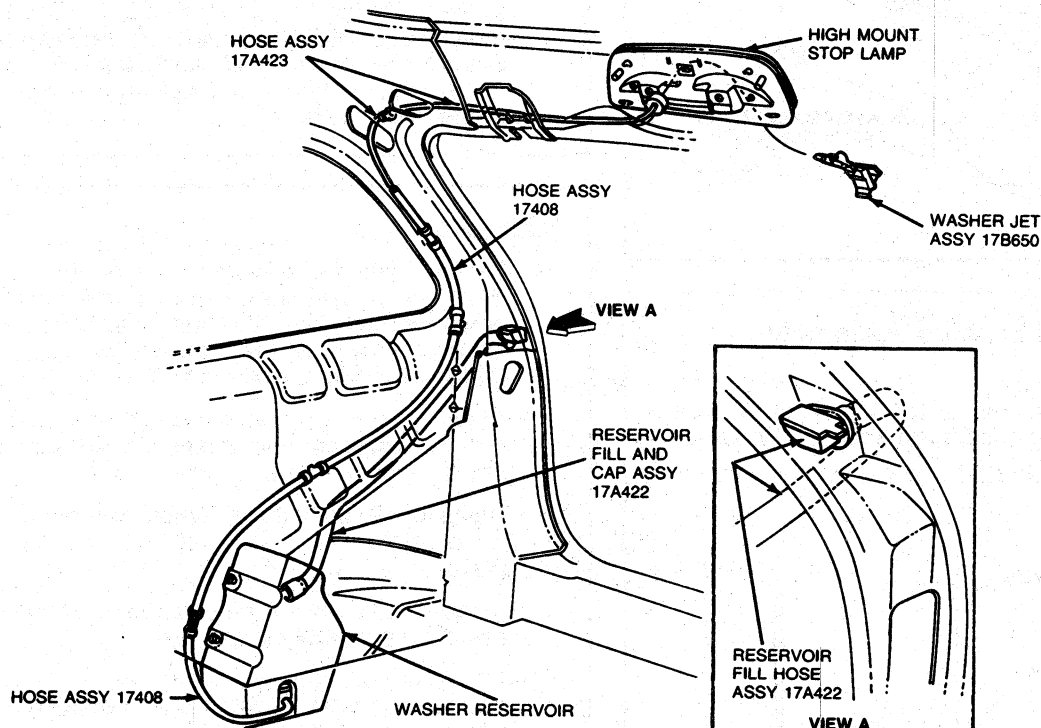
K6527-B

**Washer System, Rear**

The rear system uses a single nozzle mounted inside the rear high-mounted stoplamp assembly.

The control switch is on the instrument panel. When activated, the switch energizes an external washer pump on the washer reservoir. The reservoir on the

station wagon model is mounted behind the RH trim panel. The reservoir fill cap is located outside near the lift gate opening. Fill the reservoir slowly, otherwise air will become trapped and the reservoir will overflow.



K8719-A

**Windshield Washer Low Fluid Warning Indicator**

Vehicles equipped with a windshield washer low fluid warning indicator system have a red WASH FLUID indicator.

If the washer fluid level is low, the warning lamp will light when the washer switch is activated. The sending unit for the system is mounted in the washer

reservoir and consists of a float and a magnet assembly that opens and closes a reed-type switch. When the fluid reaches approximately one-quarter full, the switch contacts will close. Current will flow from the switch through the contacts and directly to the warning lamp.

## REMOVAL AND INSTALLATION

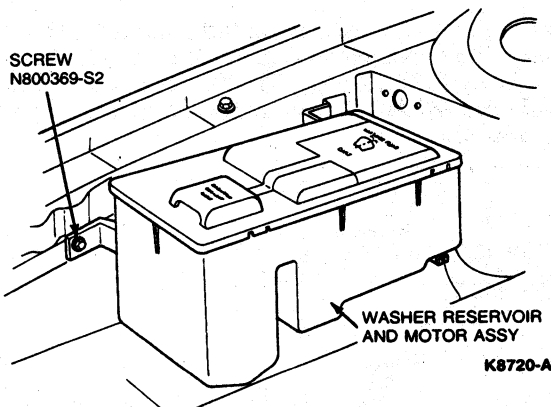
### Washer Pump, Front

#### Removal

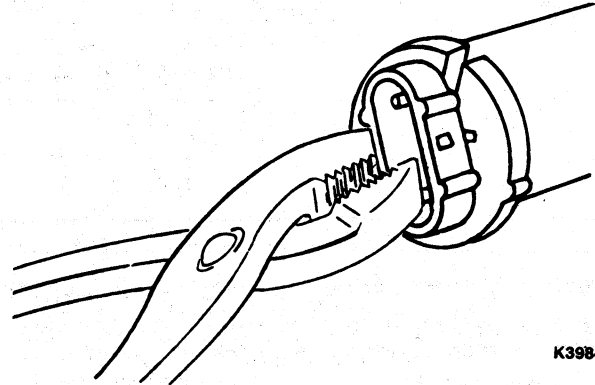
1. Open hood.
2. Remove attaching screw.
3. Disconnect electrical connectors.
4. Disconnect hoses and remove reservoir from vehicle. Reservoir will drain with hose disconnected.

#### Installation

1. Connect electrical connectors and hoses.
2. Install reservoir.
3. Install attaching screw.
4. Fill reservoir with fluid.



3. Using pliers to grip one wall around electrical terminals, pull out motor, seal and impeller assembly.

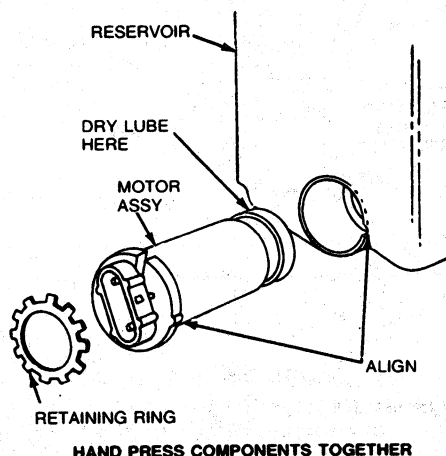


If the impeller and seal come off when the motor is pulled, they can be reassembled. Ensure the reservoir pump chamber is free of foreign material prior to installing the old motor in the new reservoir.

### Motor, Seal and Impeller Assembly

#### Removal

1. Remove reservoir assembly from vehicle. Disconnect electrical connector and hoses.
2. Using a small-blade screwdriver, pry out retaining ring.



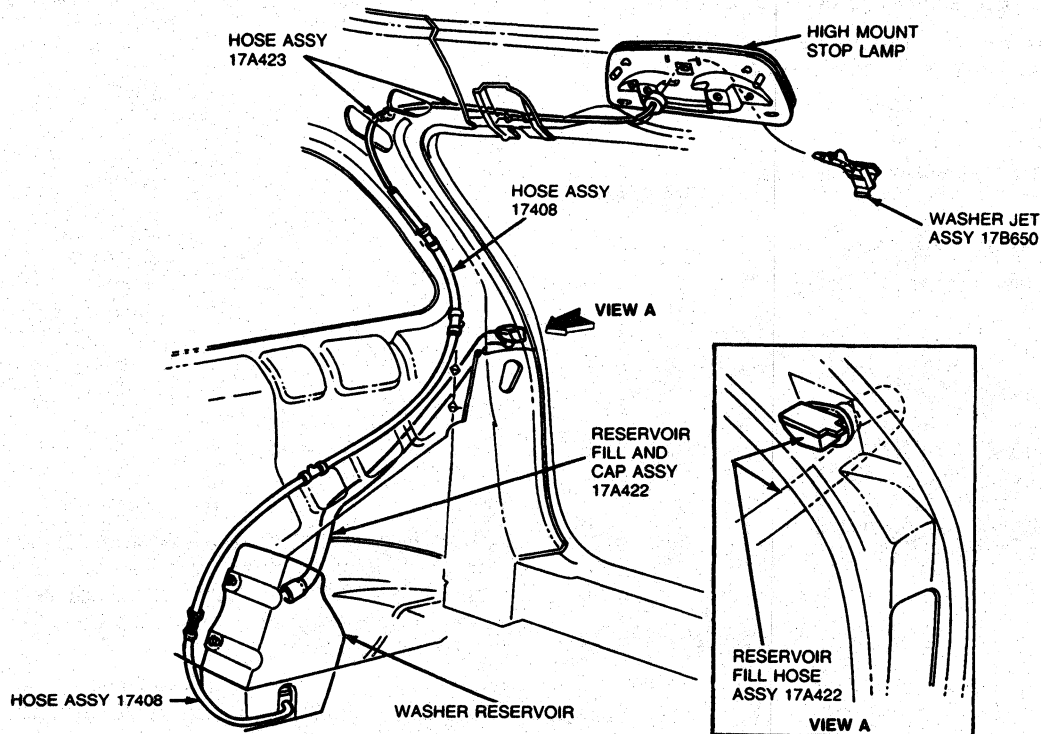
#### Installation

1. Before installing assembly, lubricate outside diameter of seal with a dry lubricant such as powdered graphite. This will prevent seal from sticking to wall of reservoir motor cavity and make assembly easier.
2. Align small projection on motor end cap with slot in reservoir and assemble so that seal seats against bottom of motor cavity.
3. Using 1-inch socket (preferably 12 point), hand press retaining ring securely against motor and plate.
4. Connect electrical plugs and hoses and replace reservoir assembly in vehicle.
5. Fill reservoir slowly (otherwise air will be trapped in reservoir causing it to overflow) and operate washer system.
6. Check for leaks.

**CAUTION: Do not operate pump until fluid is added to reservoir.**

**REMOVAL AND INSTALLATION (Continued)****Washer Hose, Rear****Removal and Installation**

1. Pull hose from nozzle.
2. Pull grommet from door and roof.
3. Remove D-pillar trim panel and remove washer hose.
4. To install, reverse Steps 1, 2 and 3.



K8719-A

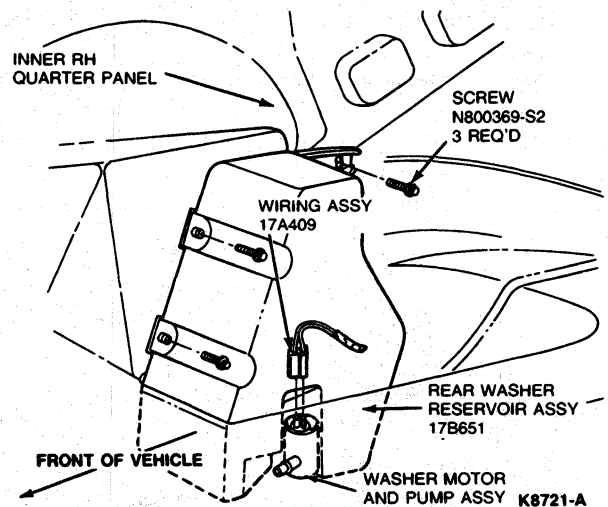
**Washer Pump, Rear****Removal**

1. Remove RH quarter trim panel. Refer to Section 45-03.
2. Disconnect electrical connector reservoir supply hose, and washer nozzle hose as outlined.
3. Remove reservoir retaining screws and remove reservoir from vehicle.
4. Using a small-blade screwdriver, pry out motor assembly. Remove screen and seal.
5. Flush reservoir and clean any foreign material from motor cavity or the reservoir.

**Installation**

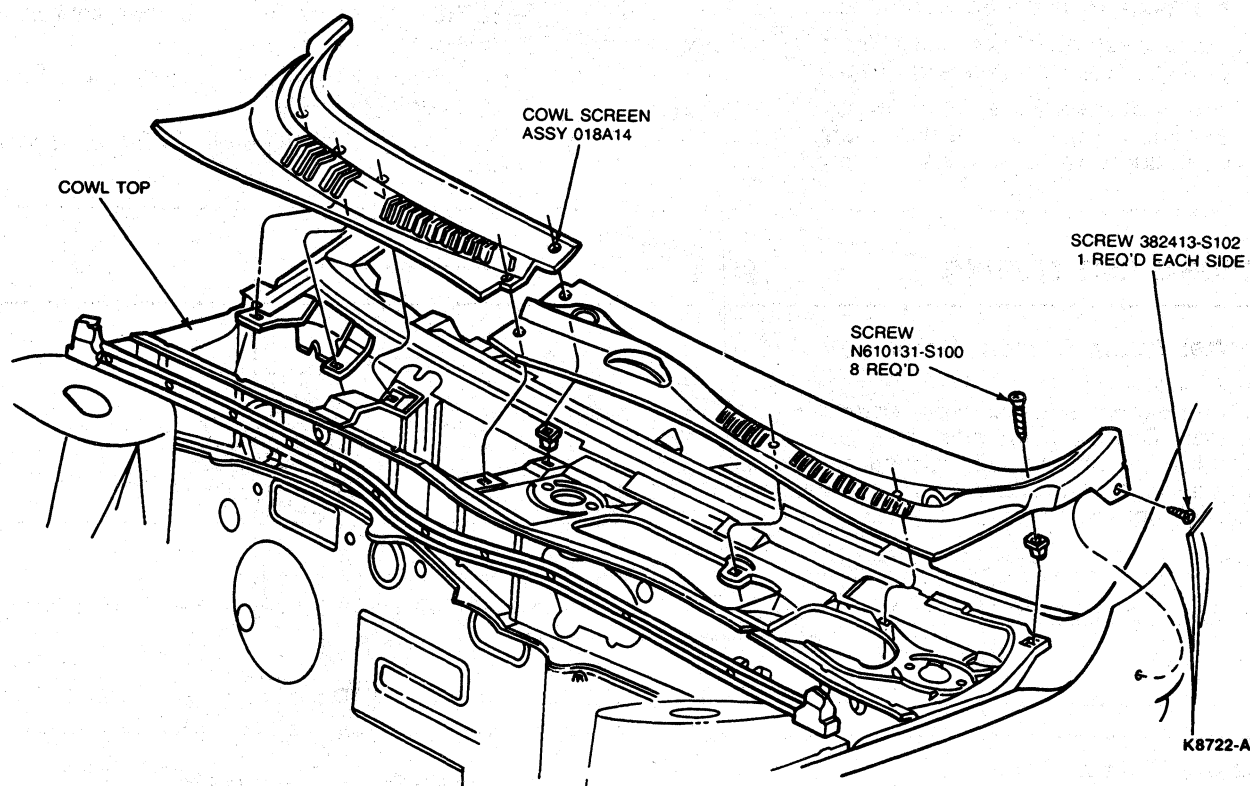
1. Lubricate outside of seal with a dry lubricant such as powdered graphite to prevent seal from sticking during reassembly.
2. Insert screen in seal and insert seal all the way down in cavity.
3. Align motor in cavity on reservoir. Insert motor in seal using hand pressure only.
4. Connect electrical connector and supply hose.
5. Install reservoir. Install retaining screws.
6. Fill reservoir slowly, otherwise air will become trapped in reservoir causing it to overflow.

7. Replace quarter trim panel.  
**CAUTION: Do not operate pump until reservoir is filled.**

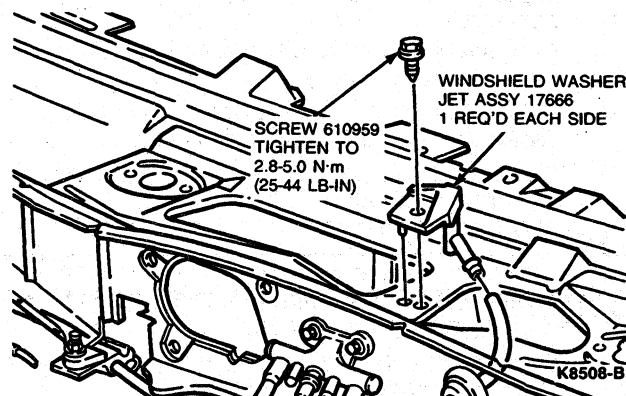


**REMOVAL AND INSTALLATION (Continued)****Fluidic Washer Nozzle, Front****Removal**

1. Raise hood.
2. Remove wiper arms. Refer to Section 35-60.
3. Remove cowl top screen. Refer to Section 35-60.



4. Disconnect washer hose and remove screws attaching retaining washer nozzle to dash panel.
5. To install, reverse Steps 1 through 4. Tighten retainer screw to 2.8-5.0 N·m (25-44 lb-in).



**REMOVAL AND INSTALLATION (Continued)****Fluidic Washer Nozzle, Rear****Removal**

1. The lift gate nozzle is attached inside the hi-mount stoplamp by two snap-in tabs.
2. Remove lift gate trim panel. Refer to Section 45-03.
3. Remove four attaching nuts of hi-mount stoplamp. Refer to Section 32-20.
4. Disconnect grommet hose from nozzle by pulling away from inside of lift gate.
5. From bottom side of hi-mount stoplamp assembly, squeeze the two snap-in tabs and push out to remove washer nozzle.

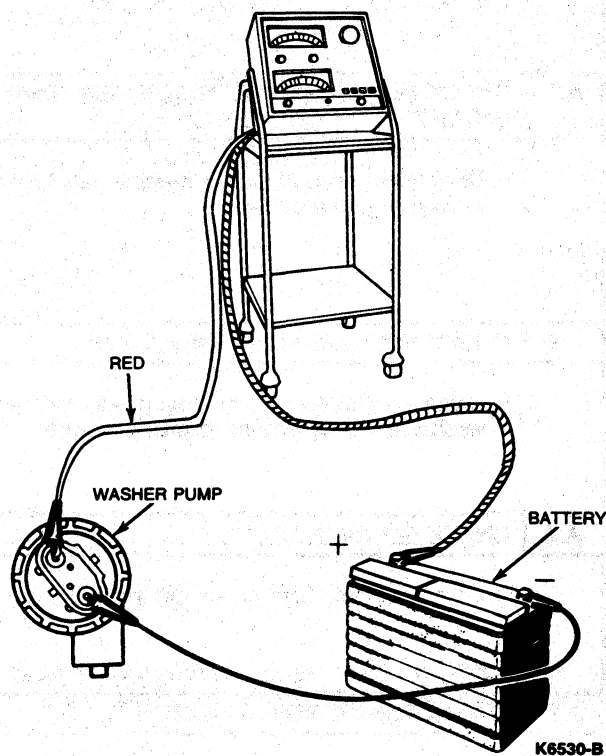
**Installation**

1. Snap washer nozzle into body of rear hi-mount stoplamp assembly.
2. Push hose and grommet onto nozzle.  
NOTE: Ensure grommet is fully seated into hole on inner panel of lift gate.
3. Position hi-mount stoplamp to lift gate. Install four retaining screws.
4. Install lift gate trim panel. Refer to Section 45-03.

**CAUTION: Ensure hose is not kinked or twisted.**

**DIAGNOSIS AND TESTING****Washer Pump Current Draw**
















Attach leads of the Volt-Amp Tester, such as Rotunda Starting and Charging Tester 078-00005 or Rotunda Digital Volt/Ohmmeter or equivalent. Current draw should not exceed four amps, or indicate less than two amps while the washer pump motor is pumping fluid.



Refer to the diagnosis charts for windshield washer checks.

## DIAGNOSIS AND TESTING (Continued)

## WINDSHIELD WASHER DOES NOT OPERATE

TEST STEP		RESULT	ACTION TO TAKE
<b>A.0</b>	<b>WINDSHIELD WASHER DOES NOT OPERATE</b>		
<b>A.1</b>	<b>CHECK FLUID LEVEL</b>		
	<ul style="list-style-type: none"> <li>Check level of fluid in reservoir.</li> </ul>	Empty 	FILL reservoir. GO to A.2.
<b>A.2</b>	<b>ACTIVATE WASHER SWITCH</b>		
	<ul style="list-style-type: none"> <li>Activate washer switch.</li> <li>Check motor for operation.</li> </ul>	Motor inoperative  Motor operates, but will not squirt fluid 	GO to A.5. GO to A.4.
<b>A.3</b>	<b>INSPECT HOSE AND NOZZLE</b>		
	<ul style="list-style-type: none"> <li>Visually inspect washer hose and nozzle for blockage or hose kinks.</li> </ul>	Hose or nozzle blocked or hose kinked  Not blocked 	CLEAN, REPLACE or SERVICE nozzle or hoses. GO to A.5.
<b>A.4</b>	<b>CHECK FOR BLOCKAGE AT WASHER PUMP OUTLET</b>		
	<ul style="list-style-type: none"> <li>Disconnect hose at reservoir and check for blockage at washer pump outlet.</li> </ul>	 	REMOVE washer pump from reservoir and CLEAN. REPLACE washer pump.
<b>A.5</b>	<b>CHECK VOLTAGE AT WASHER PUMP</b>		
	<ul style="list-style-type: none"> <li>Using a voltmeter or test lamp, check for voltage at washer pump by activating washer switch.</li> </ul>	No voltage  Voltage 	GO to A.7. GO to A.6.
<b>A.6</b>	<b>CHECK GROUND AT PUMP</b>		
	<ul style="list-style-type: none"> <li>Using an ohmmeter, check ground at washer pump.</li> </ul>	Ground  Ground 	SERVICE ground. REPLACE pump.
<b>A.7</b>	<b>CHECK FOR POWER AT SWITCH</b>		
	<ul style="list-style-type: none"> <li>Check for power at wiper switch by operating wipers.</li> </ul>	Wipers  Wipers 	GO to A.9. GO to A.8.
<b>A.8</b>	<b>CHECK FOR POWER OUT OF WASHER SWITCH</b>		
	<ul style="list-style-type: none"> <li>Using a voltmeter or test lamp, check for power out of washer switch or wash circuit.</li> </ul>	No power  Power 	GO to A.11. GO to A.10.

**DIAGNOSIS AND TESTING (Continued)****WINDSHIELD WASHER DOES NOT OPERATE — Continued**

<b>TEST STEP</b>		<b>RESULT</b>	<b>ACTION TO TAKE</b>
<b>A.9</b>	<b>CHECK HEATER BLOWER</b>		
	<ul style="list-style-type: none"> <li>• Activate heater blower.</li> </ul>	<del>OK</del> ► OK ►	SERVICE open circuit in power feed wiring. GO to A:10.
<b>A.10</b>	<b>CHECK WIPER/WASH CIRCUIT BREAKER</b>		
	<ul style="list-style-type: none"> <li>• Check wiper/wash circuit breaker, refer to Section 34-50 for location.</li> </ul>	<del>OK</del> ► OK ►	REPLACE circuit breaker. GO to A.11.
<b>A.11</b>	<b>CHECK SWITCH CIRCUITS</b>		
	<ul style="list-style-type: none"> <li>• Check switch circuits.</li> </ul>	<del>OK</del> ► OK ►	REPLACE switch. GO to A.12.
<b>A.12</b>	<b>CHECK FOR POWER TO SWITCH</b>		
		No power	► CHECK for electrical system fault before wipe/wash switch.
		Power	OK ► SERVICE wipe/wash wiring and connectors.

CL4612-B

**SPECIAL SERVICE TOOLS****ROTUNDA EQUIPMENT**

Model	Description
078-00005	Starting and Charging Tester
014-00407	Digital Volt — Ohmmeter

CL5281-A

# SECTION 35-80 Horns

SUBJECT	PAGE	SUBJECT	PAGE
DESCRIPTION		TESTING AND ADJUSTMENTS	
Horn System .....	35-80-1	Circuit Check .....	35-80-1
REMOVAL AND INSTALLATION		VEHICLE APPLICATION .....	35-80-1
Horn Switch .....	35-80-2		

## VEHICLE APPLICATION

Taurus/Sable.

## DESCRIPTION

### Horn System

The standard high and low pitch horns are mounted to the RH fender apron. The horn switch closes the circuit to the horn through a relay.

## TESTING AND ADJUSTMENTS

### Circuit Check

Verify that the ground at the horn is good by checking connection for corrosion. Also verify that the mounting screw is tight.

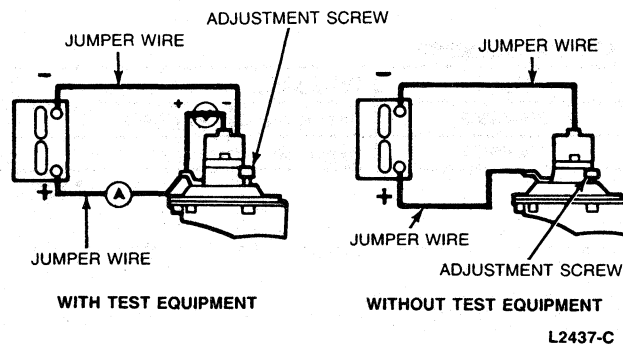
Attach a wire from battery positive terminal to horn. If the horn sounds normally, check the wiring between horn and horn switch. If the horn does not sound, perform the following procedure:

### With Equipment

Connect a voltmeter and ammeter, such as Rotunda 007-00001 or equivalent, to the horn and to vehicle battery. If current reads zero amperes (open circuit), turn adjusting screw counterclockwise until meter indicates 5.0-5.5 amperes, then secure adjusting screw by clinching housing extension with diagonals or pliers. If current is greater than 5.5 amperes, turn adjusting screw clockwise until reading is 5.5 amperes. Then, secure adjusting screw by clinching housing extension with diagonals or pliers. If 5.0-5.5 amperes limit cannot be met, remove horn and replace.

### Without Equipment

Connect a wire between the negative (-) terminal of the battery and the mounting bracket. Connect another wire from horn to the positive (+) terminal of the battery. If horn does not sound **and** there is no evidence of a spark at the battery terminal, turn adjusting screw counterclockwise one-quarter turn minimum to three-eighths turn maximum. Then, secure adjusting screw by clinching housing extension with diagonals or pliers. If horn does not function, replace horn.



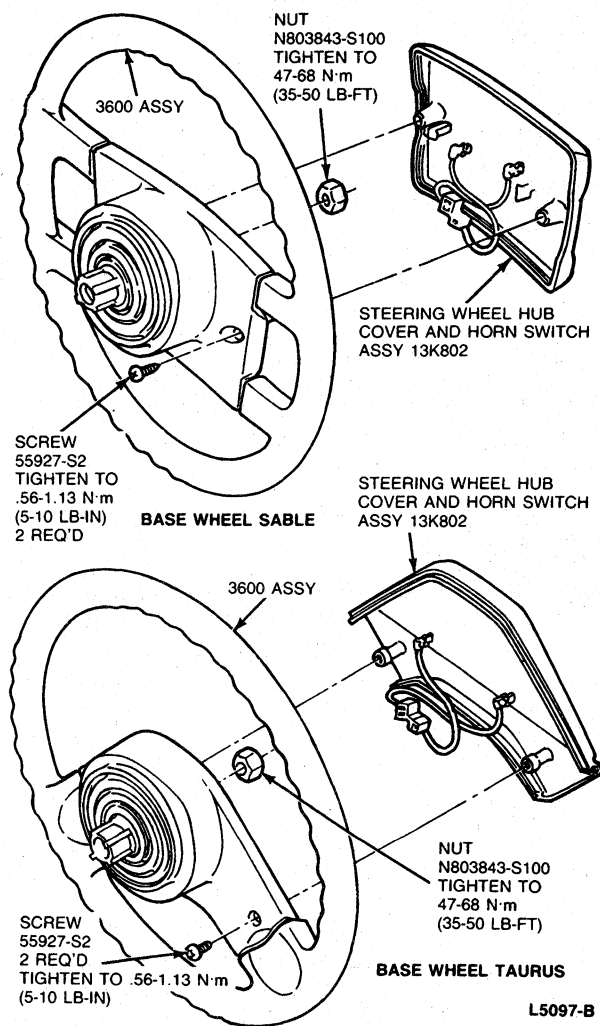


**REMOVAL AND INSTALLATION****Horn Switch****Removal**

1. Remove two screws from back side of steering wheel.
2. Remove wire terminal from steering wheel.

**Installation**

1. Attach wire terminal to steering wheel.
2. Align cover in wheel. Install two screws on back side of steering wheel.





# VENTILATING, HEATING AND AIR CONDITIONING

## GROUP **36** (18000 & 19000)

SECTION TITLE	PAGE	SECTION TITLE	PAGE
A/C AND REFRIGERANT SYSTEM—		COMPRESSOR AND CLUTCH—FS-6 .....	36-37-1
SERVICE .....	36-32-1	HEATER AND POWER VENTILATION	
A/C BASIC THEORY .....	36-31-1	SYSTEM .....	36-12-1
A/C-HEATER SYSTEM, MANUAL .....	36-45-1	WINDOW, REAR—DEFROSTER .....	36-86-1
AUTOMATIC TEMPERATURE CONTROL—			
ELECTRONIC .....	36-75-1		

## SECTION 36-12 Heater and Power Ventilation System

SUBJECT	PAGE	SUBJECT	PAGE
ADJUSTMENTS		REMOVAL AND INSTALLATION (Cont'd.)	
Temperature Control Cable .....	36-12-9	Connector Assembly, Round .....	36-12-20
DESCRIPTION AND OPERATION		Control Assembly .....	36-12-18
Airflow .....	36-12-2	Defroster Nozzle .....	36-12-24
Components .....	36-12-4	Demisters and Demister Hoses .....	36-12-24
Control Assembly .....	36-12-2	Floor Air Distribution Duct .....	36-12-25
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System Airflow and Vacuum Controls .....	36-12-2	Floor-Panel Door Vacuum Motor .....	36-12-25
Temperature Control .....	36-12-2	Heater Case Assembly .....	36-12-20
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Bench Test .....	36-12-9	Instrument Panel .....	36-12-10
Blower Switch Continuity Test .....	36-12-6	Louver Assembly, Rectangular .....	36-12-19
Electrical .....	36-12-6	Outside-Recirc Door Vacuum Motor .....	36-12-23
Heater Blower Motor Current Draw Test .....	36-12-7	Panel-Defrost Door .....	36-12-26
Heater Core Leak Test .....	36-12-7	Panel-Defrost Door Vacuum Motor .....	36-12-26
Heater Testing .....	36-12-6	Plenum Chamber .....	36-12-24
Open Circuit Test .....	36-12-7	Recirc Duct Assembly .....	36-12-21
Plugged Heater Core Test .....	36-12-7	Register Assembly, Round .....	36-12-20
Pressure Test .....	36-12-7	Register Housing Assembly, Rectangular ...	36-12-19
Vacuum .....	36-12-5	Temperature Control Cable .....	36-12-19
REMOVAL AND INSTALLATION		Vacuum Selector Switch .....	36-12-19
Air Inlet Duct and Blower Housing .....	36-12-25	SPECIAL SERVICE TOOLS AND	
Blower Motor and Wheel Assembly .....	36-12-21	EQUIPMENT .....	36-12-31
Blower Motor Resistor .....	36-12-23	SPECIFICATIONS .....	36-12-31
Blower Switch .....	36-12-18	VEHICLE APPLICATION .....	36-12-2

## VEHICLE APPLICATION

Taurus/Sable.

## DESCRIPTION AND OPERATION

### Airflow

The heater assembly is a blend air system, receiving outside air through the blower inlet, which is connected directly to an opening in the upper cowl. Outside air is drawn into the system from the cowl, through the blower inlet into the blower housing. It is forced through and/or around the heater core, mixed, and then discharged through outlets in the discharge air duct to the floor area or through the defroster outlets, depending upon the type of climate control desired. Several doors determine the amount of air that goes through the heater core and the particular outlet(s) through which it discharges. Fig. 1 shows the airflow through the system with the various function selections available.

### OFF

When the function selector knob is in the OFF position:

- The outside-recirc door is at full vacuum. As a result, outside air is closed off and recirc air is admitted to the system.
- The panel-defrost door and the floor-panel door are both at full vacuum, closing off the passages to the defrosters.
- The blend door position may be anywhere within the range of its cable travel from FULL HEAT to FULL COLD.
- The blower motor is off.

### PANEL

When the function selector knob is in the PANEL position:

- The outside-recirc door, with no vacuum being applied, will block recirc air and admit outside air. From there, airflow is directed through the system to the instrument panel registers.
- The floor-panel door is at "no vacuum" to block airflow to the floor registers, and the panel-defrost door is at full vacuum, closing off airflow to the defrosters.
- The temperature selector may be adjusted to heat the air, if desired.
- The blower motor is on.

### FLOOR

When the function selector knob is in the FLOOR position:

- The outside-recirc door is in the "no vacuum" position to block recirc air and admit outside air.
- The floor-panel door is in the vacuum position which closes off all but a minimum of airflow to the defroster.
- The blend air door position will channel airflow so that a desired temperature level will be achieved.
- The panel-defrost door is in the "no vacuum" position to block air circulation to the panel registers.
- The blower motor is on.

### MIX

When the function selector knob is in the MIX position:

- The outside-recirc air door and the panel-defrost door are in the "no vacuum" position.
- The floor-panel door is in the partial vacuum position.
- The blower motor is on.

### DEFROST

When the function selector knob is in the DEFROST position:

- The outside-recirc air door is in the "no vacuum" position to admit outside air.
- Both the floor-panel and the panel-defrost doors are in the "no vacuum" position so that most of the incoming air is directed to the defroster nozzles. There is a slight air bleed to the floor registers.
- The temperature control knob setting will determine the amount of heat being introduced into the airflow.
- The blower motor is on.

### Control Assembly

The control assembly is located in the instrument panel at the right of the steering column. The control assembly contains a four position blower knob, a temperature control knob, a function control knob and illumination bulb (Fig. 2).

The heater and power ventilation control includes a function control knob for PANEL, FLOOR, OFF, MIX and DEFROST that determines the manner in which the system will operate, a temperature control knob for manually setting the desired comfort temperature, and a blower switch to control the volume of air movement. Each position of the function control knob and blower switch is detented for positive engagement. The blower switch provides four manually selected blower speeds and may be operated in any position to select the desired amount of airflow.

### Temperature Control

Temperature control of the heater and power ventilation system is determined by the position of the temperature control knob (between COOL and WARM) of the control assembly (Fig. 3), and is accomplished by means of a control cable between the control assembly and the temperature blend door. System airflow is manually controlled by the control assembly. A vacuum selector valve, controlled by the function control knob, distributes vacuum to the various door vacuum motors which in turn, direct the airflow through the system.

The system utilizes what is called a "temperature blend" method to provide controlled temperature to the vehicle interior. With this method, all outside airflow from the blower passes through the heater case to the plenum assembly. Temperature is then regulated by heating a portion of the outside air and blending it with the remaining cooler outside air to the desired temperature. Temperature blending is varied by the temperature blend door which controls the amount of air that flows through or around the heater core, where it is mixed and directed into the distribution plenum. The air is finally directed to the heater ducts, the defroster nozzles, or the instrument panel registers, depending upon the selection made with the function selector knob.

### System Airflow and Vacuum Controls

Fig. 1 illustrates how air is circulated through the system when the function selector knob is in each of its detent positions. Fig. 4 adds a vacuum schematic and chart to a

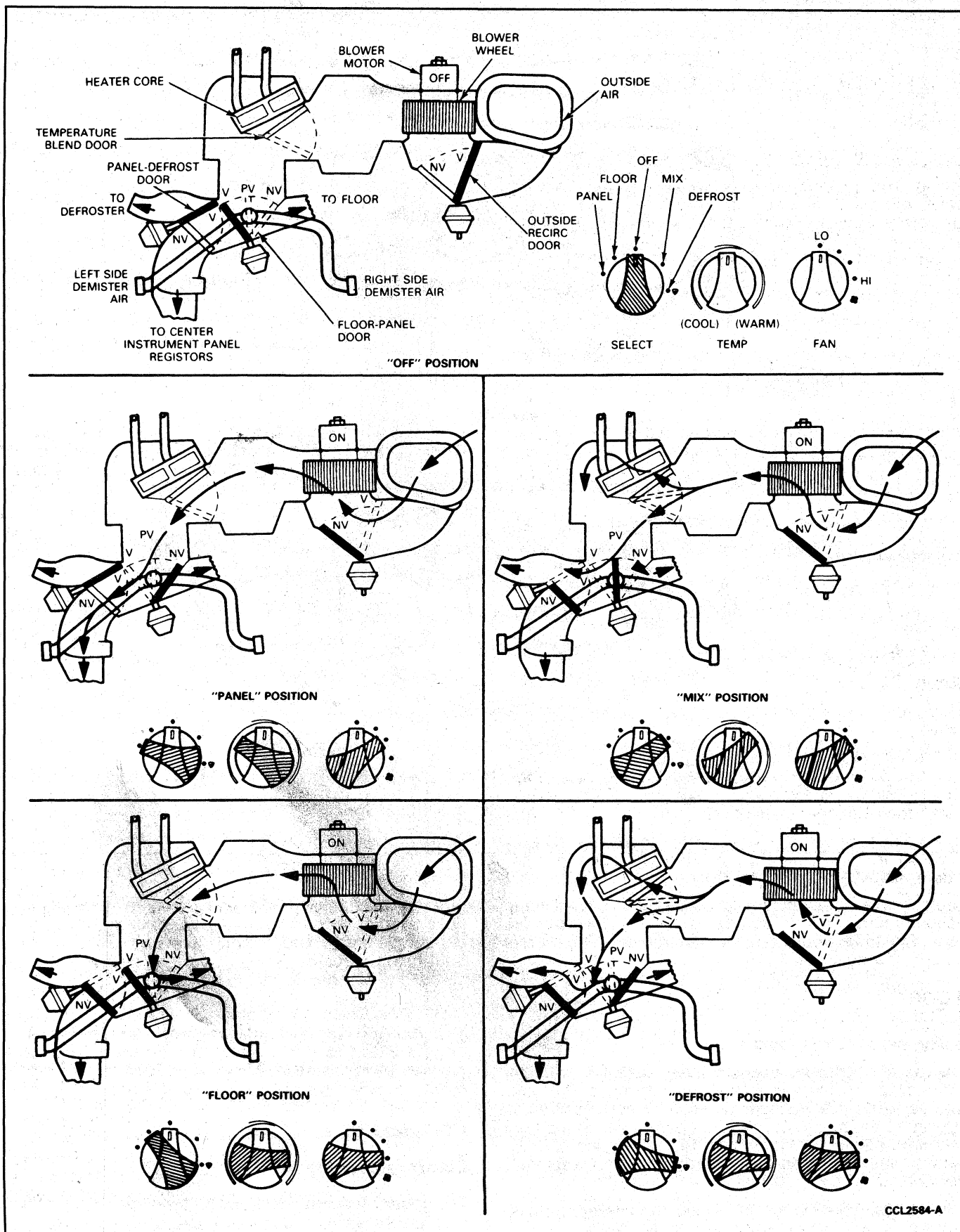
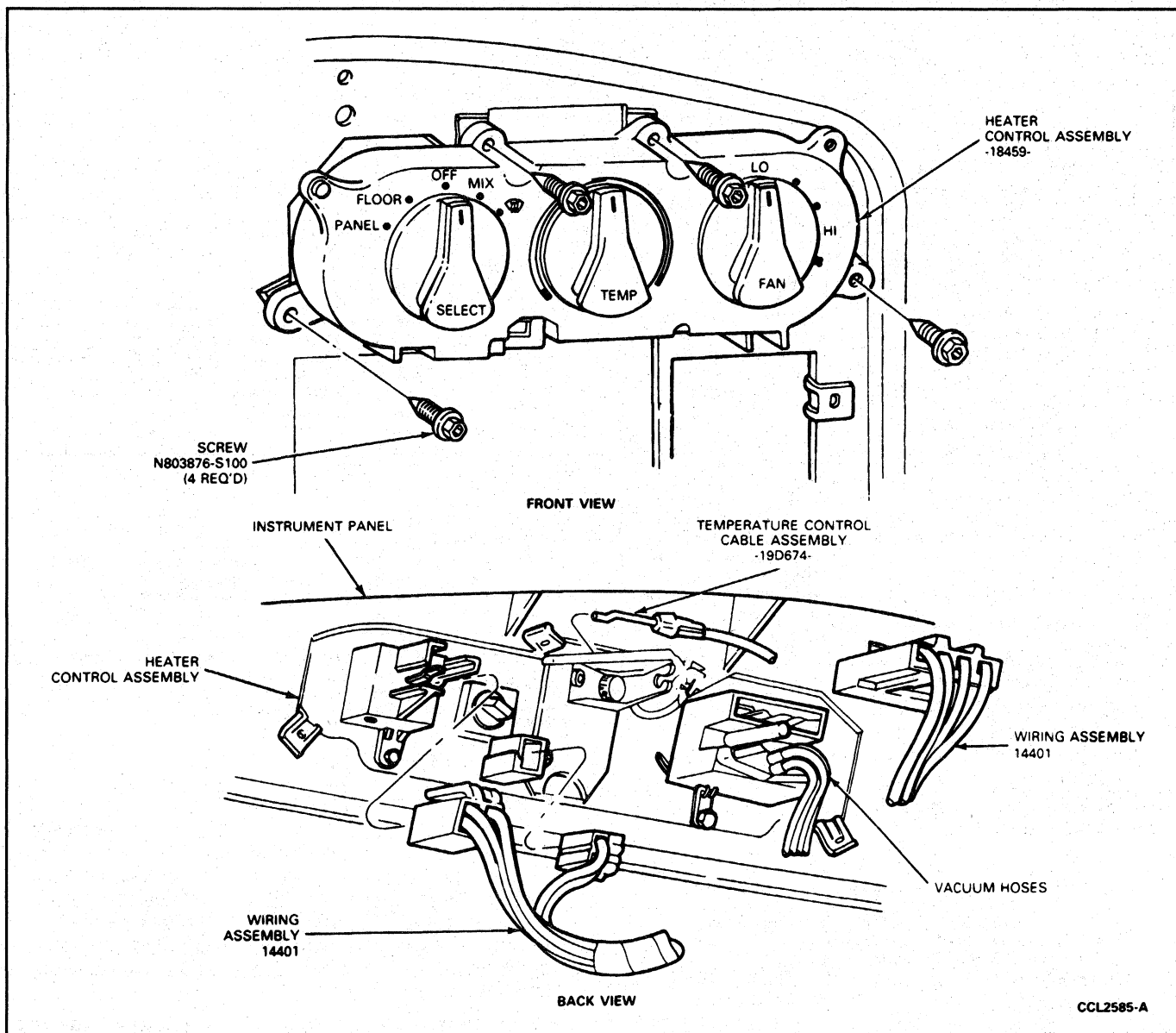


FIG. 1 System Airflow Schematic



**FIG. 2 Heater Control Assembly**

basic airflow schematic to show how the five lines in the vacuum harness are controlled by a selector valve assembly to operate three vacuum motors. The motors control the movement of:

- The outside-recirc door.
- The panel-floor door.
- The panel-defrost door.

The panel-floor door vacuum motor has two vacuum lines. When vacuum is applied to both lines, the door moves to its full vacuum position. When vacuum is applied to the blue line only, the door moves to a partial vacuum position. If it is applied to the red line only (or neither line) the door will assume a "no vacuum" position.

Fig. 5 shows the system electrical wiring diagram and provides charts which contain some test data.

### Safety Precautions

Whenever components in the engine compartment or instrument panel areas are being serviced, the battery

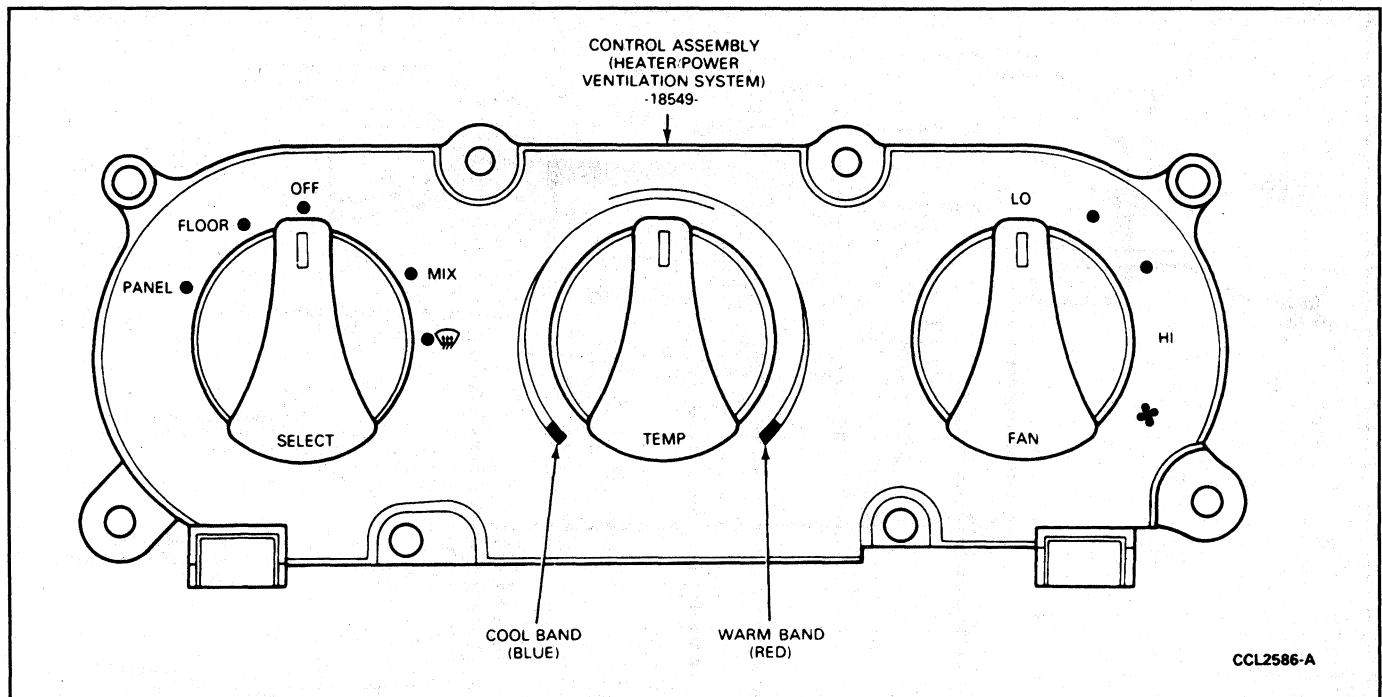
ground cable must be disconnected to eliminate the possibility of electrical shorts, burned-up wiring, and dangerous fires. Extreme care must be exercised when performing electrical tests where the battery must be connected to operate the system.

**CAUTION: Carbon monoxide is colorless, odorless and dangerous. If it is necessary to operate the engine with the vehicle in a closed area such as a garage, always use an exhaust collector to vent the exhaust gases outside the closed area.**

### Components

#### Control Assembly

The control assembly consists of three main parts: 1) the function selector; a vacuum selector valve combined with an internal electrical switch; 2) blower switch; an electrical switch that provides four speeds of blower operation, and 3) the temperature control knob which connects through a control cable assembly to the temperature blend door of the plenum assembly.



**FIG. 3 Control Assembly—Temperature Control Knob**

1. The vacuum selector valve directs source vacuum to various vacuum motors (Fig. 4). One internal single-pole electrical switch is also controlled by the selector. The internal electrical switch controls the electrical supply to the blower switch (Fig. 5).
2. The four-speed blower switch controls blower speed and is manually set to select the desired airflow (Fig. 5).
3. The temperature control knob is connected to the temperature blend door by a control cable assembly. Movement of the control knob from COOL to WARM causes a corresponding movement on the temperature blend door and determines the temperature that the system will maintain.

#### Self-Adjust Temperature Control Cable

The temperature control cable is self-adjusting with the movement of the temperature control knob to the extreme right (to the end of the WARM band marked on the face of the control assembly). To prevent damage of the control cable wire, a preset adjustment (Fig. 6) must be made before attempting to perform the self-adjust procedure. Refer to Adjustments.

#### Mini-Tube Vacuum Hoses

Mini-tube vacuum hoses are used in the vacuum harness assemblies. They provide greater flexibility with less tendency to collapse and are less susceptible to pinching. Repairs are easily made using a short piece of standard 3mm (1/8-inch) ID vacuum hose and inserting the cut ends of the mini-tube into the ends of the standard 3mm (1/8-inch) ID vacuum hose. Refer to Adjustments and Fig. 7.

#### Heater Core

Refer to Fig. 8.

The heater core consists of a number of flat, hollow, metal ribbons that are corrugated to take maximum advantage of engine coolant flow. The heater core is

located inside the evaporator case in the passenger compartment.

#### Register Assemblies

##### Rectangular Registers

##### Sable

The rectangular register assemblies have retaining pins on each end of the louver assembly that lock into pivot holes in the register housing. The housing has four flexible tabs (two on top and two on the bottom) that lock the housing into the instrument panel register assembly opening. The louver assembly swivels, directing outlet air up or down while the louvers allow side-to-side air distribution.

A knob located on the LH front of the register assembly controls an air outlet shutoff door installed in the register housing assembly.

##### Taurus

The retaining tabs lock the register assemblies to the instrument panel applique. The louver assembly swivels and directs air up or down while the louvers provide side-to-side air distribution.

##### Round Registers

The round registers used in the Sable instrument panel applique are retained by a round retainer which holds the register assembly in the register housing.

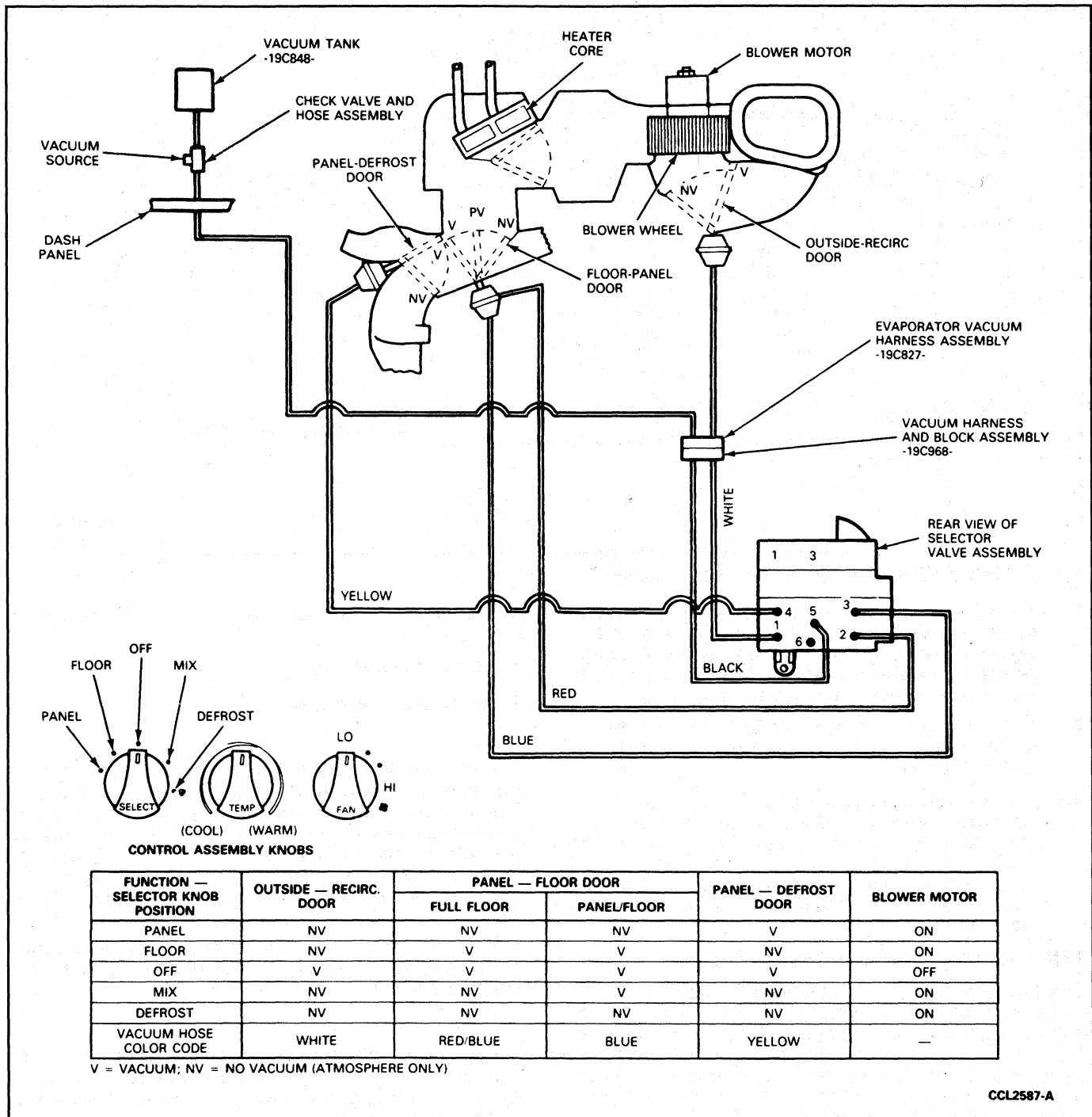
### DIAGNOSIS AND TESTING

#### Airflow

Refer to Figs. 1 and 4 to assist in performing airflow function and vacuum motor application tests.

#### Vacuum

Refer to Fig. 4 to assist in performing vacuum system and function selector valve tests. If a vacuum leak should occur, a hissing sound is most likely to exist at the point



**FIG. 4 Heater System Vacuum Schematic and Selector Test**

in the system where the leak originates. Refer to the following diagnosis chart to assist in pinpointing the vacuum leak location.

### Electrical

Refer to Fig. 5 to assist in performing component and system electrical wiring and continuity tests. The blower switch chart also provides blower motor voltage and current information for each blower switch position.

### Heater Testing

The following tests may be made on the heater: burned out fuses, loose wire connections, damaged wires, or collapsed hoses. Loose defroster ducts and air leaks in

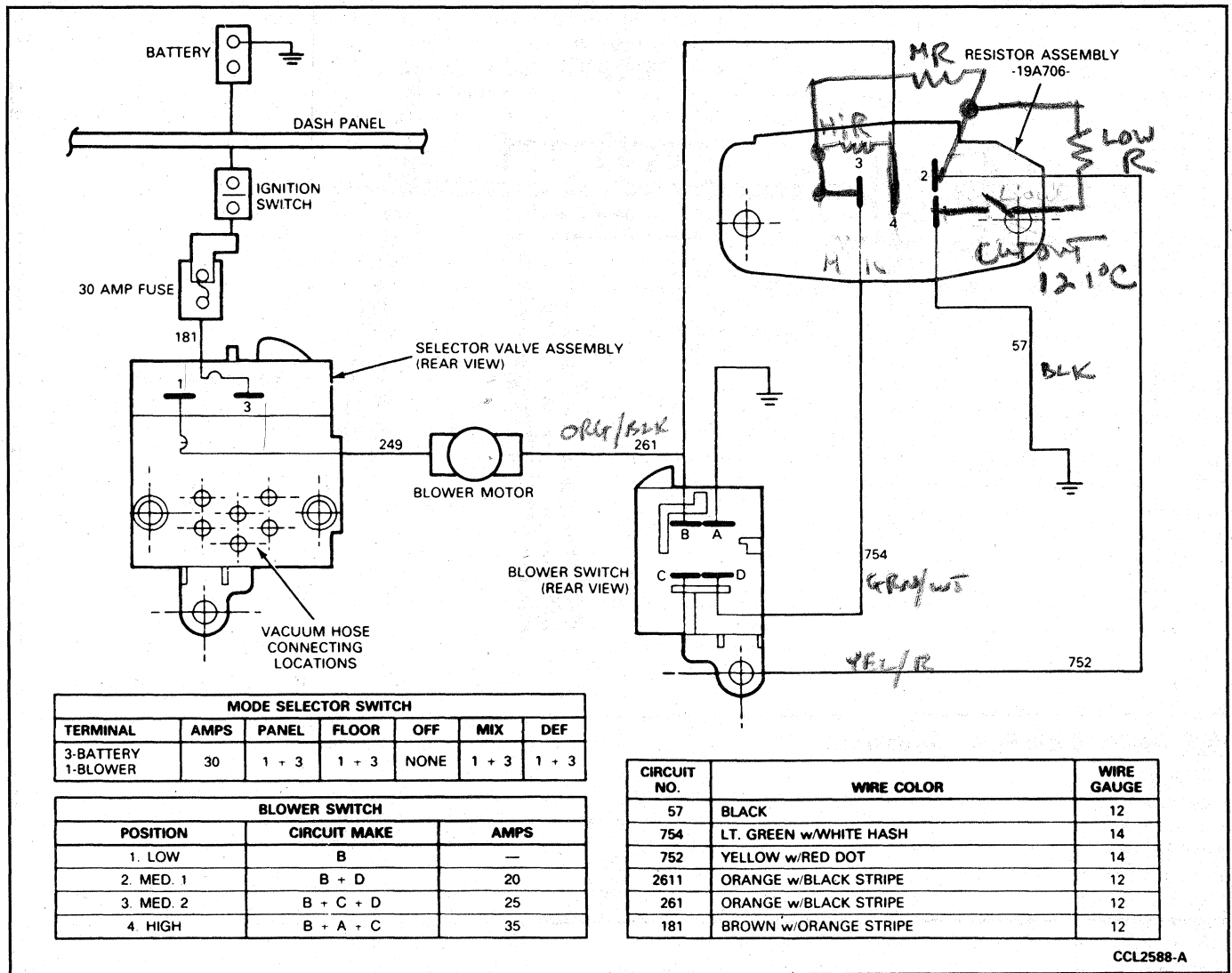
the body may be determined by visual inspection of the parts.

### Blower Switch Continuity Test

Refer to the appropriate electrical schematic. Check for continuity between connected terminals as shown in the schematic. Check terminal continuity at every lever position. The lamp should go on for each connected pair of terminals.

There should be no continuity between the battery terminal and the switch case.





### Open Circuit Test

On all electrical circuits, continuity must exist from the source of power (battery) to the unit where the power is used, and back up to the source of power (ground). A check at each connection in a circuit, starting at the battery, will locate an open circuit or will show that the circuit is complete.

An ohmmeter or self-powered test lamp connected at any two points of a circuit, with the power removed from the circuit, will show if the circuit between the two connections is open or continuous.

If the meter does not move or has a slight movement (high resistance), the circuit may have a poor connection or broken wire. If the bulb lights, the circuit is continuous.

### Heater Blower Motor Current Draw Test

This test will determine if the blower motor is operating properly. Connect a 0-30 ampere ammeter (Fig. 9), ground the negative lead of the blower motor and measure the motor current draw at the high-speed setting. If the motor is operating properly, the current draw readings will be within specification.

### Plugged Heater Core Test

Ensure the engine coolant is at the proper level, then start the engine and temporarily remove the outlet heater hose from the water pump. Very little or no flow of water from the core outlet indicates that the core or heater hose(s) is plugged.

### Heater Core Leak Test

#### Inspection

1. Inspect for visible evidence of coolant leakage at hose-to-heater core attachments. A coolant leak at hose could follow heater core tube to core and appear as a leak in heater core.
2. Check system for loose heater hose clamps. Clamps should be tightened to 1.81-2.49 N·m (16-22 lb-in).
3. If leakage is found and hose clamps are tight, check heater core tubes for distortion. Severe distortion of tubes could cause leakage at hose connection.

#### Pressure Test

1. Drain coolant from cooling system.
2. Disconnect heater hoses from heater core tubes.

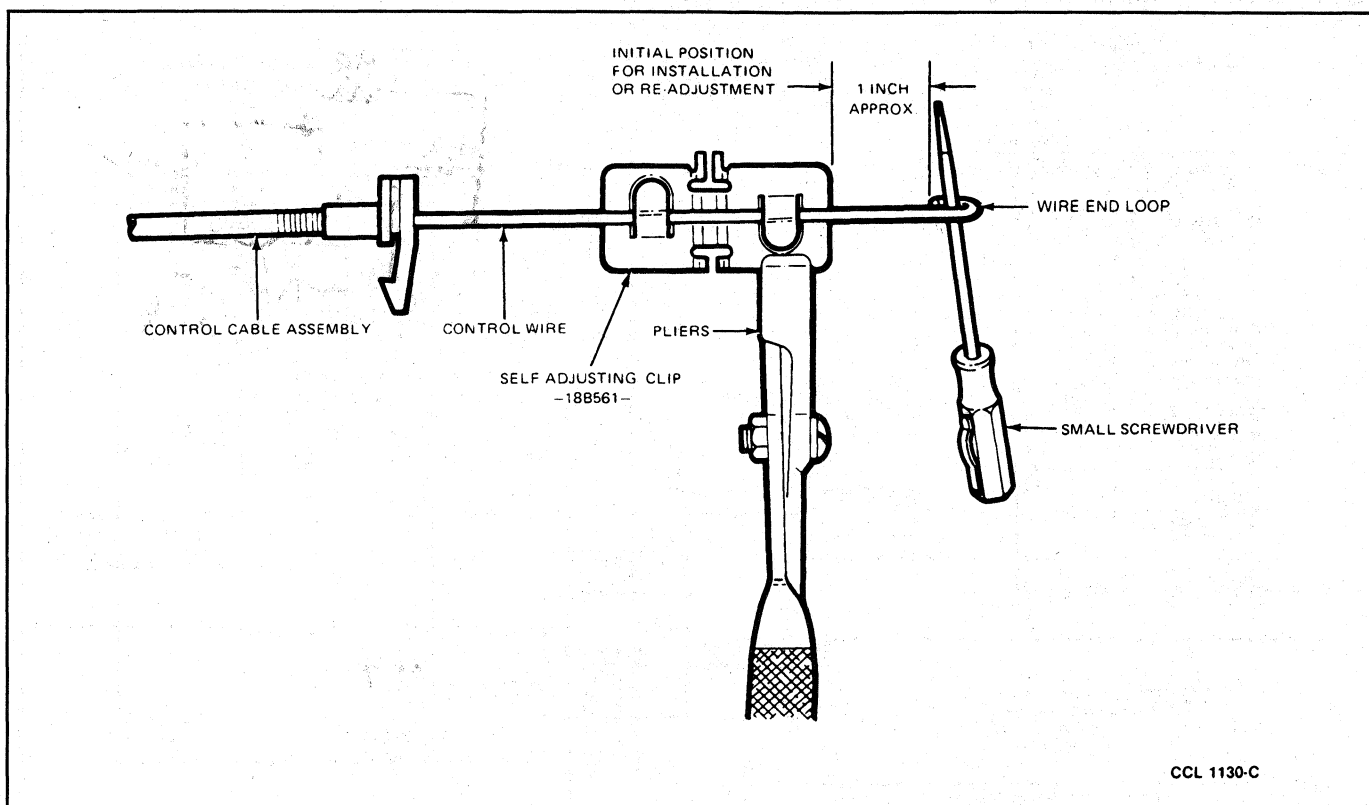


FIG. 6 Control Cable Preset Adjustment

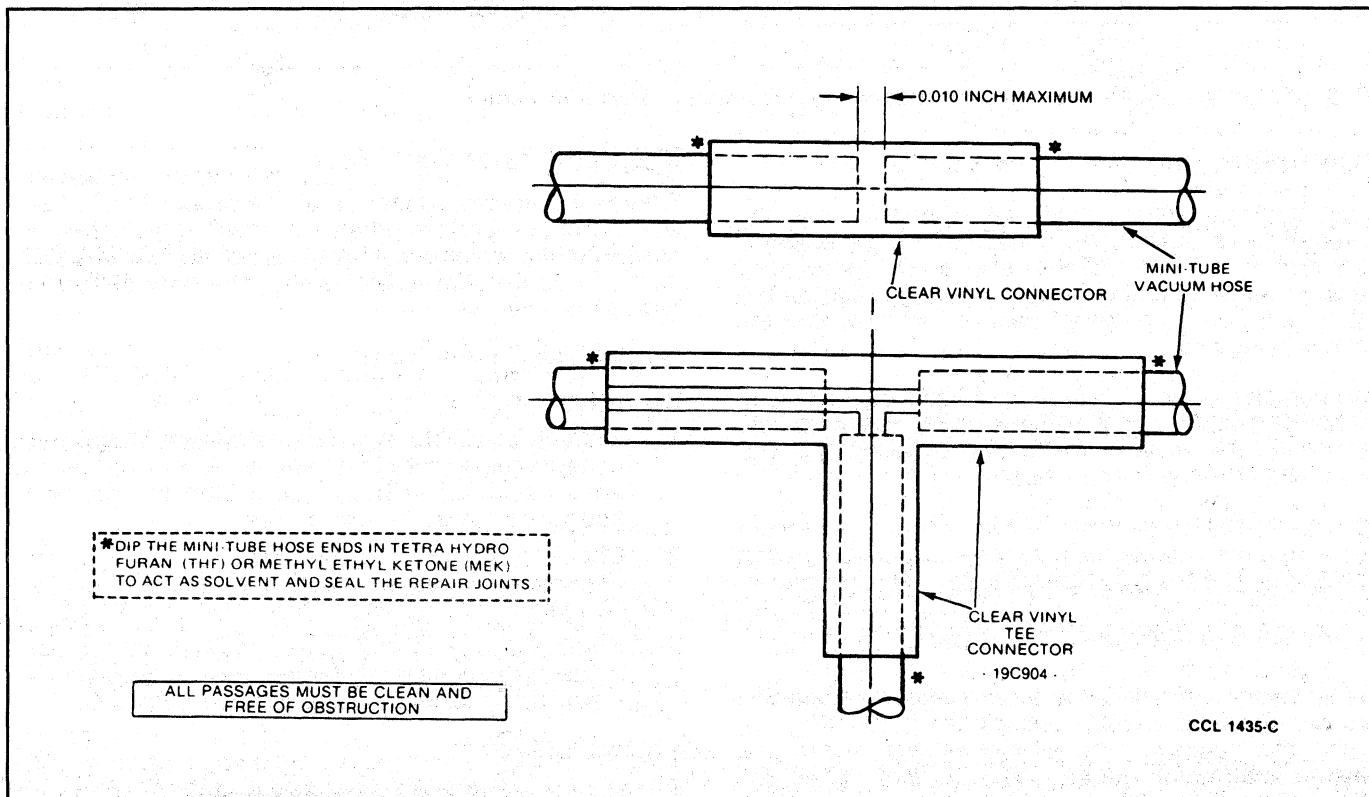


FIG. 7 Mini-Tube Vacuum Hose Service

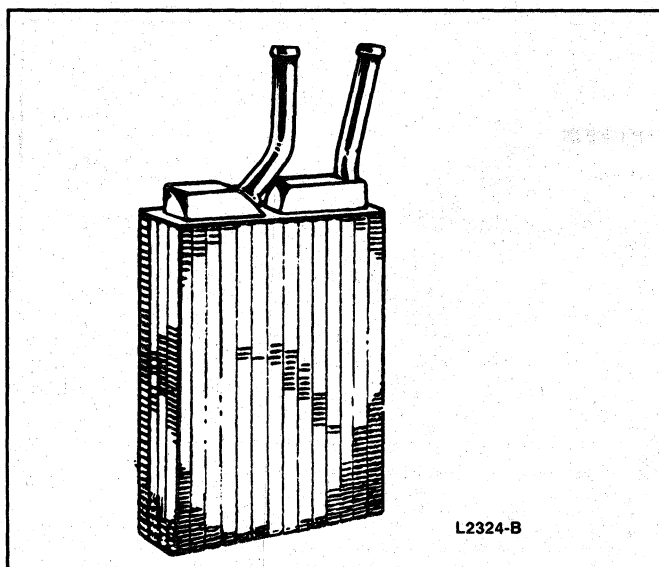


FIG. 8 Heater Core—Typical

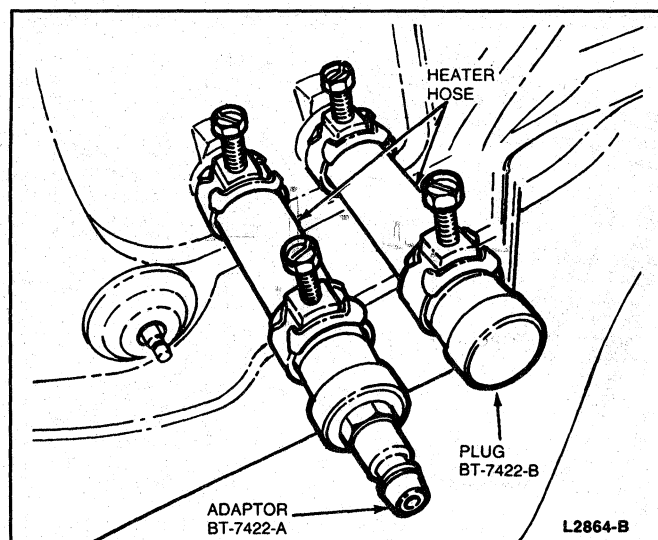


FIG. 10 Heater Hose with Plug and Adapter Installed

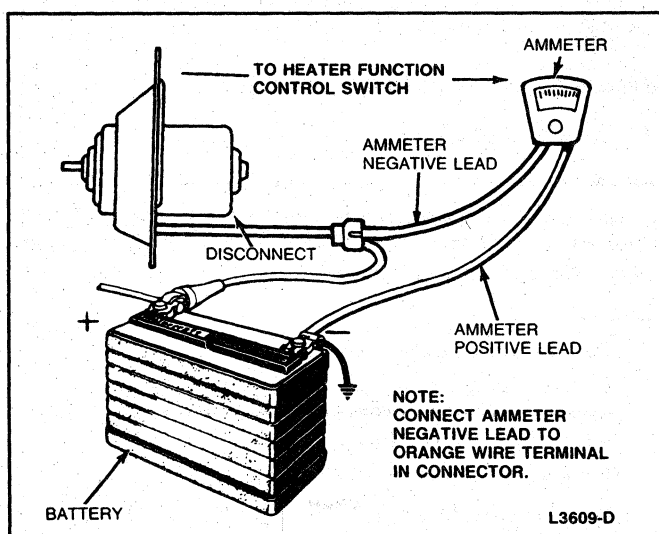


FIG. 9 Heater Blower Motor Current Draw Test—Schematic

3. Install a short piece of heater hose (approximately 101mm (4-inches) long) on each heater core tube.
4. Fill heater core and hoses with water and install Plug BT-7422-B and Adapter BT-7422-A from Rotunda Pressure Tester, 021-00012 or equivalent in hose ends (Fig. 10). Secure hoses, plug and adapter with hose clamps.
5. Attach Rotunda Pressure Tester, 021-00012 or equivalent to adapter (Fig. 11). Close bleed valve at base of gauge and pump 207 kPa (30 psi) of air pressure into heater core (Fig. 12).
6. Observe pressure gauge for a minimum of three minutes. The pressure should not drop.
7. If pressure does not drop, no leaks are indicated.
8. If pressure drops, check hose connections to core tubes for leaks. If hoses do not leak, remove heater core from vehicle and test core as outlined.

### Bench Test

1. Drain all coolant from heater core.

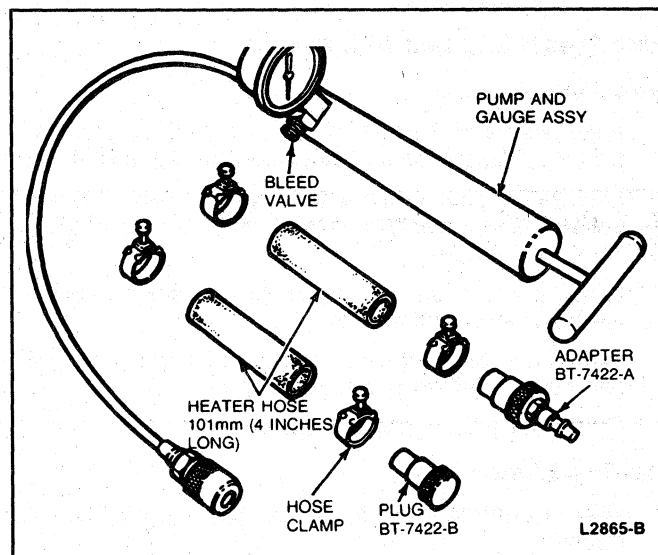


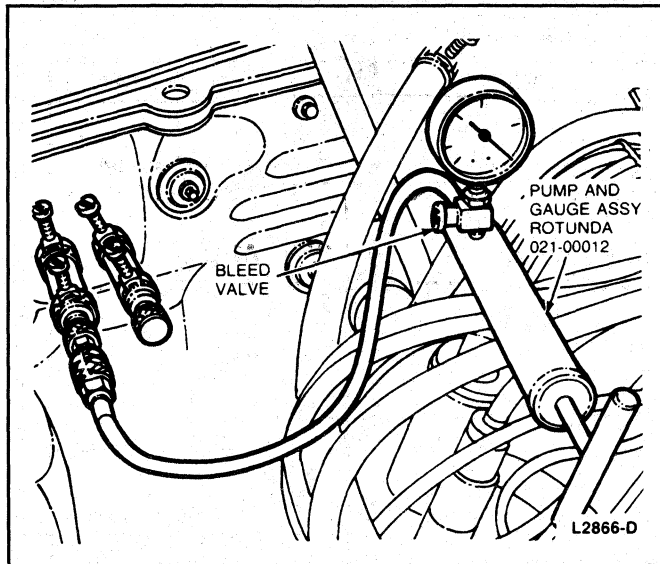
FIG. 11 Rotunda Pressure Tester 021-00012 with Heater Hose and Clamps

2. Connect 101mm (4-inch) test hoses with plug and adapter to core tubes. Then, connect air pump and gauge assembly to adapter (Fig. 13).
3. Apply 207 kPa (30 psi) of air pressure to heater core with Rotunda Pressure Tester, 021-00012 or equivalent, and submerge core in water.
4. If a leak is observed, service or replace heater core, as necessary.

## ADJUSTMENTS

### Temperature Control Cable

The temperature control cable is self-adjusting when the temperature control knob is rotated rapidly in a clockwise direction (toward its maximum WARM setting). To prevent kinking of the control cable wire, a preset adjustment should be made before attempting to perform the self-adjustment operation. The preset adjustment may be performed either in the vehicle with the cable installed, or before installation.



**FIG. 12 Rotunda Pressure Tester 021-00012 Installed for Pressure Test**

### Cable Preset and Self Adjustment

#### Before Installation

1. Insert blade of a small pocket screwdriver into wire end loop (crank arm end) of control cable (Fig. 6).
2. Grip self-adjusting clip with pliers and slide it down control wire (away from end loop) approximately 25.4mm (1-inch).
3. Install cable assembly. Refer to Control Assembly Removal and Installation.
4. Rapidly rotate control knob to extreme right (WARM). Position self-adjusting clip.
5. Check for proper control operation.

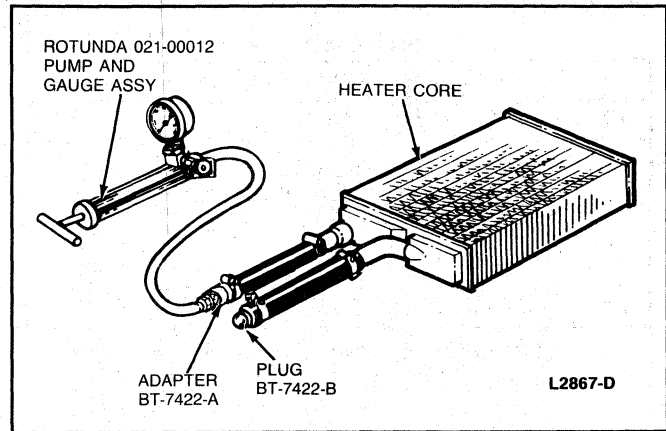
#### After Installation

1. Rotate control knob to COOL (counterclockwise) position.
2. Hold crank arm firmly in position, insert blade of a small pocket screwdriver into wire loops (Fig. 6), and pull cable wire through self-adjusting clip until there is a space of approximately 25.4mm (1-inch) between clip and wire end loop.
3. Rapidly rotate control knob in a clockwise direction (toward full COOL position). Position self-adjusting clip.
4. Check for proper control operation.

### Mini-Tube Vacuum Hoses

#### Service

1. Measure length of damaged area of mini-tube vacuum hose.
2. Cut a piece of standard 3mm (1/8-inch) ID vacuum hose approximately 25mm (1-inch) longer than damaged area of mini-tube vacuum hose.
3. Cut off mini-tube vacuum hose on each side of damaged area.
4. Dip mini-tube hose ends in Tetra Hydro Furan (THF) or Methyl Ethyl Ketone (MEK). This solvent will seal mini-tube in vacuum hose.



**FIG. 13 Heater Core Bench Test**

5. Insert ends of mini-tube vacuum hose (Fig. 7) approximately 9mm (3/8 inch) into ends of standard 3mm (1/8-inch) service vacuum hose section.
6. Shake service joint after assembly to ensure solvent is dispersed and vacuum line is not plugged.
7. Test system for a vacuum leak in service area.

### REMOVAL AND INSTALLATION

#### Instrument Panel

##### Taurus

Fig. 14 shows the Taurus instrument panel assembly and identifies the components which are visible when viewing the panel from the front.

#### Removal

1. Disconnect battery ground cable.
2. Remove two upper and two lower screws which attach steering column opening cover to instrument panel (Fig. 15). Remove cover.
3. Remove round insulator in cowl area.
4. Remove steering column trim shrouds. Disconnect all electrical connections from steering column switches.
5. Remove four screws at steering column bracket. Lower steering column.
6. Remove lower LH radio finish panels by removing one screw from each panel. Snap each out of position in the instrument panel (Fig. 16).
7. Remove seven cluster opening finish panel retaining screws, one jam nut behind headlamp switch knob, and one screw behind clock (or clock cover). Release finish panel by rocking its upper edge toward driver's position (Figs. 17 and 18).
8. Swing fuse panel downward to provide access to speedometer cable. Press on flat surface of cable's plastic connector to disconnect cable.
9. The panel can now be removed with cluster attached.
10. Using steering column, cluster and glove compartment openings for access, reach under instrument panel and disconnect all electrical connections, vacuum hoses, heater-A/C control cables, and radio antenna cable.
11. Disconnect all under-hood connectors from main wiring harness. Disengage main harness rubber

## HISSING VACUUM SYSTEM OR CONTROL ASSEMBLY SELECTOR VALVE

TEST STEP		RESULT	ACTION TO TAKE
<b>A0</b>	<b>CHECK CONNECTORS</b>		
	<ul style="list-style-type: none"> <li>• Check in-line and control assembly multiple connectors for proper installation.</li> <li>• Listen for hiss.</li> </ul>	Hiss stops Hiss continues	RECHECK system for proper operation. GO to A1.
<b>A1</b>	<b>DETERMINE LEAKING VALVE</b>		
	<ul style="list-style-type: none"> <li>• Move function knob to determine which Selector Valve positions are leaking.</li> </ul>	All leak Some leak but not all	GO to A2. GO to A4.
<b>A2</b>	<b>CHECK SOURCE TUBE</b>		
	<ul style="list-style-type: none"> <li>• Check vacuum source tube (black) from reservoir to control assembly for cut or disconnection.</li> <li>• Listen for hiss.</li> </ul>	Hiss stops Hiss continues	SERVICE tube. RECHECK system for proper operation. GO to A3.
<b>A3</b>	<b>PINCH OFF SOURCE TUBE</b>		
	<ul style="list-style-type: none"> <li>• Pinch off source tube (black) at control assembly.</li> <li>• Listen for hiss.</li> </ul>	Hiss stops Hiss continues	REPLACE selector valve. RECHECK system for proper operation. RECHECK source tube (black), connections, reservoir and check valve. SERVICE or REPLACE as required.
<b>A4</b>	<b>DETERMINE LEAKING TUBE(S)</b>		
	<ul style="list-style-type: none"> <li>• Determine what color tube(s) are used in leaking function selector valve position(s). (Refer to airflow schematic and vacuum control chart.)</li> <li>• Pinch off suspect tube(s), one at a time, near each respective vacuum motor.</li> <li>• Listen for hiss.</li> </ul>	Hiss stops Hiss continues	CHECK tube connection to vacuum motor and SERVICE and/or RECONNECT if loose or split. RECHECK for hiss. If hiss still continues, REPLACE vacuum motor.* RECHECK system for proper operation. GO to A5.
<b>A5</b>	<b>PINCH OFF SUSPECT TUBE(S)</b>		
	<ul style="list-style-type: none"> <li>• Pinch off suspect tube(s), one at a time, near control assembly and/or in-line connector.</li> <li>• Listen for hiss.</li> </ul>	Hiss stops Hiss continues	CHECK tube for cut or damage. SERVICE if required. RECHECK system for proper operation. REPLACE function vacuum selector valve.

\*Never manually operate any vacuum motor or vacuum motor controlled door — this may cause internal damage to the vacuum motor diaphragm.

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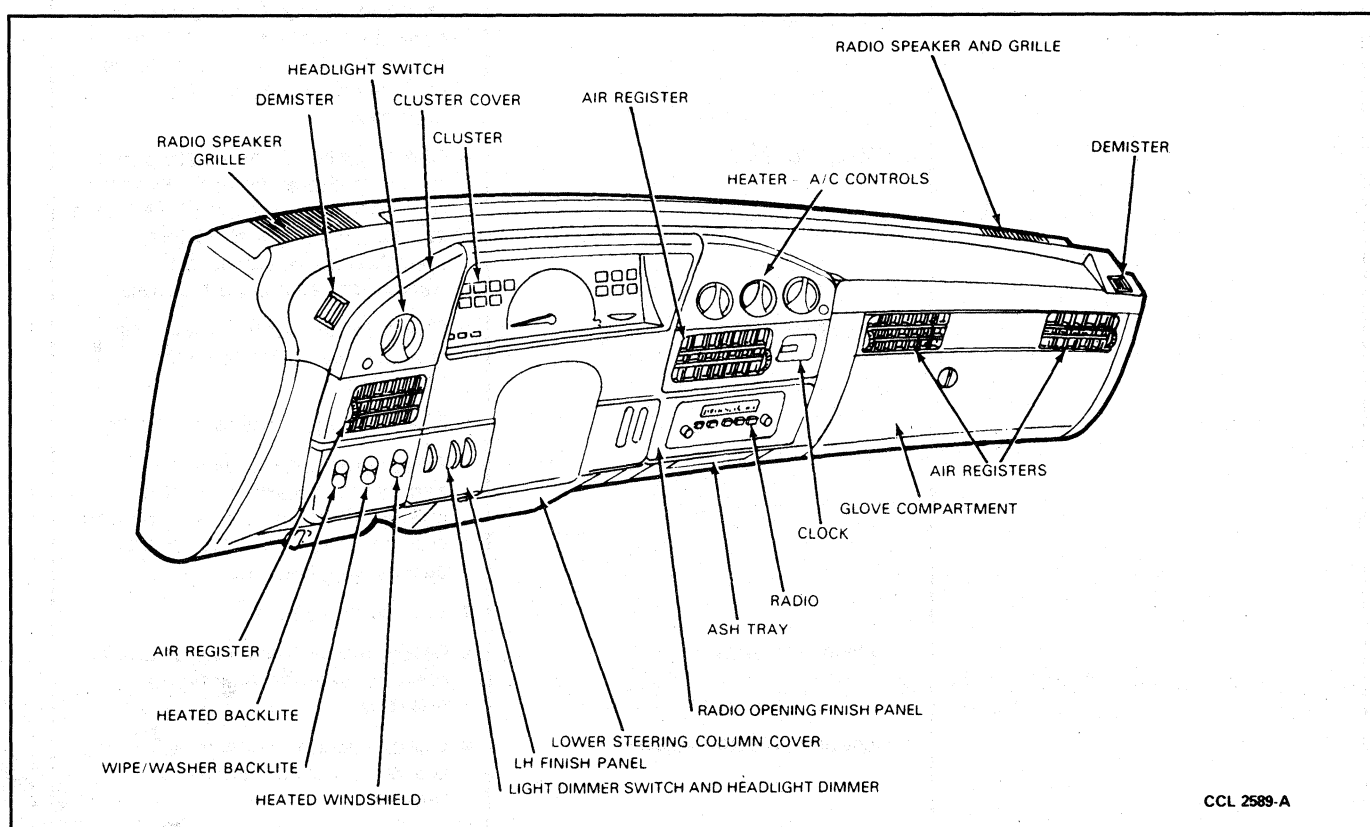
CONDITION	POSSIBLE SOURCE	ACTION
<ul style="list-style-type: none"> <li>Insufficient, erratic, or no heat or defrost.</li> </ul>	<ul style="list-style-type: none"> <li>Low radiator coolant due to:               <ul style="list-style-type: none"> <li>Coolant leaks</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>Check radiator cap pressure. Replace if below minimum pressure.</li> <li>Fill to level. Pressure test for engine cooling system and heater system leaks. Service as required.</li> </ul>
	<ul style="list-style-type: none"> <li>Engine overheating</li> </ul>	<ul style="list-style-type: none"> <li>Remove bugs, leaves, etc. from radiator or condenser fins.</li> <li>Check for:               <ul style="list-style-type: none"> <li>Loose fan belt</li> <li>Sticking thermostat</li> <li>Incorrect ignition timing</li> <li>Water pump impeller damage</li> <li>Restricted cooling system</li> </ul> </li> <li>Leaks in cooling system</li> <li>Service as required.</li> </ul>
	<ul style="list-style-type: none"> <li>Loose fan belt</li> <li>Thermostat</li> </ul>	<ul style="list-style-type: none"> <li>Replace if cracked or worn and/or adjust belt tension.</li> <li>Check coolant temperature at radiator filler neck. If under 170°F, check thermostat. Refer to Powertrain manual, Group 27 for complete testing.</li> </ul>
	<ul style="list-style-type: none"> <li>Plugged or partially plugged heater core</li> </ul>	<ul style="list-style-type: none"> <li>Clean and backflush engine cooling system and heater core.</li> </ul>
	<ul style="list-style-type: none"> <li>Loose or improperly adjusted control cables</li> </ul>	<ul style="list-style-type: none"> <li>Adjust to specifications.</li> </ul>
	<ul style="list-style-type: none"> <li>Vacuum hoses crossed, collapsed, or linked (if applicable)</li> </ul>	<ul style="list-style-type: none"> <li>Check to see if door vacuum motors respond properly to movements of the Functional Selector Lever and the Temperature Control Knob. Visually check vacuum hoses, and service as required.</li> </ul>
	<ul style="list-style-type: none"> <li>Airflow control doors sticking or binding</li> </ul>	<ul style="list-style-type: none"> <li>Check to see if door vacuum motors or cable operated blend door respond properly to movements of Functional and Temperature Control Knobs. If hesitation in movement is noticed, disconnect vacuum motor arm or cable from door crank arm, and move crank arm by hand. Service sticking or binding door as required.</li> </ul>
	<ul style="list-style-type: none"> <li>Vacuum motor or hose leaks (if applicable)</li> </ul>	<ul style="list-style-type: none"> <li>Disconnect multiple vacuum connector from back of Control Assembly, and check each connector opening with hand operated vacuum pump. If one line leaks vacuum, test motor by itself before replacing (Be careful of vacuum hoses that operate two motors at same time.) Service vacuum hose(s), or replace vacuum motor as required.</li> </ul>

CONDITION	POSSIBLE SOURCE	RESOLUTION
<ul style="list-style-type: none"> <li>• Air comes out of defroster outlet in any function selector lever position.</li> </ul>	<ul style="list-style-type: none"> <li>• Vacuum system (indicates a very bad leak)</li> </ul>	<ul style="list-style-type: none"> <li>• Listen for vacuum system leak. Look for disconnected vacuum hose connector. Use hand-operated vacuum pump, and check vacuum motors for diaphragm leak. Also check for leaking vacuum selector valve on control assembly, check valve, and leaking vacuum reservoir tank. Service hoses, or replace components as required.</li> </ul>
<ul style="list-style-type: none"> <li>• Blower does not operate properly.</li> </ul>	<ul style="list-style-type: none"> <li>• Blower motor</li> <li>• Blower resistor</li> <li>• Blower wire harness</li> <li>• Blower switch(s)</li> <li>• Vacuum Selector Valve</li> </ul>	<ul style="list-style-type: none"> <li>• Run a No. 10 gauge jumper wire directly from the (grounded) negative battery terminal to the negative lead (black wire) of the blower motor. If the motor runs the problem must be external to the motor. If the motor will not run, check the ground connection for good electrical contact. If this connection is good, the motor is inoperative and should be replaced.</li> <li>• Check continuity of resistors for opens or check thermal limiter for continuity, if so equipped. (A blown thermal limiter will allow motor operation on Hi blower only). Service or replace as required.</li> <li>• Check for proper installation of harness connector terminal connectors.</li> <li>• Check wire-to-terminal continuity.</li> <li>• Check continuity of wires in harness for shorts (a short to ground will cause motor to operate with no control over the motor), opens, abrasion, etc.</li> <li>• Service as required.</li> <li>• Check blower switch(s) for proper contact. Replace switch(s) as required.</li> <li>• Check vacuum selector valve for proper contacts. Replace if required.</li> </ul>

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CONDITION	POSSIBLE SOURCE	ACTION
<ul style="list-style-type: none"> <li>● Airflow changes direction when vehicle is accelerated.</li> </ul>	<ul style="list-style-type: none"> <li>● Vacuum system leak (if applicable)</li> </ul>	<ul style="list-style-type: none"> <li>● Check vacuum system with hand vacuum pump from control head connector. Service tubing, or replace damaged components as required.</li> </ul>
<ul style="list-style-type: none"> <li>● Insufficient, erratic, or no heat or defrost.</li> </ul>	<ul style="list-style-type: none"> <li>● Kinked, clogged, collapsed, soft, swollen, or decomposed engine cooling system or heater system hoses</li> <li>● Blocked air inlet</li> </ul>	<ul style="list-style-type: none"> <li>● Replace damaged hoses and backflush engine cooling system. Then back flush heater system, until all particles have been removed.</li> <li>● Check cowl air inlet for leaves, foreign material, etc. Remove as required.</li> </ul>

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FIG. 14 Taurus Instrument Panel

grommet from dash panel. Feed harness and its connector halves from engine compartment through grommet hole into instrument panel area.

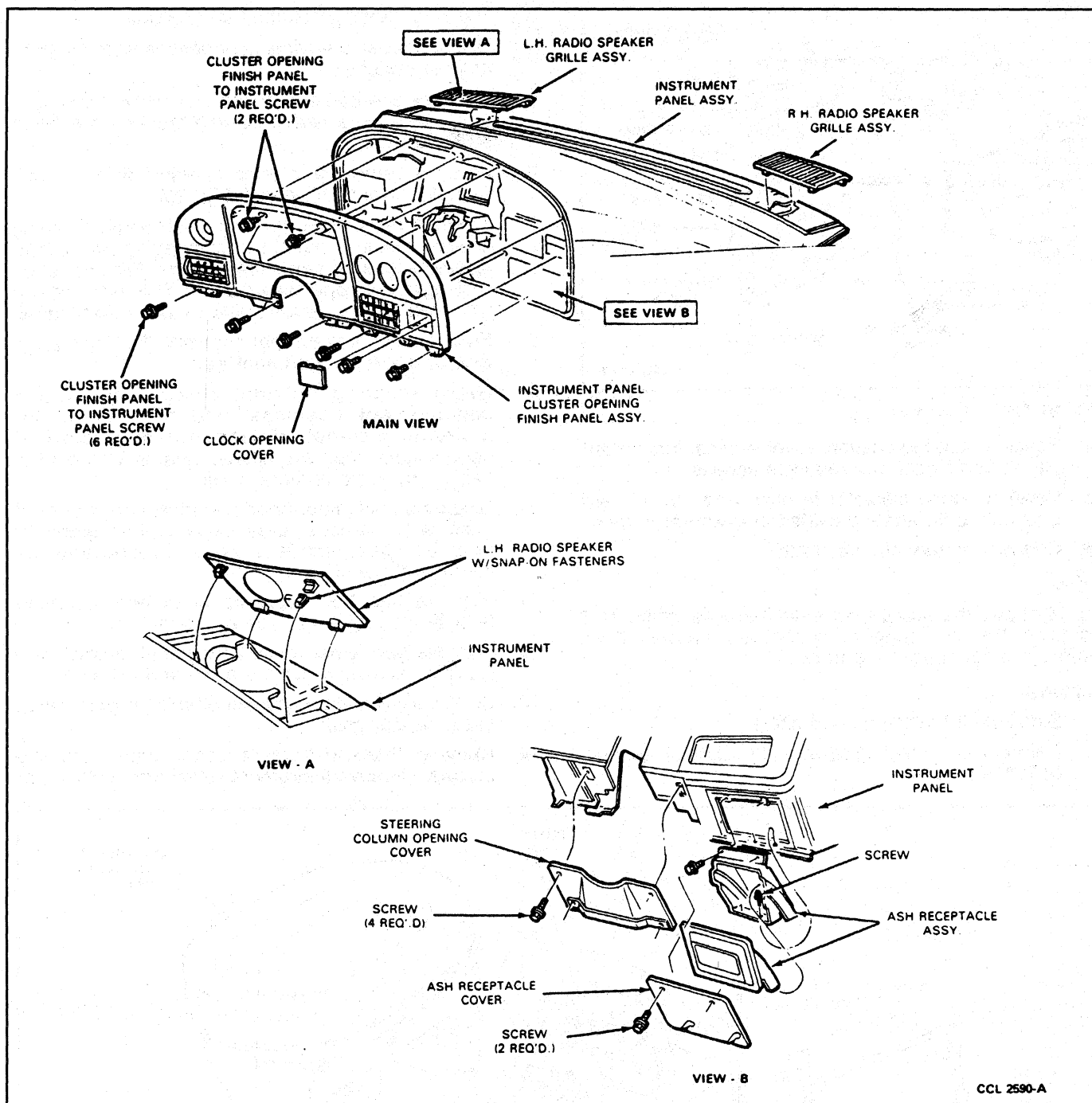
12. Remove two lower instrument panel-to-cowl side retaining screws from both RH and LH sides of panel.
13. Remove two instrument panel brace retaining screws located near underside of radio.
14. Snap out RH and LH speaker opening covers.
15. Remove instrument panel upper retaining screws. Remove instrument panel from vehicle.
16. If instrument panel replacement is required, transfer all attaching components to new instrument panel,

including heater or air conditioning switches, main harness and glove compartment door.

#### Installation

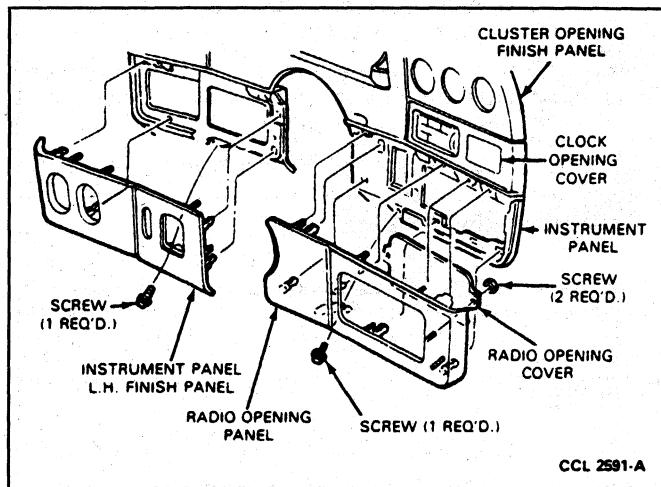
1. Feed instrument panel wiring harness and connectors through dash panel and into engine compartment.
2. Install grommet for harness into hole in dash panel.
3. Connect speedometer cable to speedometer head.
4. Position instrument panel with its locating pin inserted into mating hole provided in cowl top. Install three upper panel retaining screws. Tighten to 1.4-2.3 N·m (12-20 lb-in).





**FIG. 15 Taurus Instrument Panel—Disassembled View**

5. Install two lower instrument panel-to-side cowl retaining screws. Tighten to 7-11 N·m (5-8 lb-ft).
6. Install instrument panel brace located under radio. Tighten attachments to 7-11 N·m (5-8 lb-ft).
7. From inside engine compartment, connect instrument panel wiring connectors to their mating connectors in engine compartment wiring.
8. Working through openings for instrument cluster, steering column, and glove compartment, connect all electrical connections, vacuum hoses, heater control cable, A/C control cable, and radio antenna cable.
9. Position instrument cluster finish panel into opening and install eight retaining screws. Tighten to 2.0-2.9 N·m (18-26 lb-in).
10. Install clock or clock cover plate.
11. Snap LH radio applique into position. Install one retaining screw. Tighten to 2.0-2.9 N·m (18-26 lb-in).
12. Raise steering column and install four screws securing column to its support bracket.
13. Complete all electrical connections to steering column switches. Install steering column trim shrouds.



**FIG. 16 Radio Finish Panels**

14. Position steering column cover against instrument panel, and install four retaining screws.
15. Position sound insulator in cowl area. Install two pushnuts onto studs provided in evaporator case.
16. Connect battery ground cable.

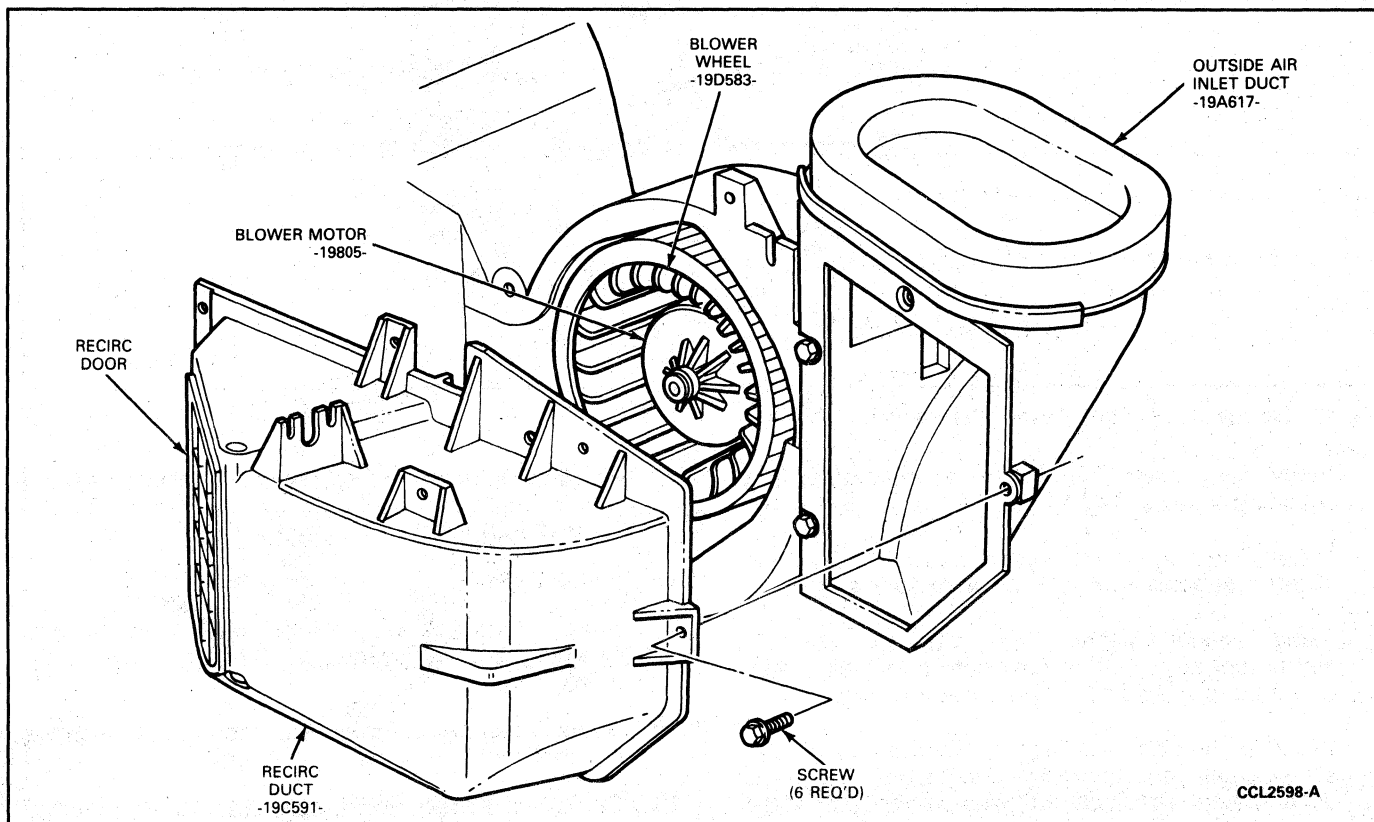
#### Sable

Fig. 19 shows the Sable instrument panel assembly and identifies the components which are visible when viewing the panel from the front.

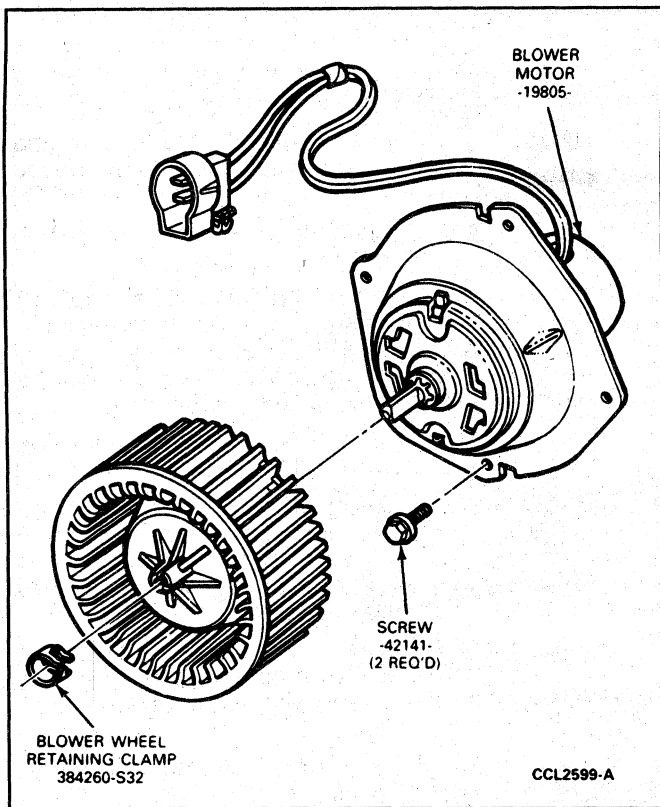
#### Removal

1. Disconnect battery ground cable.
2. Remove four retaining screws at bottom of steering column opening.

3. Remove steering column trim shrouds.
4. Disconnect all electrical connections from steering column switches.
5. Remove one bolt and nut at lock pillar U-joint and four screws at steering column bracket to release steering column.
6. Prior to removing cluster opening finish panel, remove lower finish panel (Fig. 20).
7. Remove five cluster opening finish panel retaining screws. Remove panel by disengaging five hidden retainers located along upper edge. Free panel by rocking upper edge toward driver. The panel can be removed without disassembling cluster from panel.
8. Pivot glove compartment assembly by depressing side of glove compartment tray.
9. Using steering column, cluster, and glove compartment openings, and reaching under instrument panel, disconnect all electrical connections, vacuum hoses, heater-A/C control cable, and radio antenna cable.
10. Disconnect all under-hood electrical connectors of main wire harness. Disengage rubber grommet from dash panel and feed wire and connectors into instrument panel area.
11. Remove one bolt attaching instrument panel to floor brace above LH side of tunnel.
12. Remove two lower instrument panel-to-cowl side retaining screws at both the RH and LH side.
13. Snap out RH and LH speaker opening covers. Snap out defroster grille.
14. Remove three instrument panel upper retaining screws. Remove instrument panel from vehicle, or



**FIG. 17 Recirc Duct-to-Heater Assembly Attachment**



**FIG. 18 Blower Motor and Motor Mounting Plate**

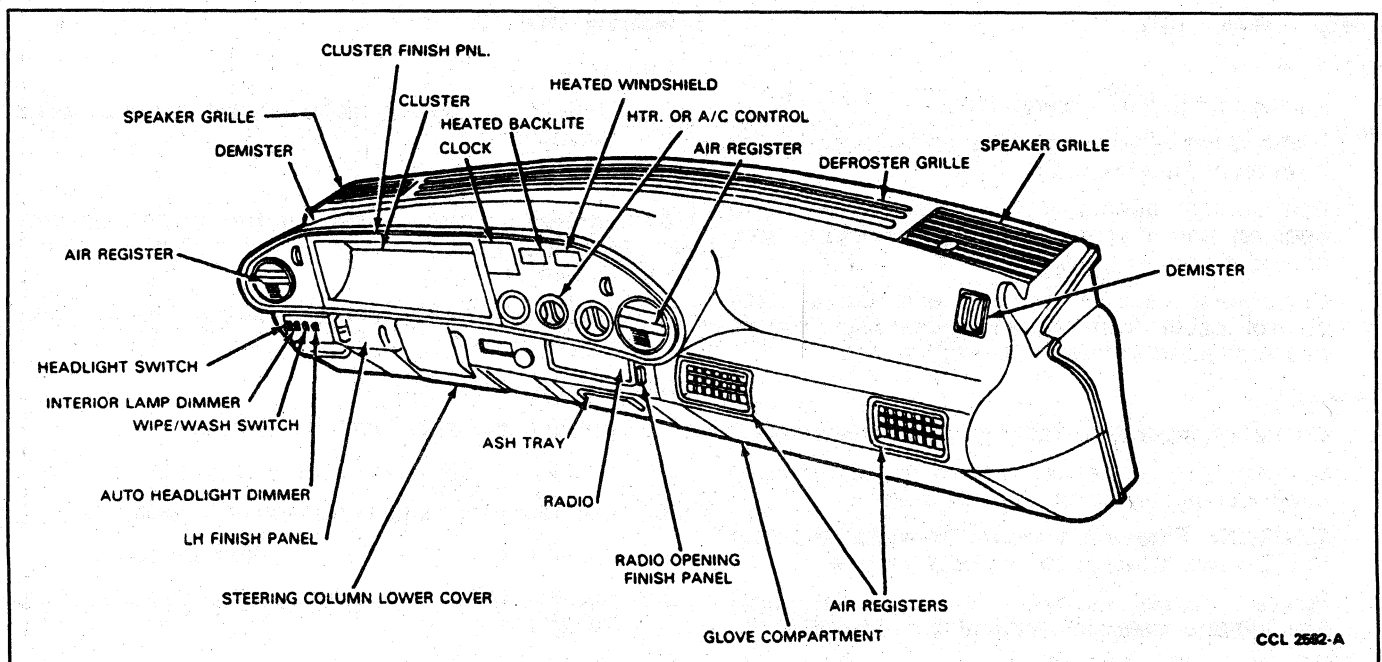
place it on front seat if removal was performed to gain accessibility.

15. If instrument panel replacement is required, transfer all attaching components to new instrument panel, including heater or air conditioner ducts, switches, main harness and glove compartment door.

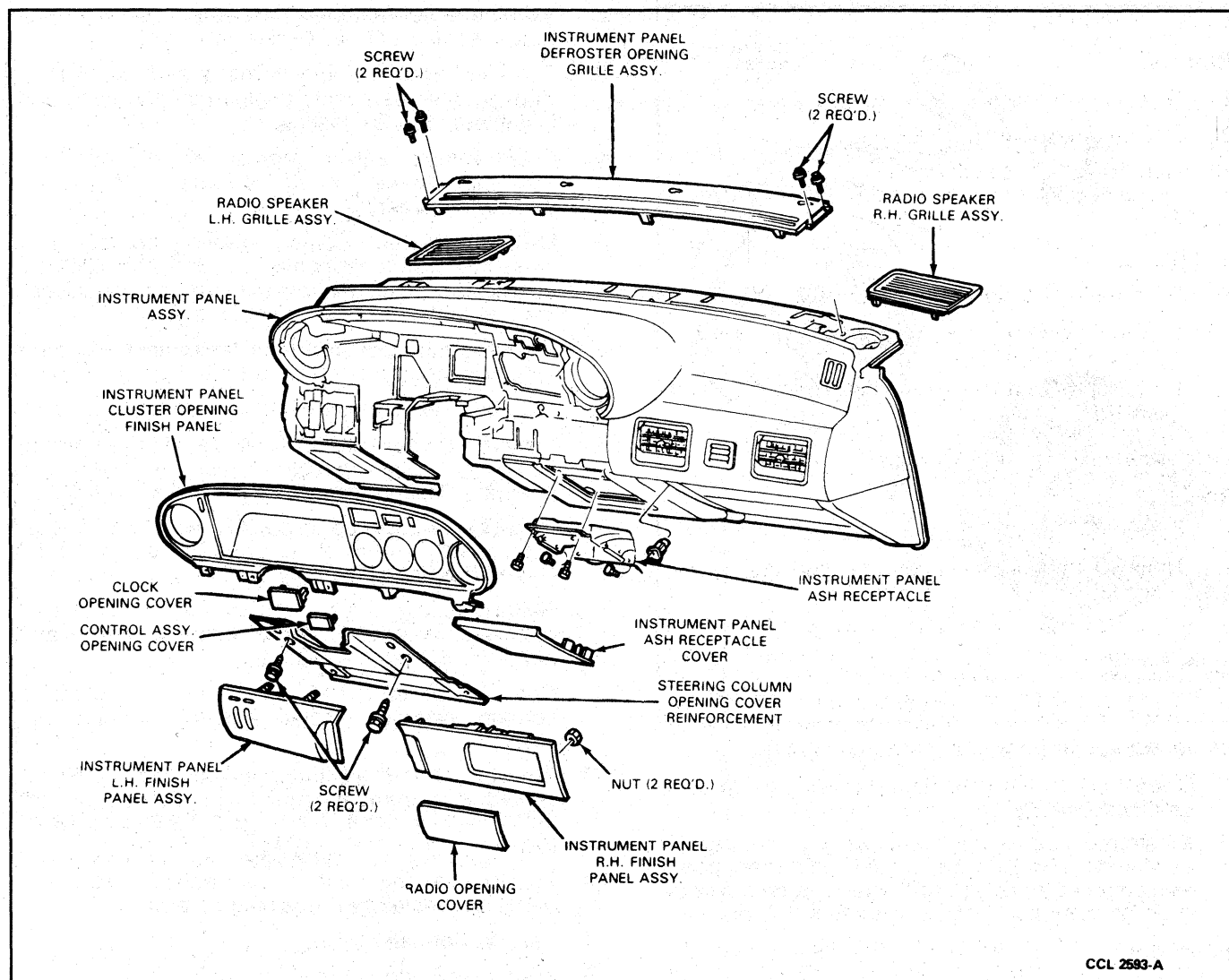
#### Installation

1. Install two lower instrument panel-to-side cowl retaining screws. Tighten to 7-11 N·m (5-8 lb-ft).

2. Install one bolt attaching instrument panel to floor brace located above LH side of tunnel.
3. Feed instrument wiring harness and connectors through dash panel into engine compartment, and install grommet in dash panel.
4. From inside engine compartment, connect instrument panel wiring connectors to engine compartment wiring.
5. Using instrument cluster, steering column, and glove compartment openings, connect all electrical connections, vacuum hoses, heater-air conditioner control cables, and radio antenna cable.
6. Install glove compartment assembly. Tighten attachments to 2.0-2.6 N·m (18-23 lb-in).
7. Connect speedometer cable to speedometer head.
8. Install instrument cluster finish panel in position to install five retaining screws. Engage five upper retainers. Tighten screws to 7-11 N·m (5-8 lb-ft).
9. Install radio applique in position with two retainer clips and two retaining screws. Tighten to 2.0-2.7 N·m (18-23 lb-in).
10. Raise steering column into position. Install four retaining screws at support bracket and one nut and bolt at locking collar U-joint.
11. Connect all electrical connections to steering column switches. Install steering column trim shrouds.
12. Position sound insulator. Install two retaining screws at instrument panel. Push retaining pin into brake pedal support. Tighten to 2.0-2.6 N·m (18-23 lb-in).
13. Position steering column cover against instrument panel and install four retaining screws.
14. Snap in defroster grille.
15. Snap in RH and LH radio speaker grilles.
16. Connect battery ground cable.



**FIG. 19 Sable Instrument Panel Assembly**



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FIG. 20 Sable Instrument Panel—Disassembled View

## Control Assembly

### Removal

1. Disconnect battery ground cable.
2. Remove four screws attaching control assembly to instrument panel (Fig. 2).
3. Pull control assembly from instrument panel opening and disconnect wire connectors from control assembly.
4. Disconnect vacuum harness and temperature control cable from control assembly. Discard pushnuts used to retain vacuum harness.

### Installation

1. Connect temperature cable to control assembly.
2. Connect wire connectors and vacuum harness to control assembly using new pushnuts.

**CAUTION: Push on vacuum harness retaining nut. Do not attempt to screw onto post.**

3. Position control assembly to instrument panel opening and install four attaching screws (Fig. 2).
4. Connect battery ground cable.
5. Check system for proper operation.

## Blower Switch

### Removal

1. Remove control assembly from instrument panel as outlined.
2. Remove switch knob.
3. Remove screw (from underside of control assembly) which attaches the switch to control assembly.
4. Disconnect wire connectors from switch and remove switch.

### Installation

1. Position switch on control assembly.
2. Install screw to attach switch to control assembly.
3. Connect wire harness connector to switch.
4. Install control assembly in instrument panel.
5. Place switch knob on switch shaft and push knob all the way on.
6. Connect battery ground cable.
7. Check system for proper operation.

## Vacuum Selector Switch

### Removal

1. Remove control assembly from vehicle.
2. Pull knob off function selector shaft.
3. Remove screw attaching vacuum switch to control assembly, and remove vacuum selector switch (Fig. 2).

### Installation

1. Rotate function selector shaft to OFF position.
2. Position vacuum selector switch on control assembly bracket.
3. Install screw attaching vacuum switch to control assembly.

## Temperature Control Cable

### Removal

1. Disconnect battery ground cable.
2. Remove instrument cluster opening finish panel as outlined.
3. Rotate temperature control knob to COOL position and disconnect the temperature control cable housing end retainer from heater case bracket using Heater Control Cable Disconnect Tool T83P-18532-AH (Fig. 21). Disconnect cable wire from temperature door crank arm.
4. Remove four screws attaching control assembly to instrument panel and pull control assembly away from instrument panel.
5. Disconnect cable housing end retainer from control assembly (Fig. 21) and cable wire from temperature control lever arm.
6. Remove cable assembly from vehicle through control assembly opening in instrument panel, using care not to hook or damage wiring or other cables.

### Installation

1. Position self-adjusting clip on control cable.
2. Insert cable through control assembly opening of instrument panel and over LH duct to LH side of evaporator case.
3. Rotate temperature control knob to COOL position.
4. Insert cable wire end into hole in temperature control arm. Connect cable and retainer to control assembly.
5. Position control assembly to instrument panel opening and install four attaching screws.
6. Slide cable housing and retainer into heater case cable bracket and push to secure cable housing to bracket.
7. Connect self-adjusting clip at temperature cable to temperature door crank arm.
8. Connect battery ground cable.

## Louver Assembly, Rectangular

### Removal and Installation

1. Insert a flat-blade screwdriver under retaining tab and pry it toward louvers until retaining tab pivot clears hole in register opening (Fig. 22).

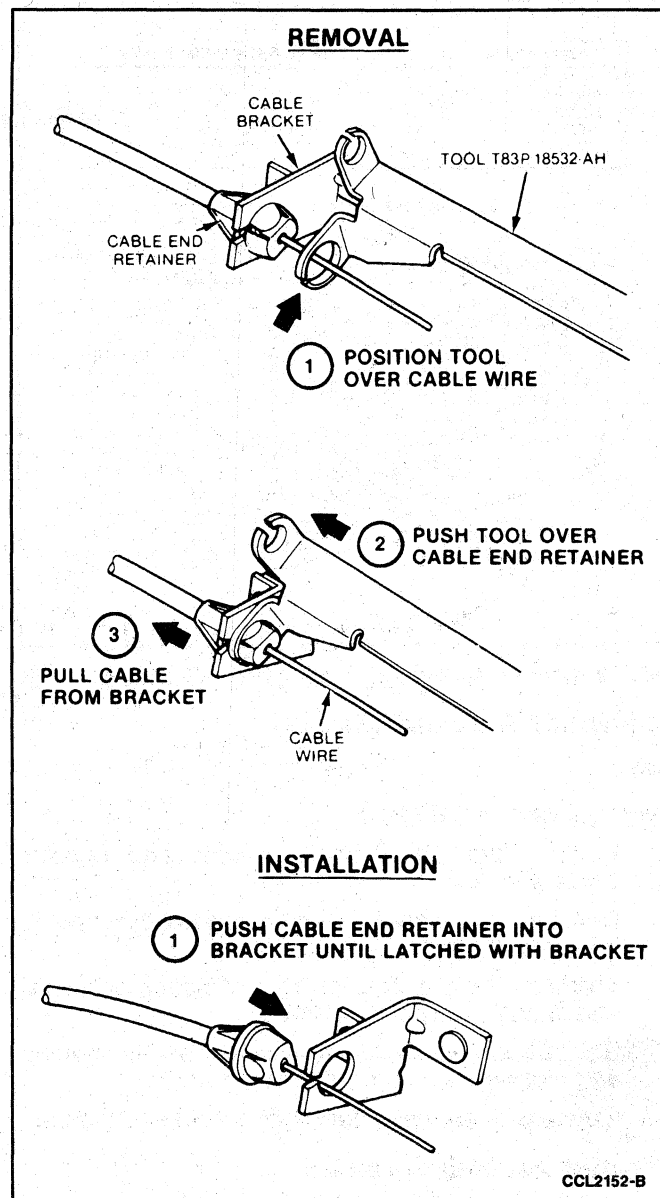


FIG. 21 Control Cable End Retainer Attachment

2. Pull louver assembly out from housing, only far enough to prevent pivot from going back into pivot hole.
3. Repeat Step 1 for second retaining tab. Remove louver assembly from opening.
4. To install louver assembly, depress retaining tabs, push assembly into opening, and engage retaining tab pivots in pivot holes.

## Register Housing Assembly, Rectangular

### Sable

### Removal and Installation

1. Remove louver assembly (Fig. 22).
2. Depress retaining tabs in upper surface of housing and pull out of opening in instrument panel.
3. To install housing reverse Steps 1 and 2.

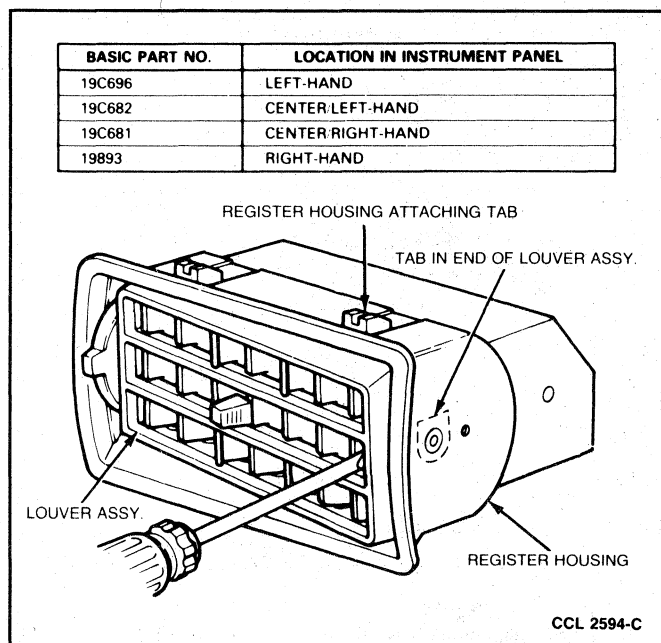


FIG. 22 Louver Assembly, Rectangular—Removal

**Connector Assembly, Round****Sable****Removal and Installation**

1. Remove plenum, defroster nozzle and register ducts (Fig. 23).
2. Remove two screws retaining register housing to instrument panel.
3. To install housing, position against instrument panel and install two retaining screws.
4. Rotate knob on housing to ensure that it is opening and closing air shut-off door properly.
5. Install register ducts, defroster nozzle and plenum.

**Register Assembly, Round****Removal and Installation**

1. Remove instrument panel applique (Fig. 23).
2. Remove retaining ring from housing.
3. Pull register assembly from opening.
4. To install register, back it into opening in housing.
5. Install retaining ring.
6. Install applique on instrument panel.

**Heater Case Assembly****Removal**

Refer to Fig. 24.

1. Disconnect battery ground cable.
2. Drain coolant from radiator into a clean container.
3. Disconnect heater hoses from heater core. Plug heater core tubes or blow any coolant from heater core with low-pressure air.
4. Disconnect vacuum supply hose from in-line vacuum check valve in engine compartment.
5. Remove instrument panel as outlined.

6. Remove screw holding instrument panel shake brace to heater case. Remove instrument panel shake brace.
7. Remove floor register (or rear seat adapter) attached by two screws to bottom of heater case (Fig. 24, View B).
8. Remove three nuts attaching heater case to dash panel in engine compartment (Fig. 24).
9. Remove two screws attaching brackets to cowl top panel (Fig. 24 View A).
10. Carefully pull heater assembly away from dash panel and remove heater from vehicle.

**Installation**

1. Position heater case assembly to dash panel and cowl top panel at air inlet opening. Install two screws to attach support brackets to cowl top panel.
2. Install three nuts in engine compartment to attach heater case to dash panel.
3. Install floor register and two screws (or rear seat adapter) to heater case.
4. Install instrument panel shake brace and screw to heater case.
5. Install instrument panel as outlined.
6. Connect heater hoses to heater core.
7. Connect black vacuum supply hose to vacuum check valve in engine compartment.
8. Fill radiator to correct level with previously removed coolant or specified mixture of coolant and water.
9. Connect battery ground cable.
10. Check system for proper operation.

**Heater Core****Removal**

1. Remove instrument panel and lay it on front seat.
2. Remove heater case assembly as outlined.
3. Remove vacuum source line from heater core tube seal.
4. Remove seal from heater core tubes (Fig. 24).
5. Remove four heater core access cover attaching screws and remove access cover from heater case (Fig. 25).
6. Lift heater core and seals from heater case.

**Installation**

1. Transfer three foam core seals to new heater core.
2. Install heater core and seals into heater case.
3. Position heater case access cover on heater case. Install four attaching screws.
4. Install seal on heater core tubes.
5. Install vacuum source line through heater core tube seal.
6. Install heater case assembly into vehicle, as outlined.

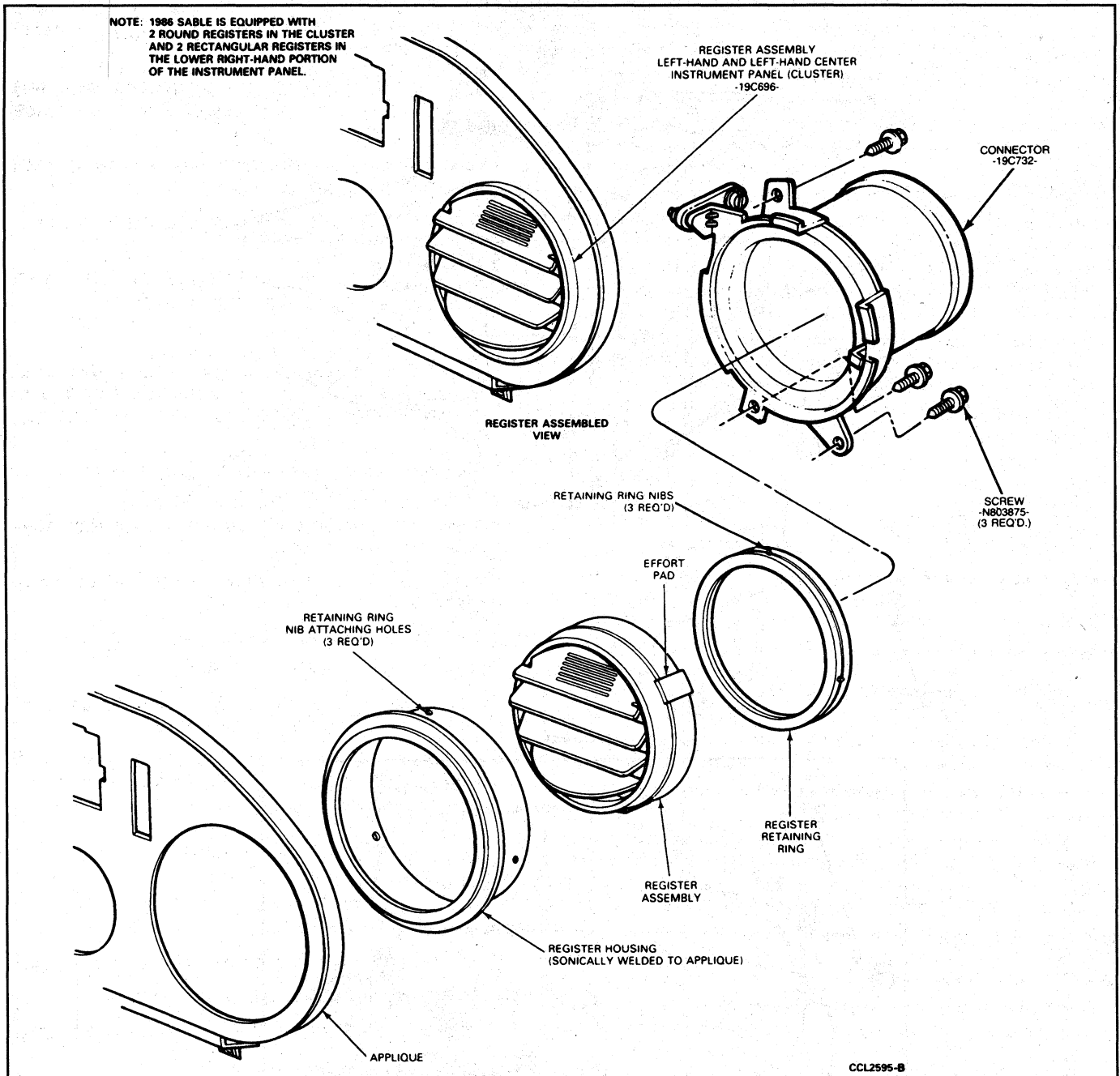


FIG. 23 Register Assembly, Round—Removal

## Recirc Duct Assembly

### Removal

1. Open glove compartment door and release retainers, lowering door.
2. Remove screw attaching recirc duct support bracket to cowl (Fig. 24).
3. Remove vacuum connection to recirc door vacuum motor.
4. Remove six screws attaching recirc duct to heater assembly (Fig. 17).
5. Remove recirc duct from heater assembly, lowering recirc duct from between instrument panel and heater case.

### Installation

1. Install recirc duct to heater, lifting recirc duct between instrument panel and heater case.
2. Install six screws retaining recirc duct to heater case.
3. Install vacuum connector to recirc door vacuum motor.
4. Install screw attaching support bracket to cowl.
5. Close glove compartment.

## Blower Motor and Wheel Assembly

### Removal

Refer to Fig. 18.

1. Remove recirc duct assembly from vehicle.

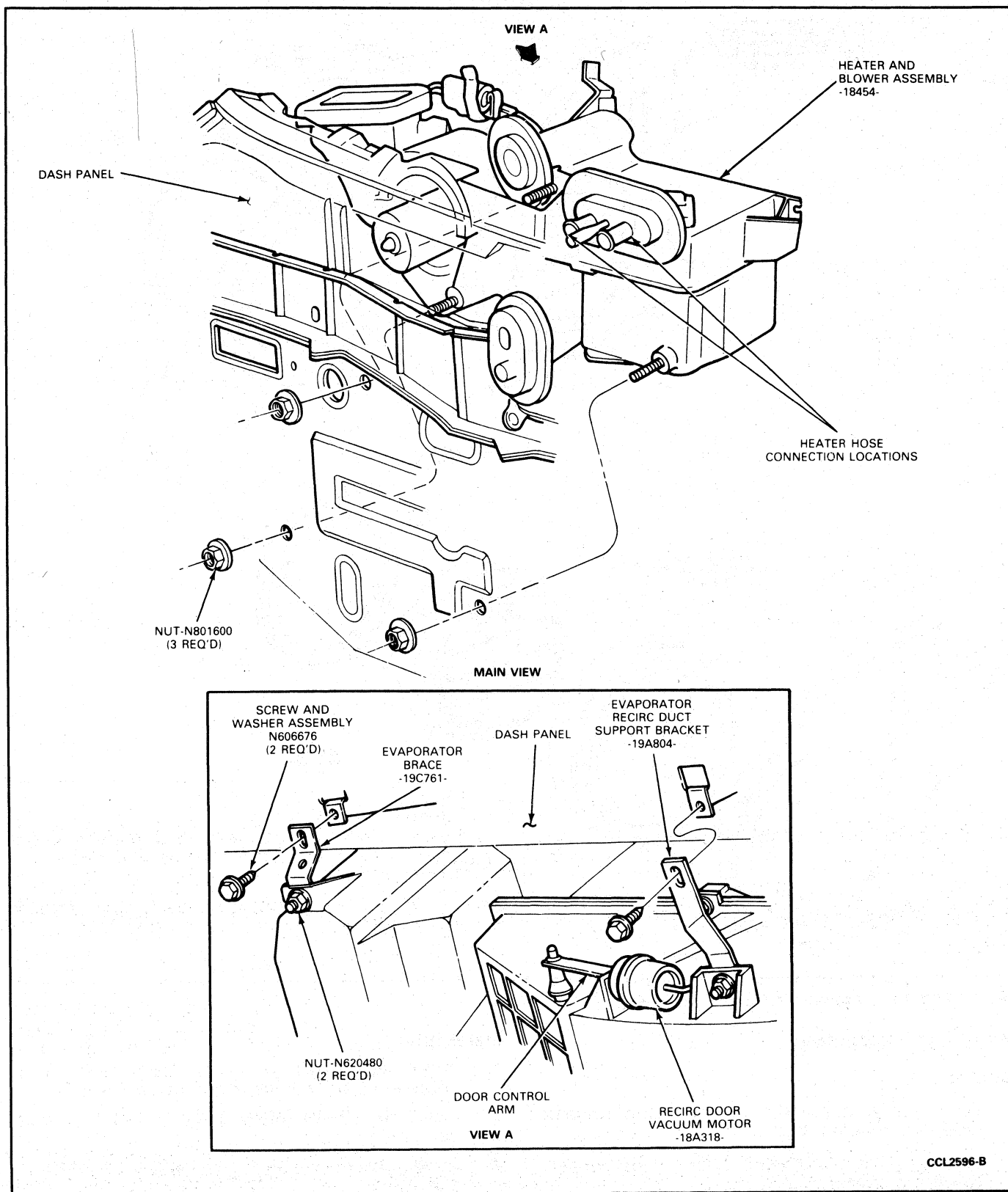
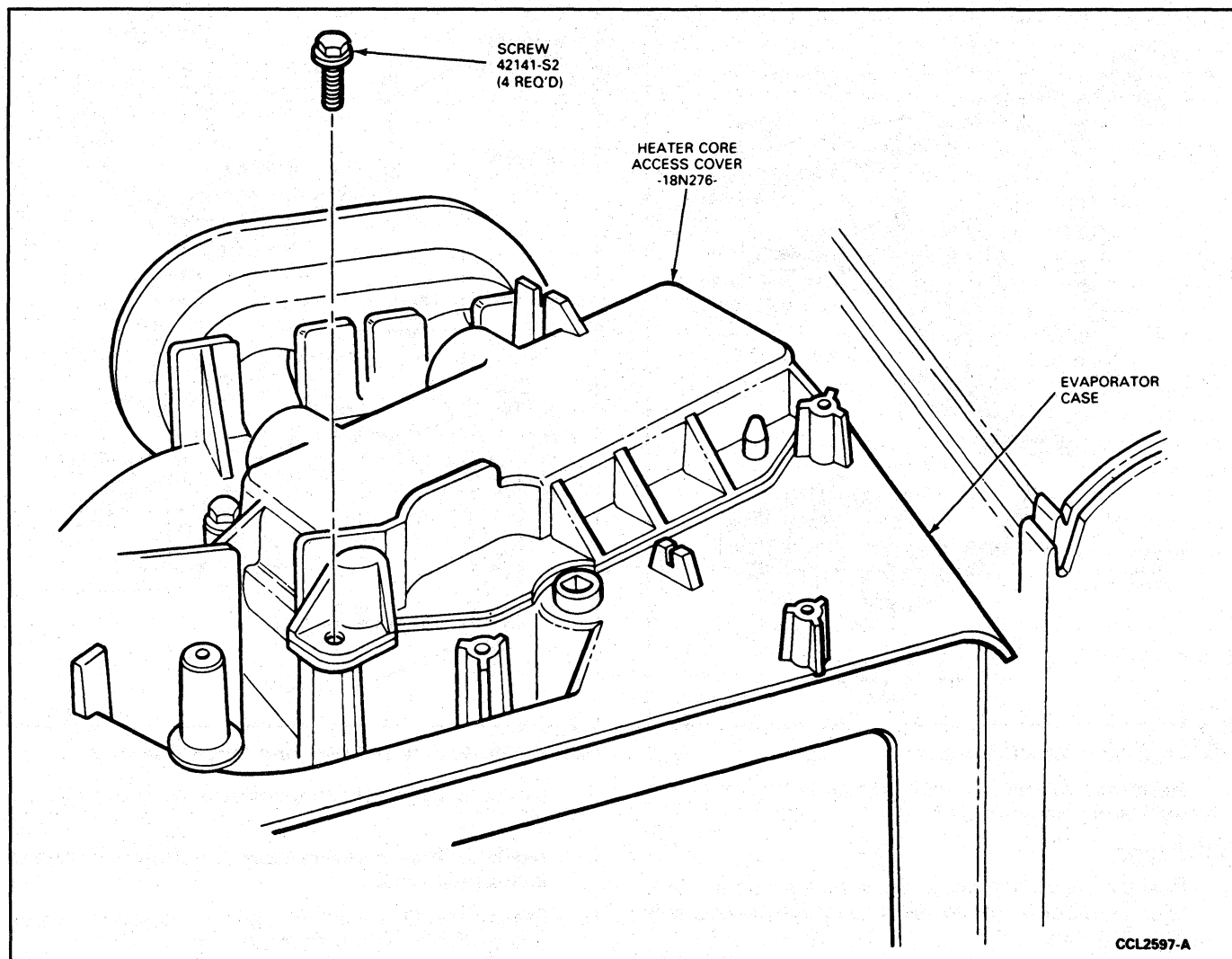


FIG. 24 Heater Case Assembly





**FIG. 25 Heater Core Access Cover Attaching Screws**

2. Disconnect blower electrical lead.
3. Remove blower wheel clip and blower wheel.
4. Remove four blower motor mounting plate screws. Remove blower motor from evaporator case.

#### Installation

1. Assemble blower motor electrical lead through evaporator case.
2. Position blower motor into evaporator. Install four attaching screws.
3. Assemble blower wheel to blower motor shaft and install retaining clip.
4. Connect blower motor electrical lead to wiring harness.
5. Install recirc duct assembly in vehicle.

#### Blower Motor Resistor

##### Removal and Installation

The blower motor resistor and thermal limiter assembly is installed on the passenger side of the heater case behind the glove compartment (Fig. 26). Use only the specified resistor assembly for service replacement. Do not apply sealer to the resistor board mounting surface.

1. Open glove compartment and release glove compartment retainers so that glove compartment hangs down.
2. Disconnect wire harness connector from resistor assembly.
3. Remove two resistor attaching screws and remove resistor from heater case.
4. To install, position resistor assembly in heater case opening and install two attaching screws. Do not apply sealer to resistor assembly mounting surface.
5. Connect wire harness connector to resistor.
6. Check operation of blower motor.
7. Close glove compartment.

#### Outside-Recirc Door Vacuum Motor

##### Removal

1. Lower glove compartment door to provide access to recirc duct assembly.
2. Disconnect vacuum hose from end of vacuum motor.
3. Remove motor arm retainer from door crank arm (Fig. 27).

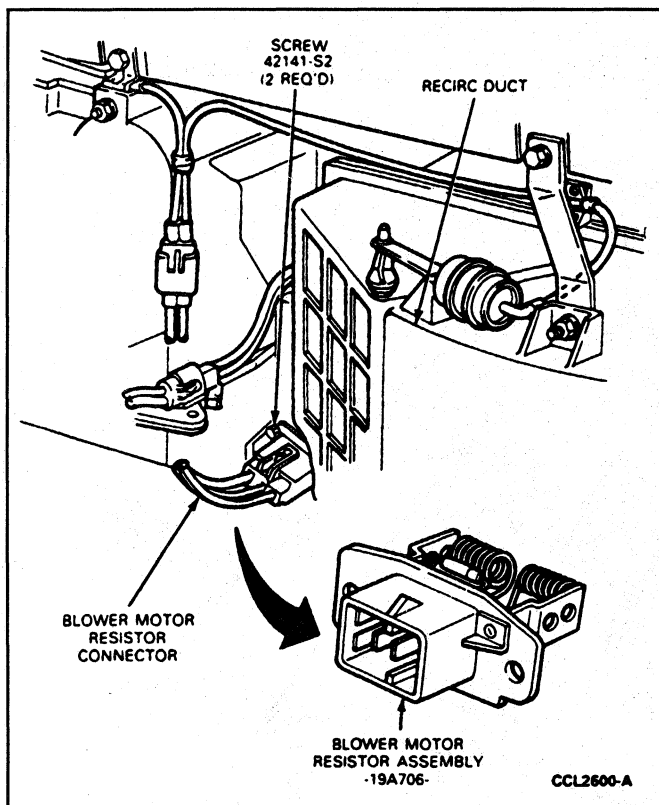


FIG. 26 Blower Motor Resistor

4. Remove two nuts retaining vacuum motor to recirc duct and remove motor.

#### Installation

1. Position vacuum motor to outside-recirc door crank arm. Position motor to recirc duct and install two retaining nuts.
2. Install retainer on door crank arm.
3. Connect white vacuum hose to vacuum motor and check operation of vacuum motor.
4. Lift glove compartment into position.

#### Plenum Chamber

##### Removal and Installation

1. Remove instrument panel. Refer to Section 45-61.
2. Remove two screws retaining plenum to instrument panel (Fig. 28). Remove screw retaining defroster nozzle to plenum (Fig. 29).
3. Disconnect vacuum hose connector retaining defroster nozzle.
4. Disconnect demister hoses.
5. Remove plenum chamber.
6. To install, reverse Steps 1 through 5.

#### Defroster Nozzle

##### Removal and Installation

1. Remove instrument panel. Refer to Section 45-61.
2. Disconnect vacuum hose from retaining tab on upper surface of instrument panel register duct assembly (Fig. 27).
3. Lower plenum chamber by loosening the two screws retaining it to instrument panel.

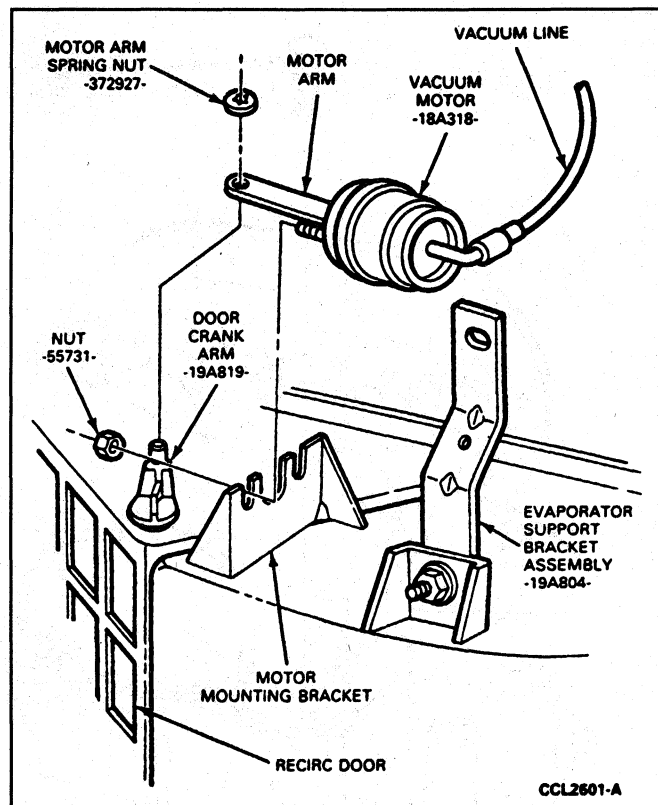


FIG. 27 Motor Arm Retainer and Screw Removal

4. Remove screw retaining defroster nozzle to plenum (Fig. 27).
5. Remove three screws retaining defroster nozzle to instrument panel.
6. Disconnect LH demister hose from defroster nozzle and both RH hoses from plenum.
7. To install, reverse Steps 1 through 6.

#### Demisters and Demister Hoses

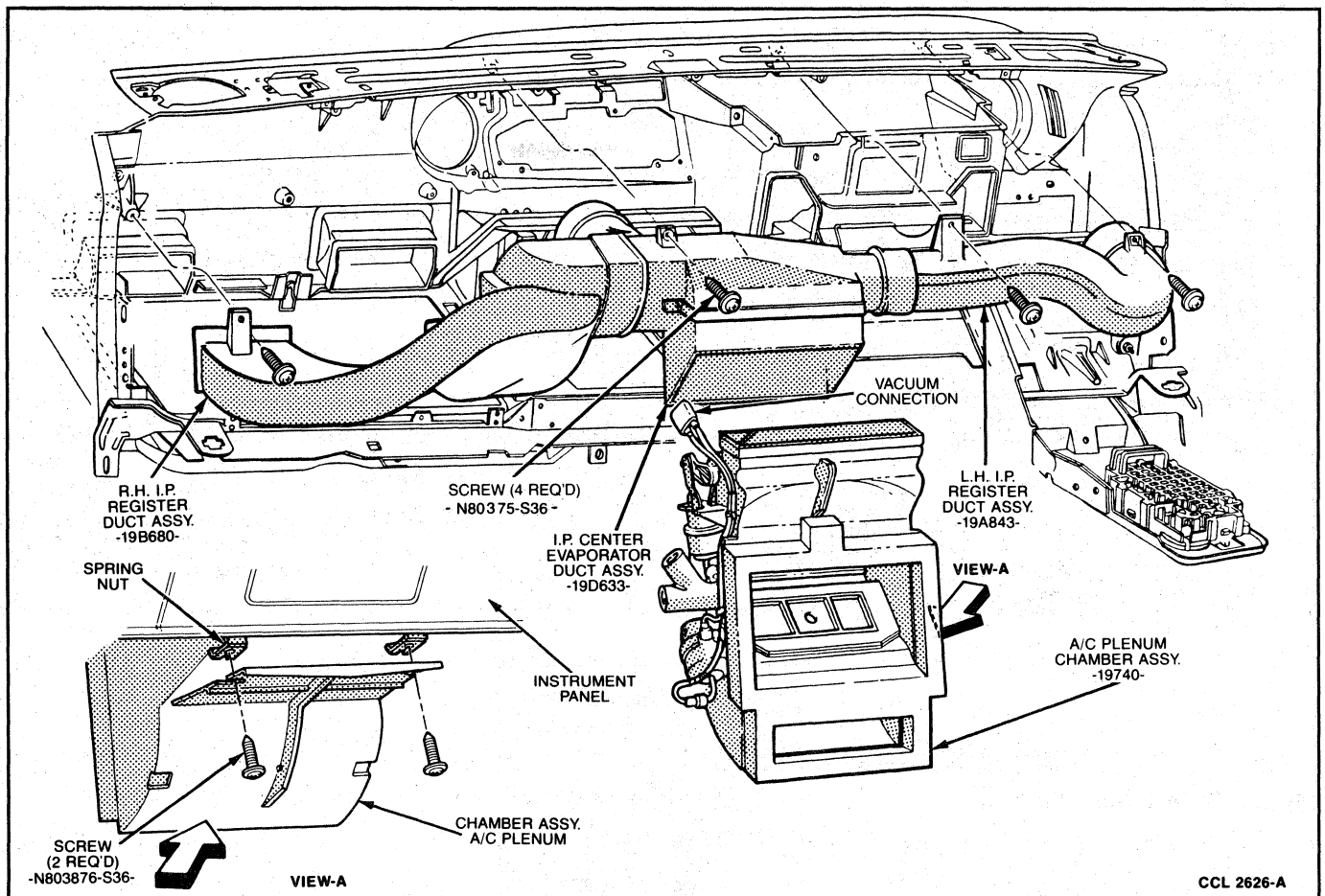
##### Removal

Refer to Fig. 30.

1. Remove instrument panel, resting it against front seat.
2. To remove the demister hose and nozzle assemblies at the instrument panel refer to the following:
  - Taurus: Remove two screws that attach nozzle to instrument panel at LH and RH demister opening, in instrument panel.
  - Sable: Remove two screws to detach demister nozzle from RH end of instrument panel at demister opening.
  - Sable: Remove two screws retaining nozzle to round connector for register on LH side of instrument panel.
3. Remove flexible hoses from plenum chamber demister outlets.

##### Installation

1. Install flexible hoses on plenum chamber demister outlets.



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**FIG. 28 Plenum Chamber**

2. Position demister nozzle over demister registers in instrument panel and install two retaining screws on each side.
3. Install instrument panel.

**Floor Air Distribution Duct****Front Heater****Removal and Installation**

1. Remove two screws attaching duct to evaporator case assembly just below heat distribution duct (Fig. 24).
2. Pull floor air distribution duct away from evaporator case.
3. To install, position duct to evaporator case. Ensure retainer at forward edge of duct is inserted over edge of opening in evaporator case. Install attaching screws.

**Floor Heater System****Removal and Installation**

1. Remove carpet.
2. Remove nut holding rear duct on tunnel (Fig. 31).
3. Remove two screws attaching floor duct to evaporator case assembly.
4. Pull floor duct away from evaporator case assembly.
5. Pull floor duct away from evaporator case.
6. To install duct, reverse Steps 1 through 5.

**Air Inlet Duct and Blower Housing Assembly—Disassembled View**

Fig. 32 shows the components of the air inlet duct and blower housing assembly.

**Floor-Panel Door Vacuum Motor****Removal**

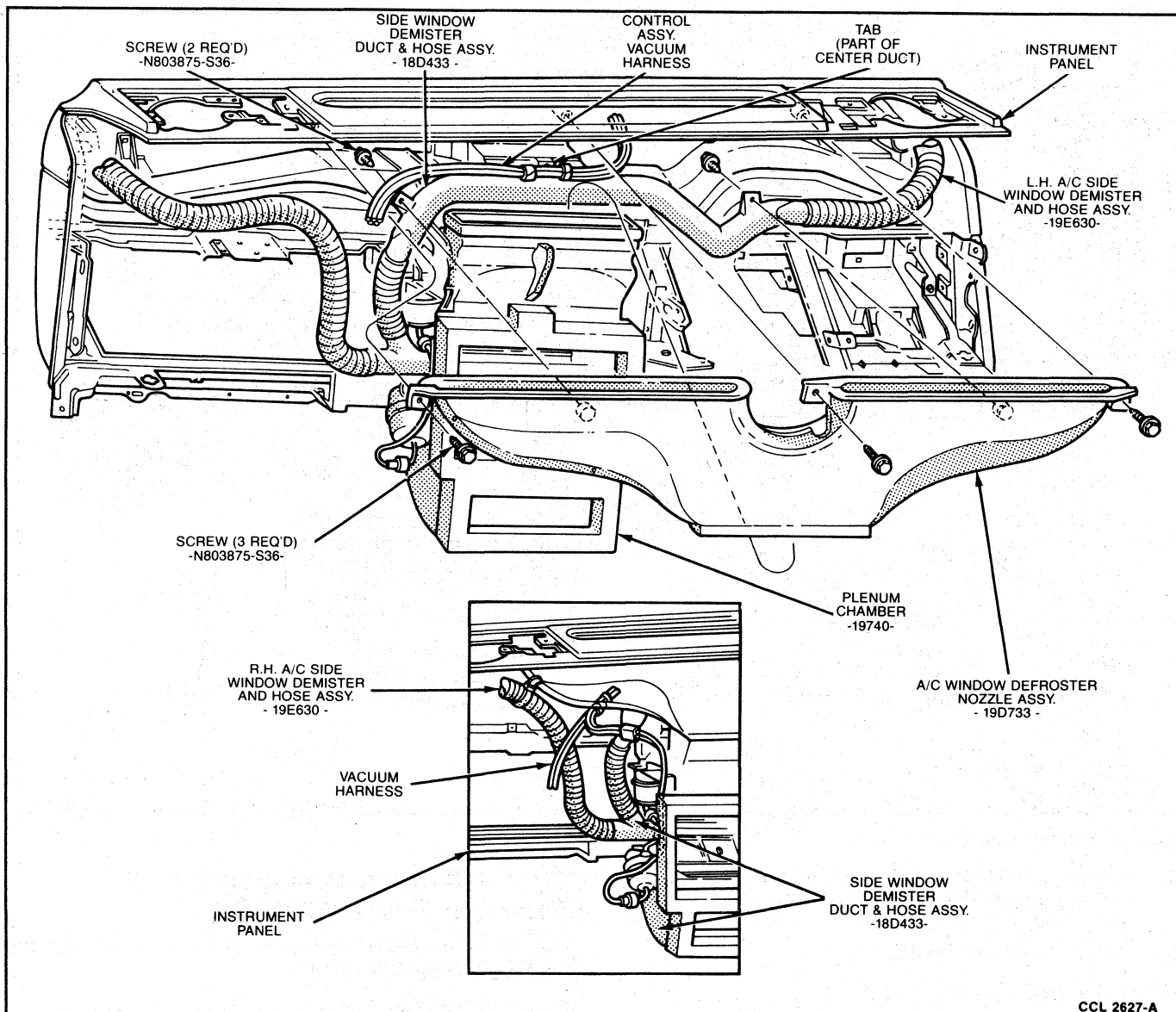
1. Remove instrument panel, resting it against front seat.
2. Remove heater case assembly as outlined.
3. Disconnect arm and pivot shaft assembly from motor clip.
4. Remove two nuts retaining motor to bracket on LH side of plenum and disconnect vacuum hoses.
5. Remove motor.

**Installation**

1. Position motor to bracket and secure with two nuts.
2. Connect vacuum hose to motor.
3. Install motor arm and clip.
4. Install heater case assembly as outlined.
5. Install instrument panel.

**Floor-Panel Door****Removal**

1. Remove instrument panel.



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FIG. 29 Defroster Nozzle and Demister Hoses

- Slide door off shaft and remove door from heater case.

### Installation

- Position floor panel door in evaporator case and slide it on shaft. Ensure it is firmly seated on shaft.
- Install instrument panel.

### Panel-Defrost Door Vacuum Motor

#### Removal

- Disconnect battery ground cable.
- Remove instrument panel.
- Remove spring nut retaining panel-defrost door vacuum motor arm to door shaft.
- Remove two screws retaining vacuum motor to mounting bracket.
- Remove vacuum motor from mounting bracket and disconnect vacuum hose.

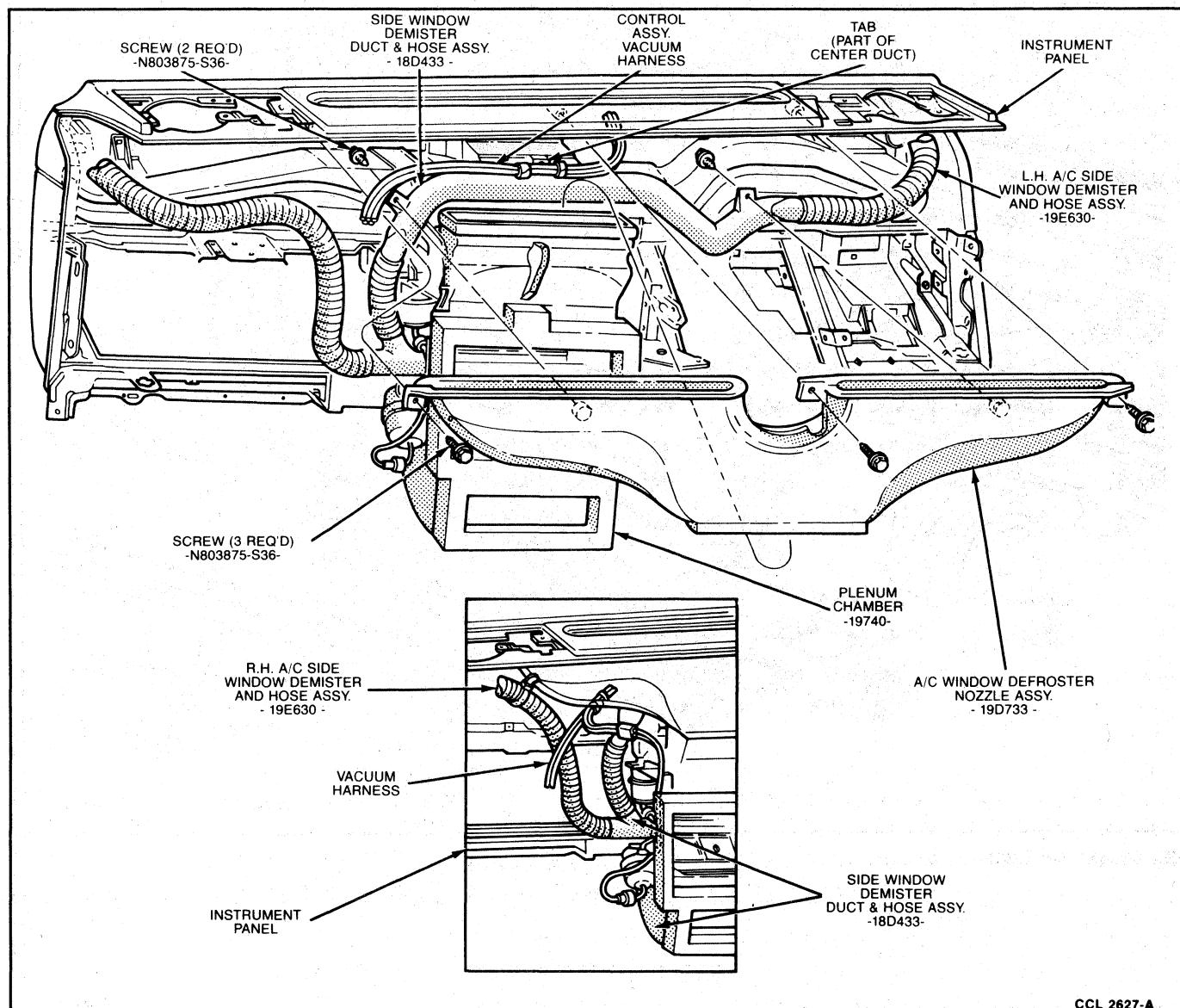
### Installation

- Position vacuum motor to mounting bracket and door shaft.
- Install two screws attaching panel-defrost vacuum motor to mounting bracket.
- Install a new spring nut to retain vacuum motor arm on heat-defrost door shaft.
- Connect vacuum hose to defrost vacuum motor.
- Install instrument panel.
- Connect battery ground cable.

### Panel-Defrost Door

#### Removal

- Remove panel-defrost distribution duct.
- Remove one screw retaining panel-defrost door to door crank and pull door from door crank.
- To replace door crank, remove spring nut retaining crank to vacuum motor arm. Disengage vacuum



**FIG. 30 Demisters, A/C Nozzle, and Demister Hoses**

motor arm from door crank and remove crank from panel-defrost distribution duct.

#### Installation

1. Place door crank in panel-defrost distribution duct. Place flatwasher on crank end of shaft, then vacuum motor arm, and install a new spring nut to retain vacuum motor arm on door crank.

2. Position panel-defrost door on crank so door is on same side of crank as vacuum motor. Install retaining screw.
3. Install panel-defrost distribution duct.

#### Heater Hoses

Refer to Figs. 33 and 34 for heater hose installation.

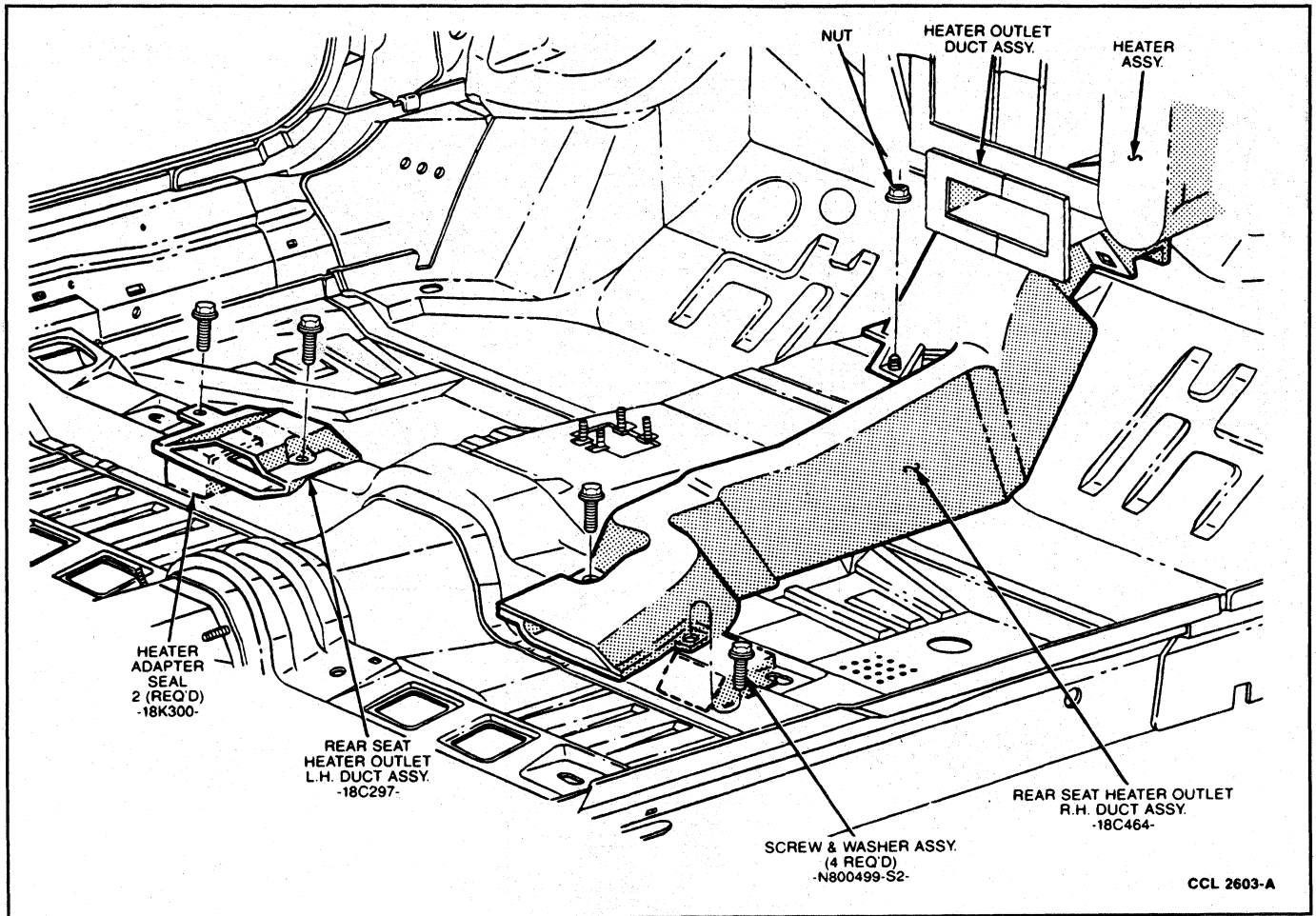


FIG. 31 Heater Duct—Rear Seat

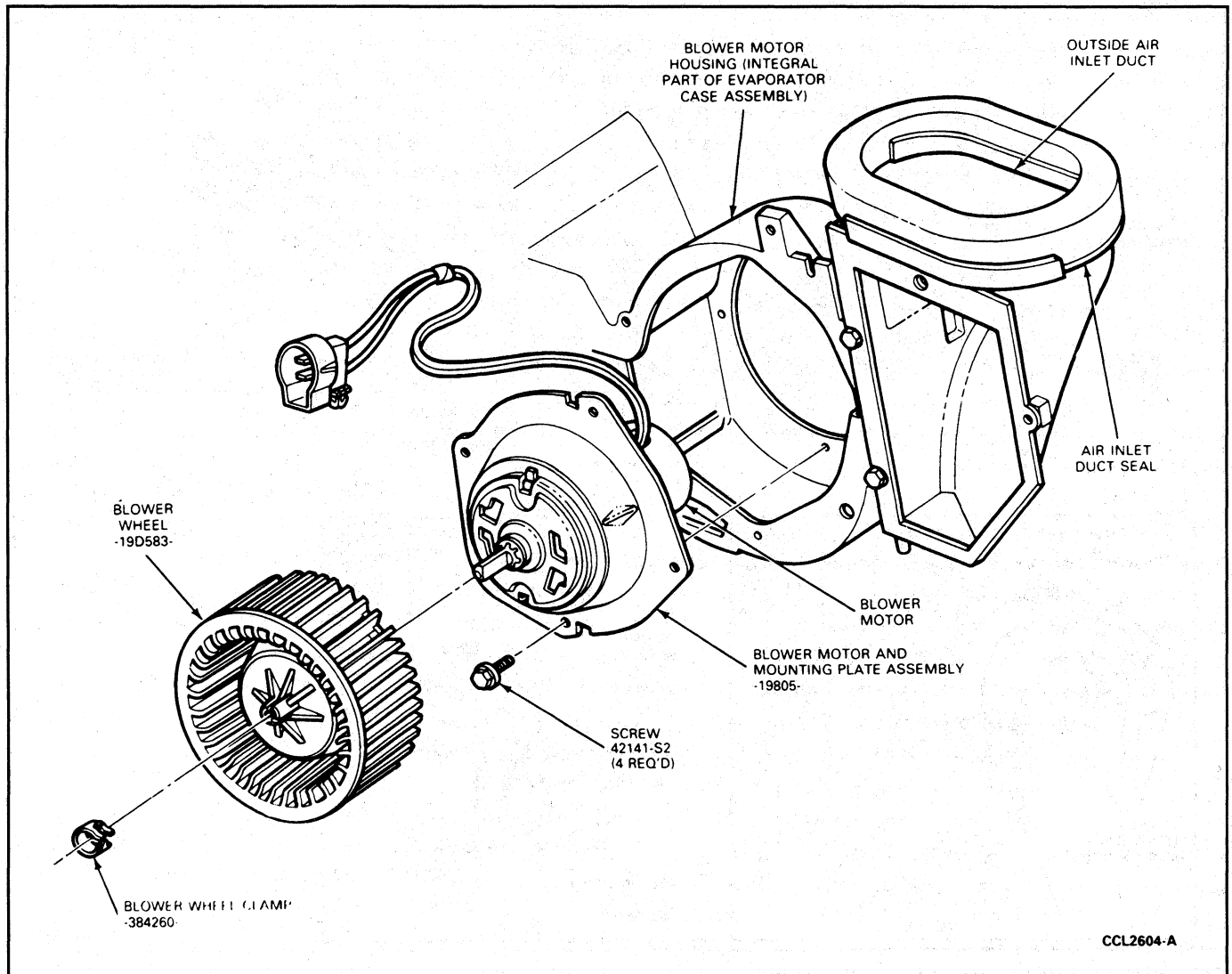
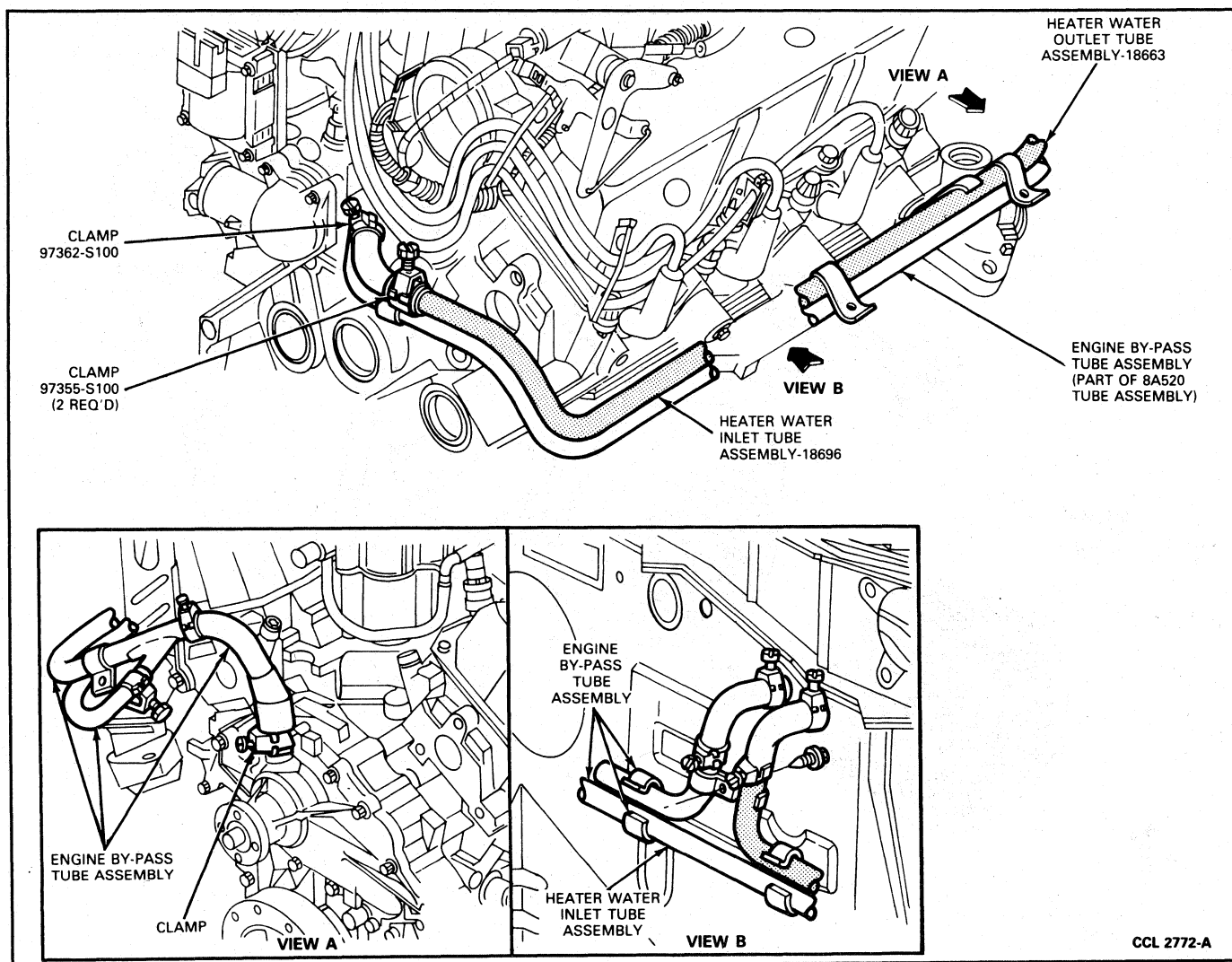


FIG. 32 Air Inlet Duct and Blower Housing Assembly—Disassembled View

**FIG. 33 Heater Hose Installation, 3.0L Engine**



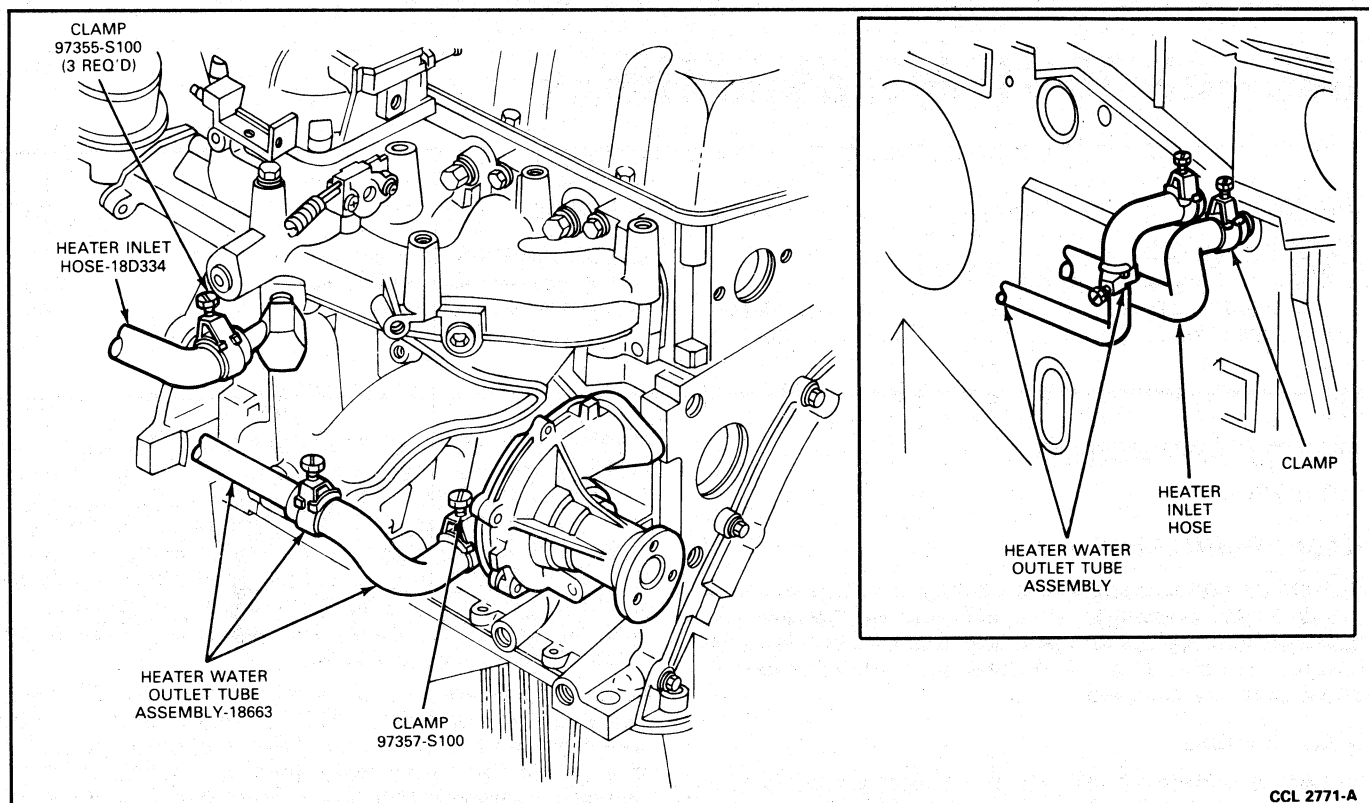


FIG. 34 Heater Hose Installation, 2.5L Engine

## SPECIFICATIONS

### TORQUE SPECIFICATIONS

Description	N-m	Lb-in
Heater Hose Clamps	1.81-2.49	16-22
Upper Panel Retaining Screws	1.4-2.3	12-20
Lower Instrument Panel-to-Side Cowl Retaining Screws	7-11	5-8 (lb-ft)
Instrument Cluster Finish Panel Retaining Screws	2-2.9	18-26
Radio Applique Retaining Screws	2-2.9	18-26
Glove Compartment Retaining Screws	2-2.6	18-23
Sound Insulator Retaining Screws	2-2.6	18-23

CK8905-A

## SPECIAL SERVICE TOOLS AND EQUIPMENT

- TOOL BT-7422-B, TOOL BT-7422-A.  
Borroughs Tool and Equipment Corporation  
2429 North Burdick St.  
Kalamazoo, Michigan 49007
- Rotunda Pressure Tester 021-00012
- OTC Heater Control Cable Disconnect Tool T83P-18532-AH.

# SECTION 36-31 A/C Basic Theory

SUBJECT	PAGE	SUBJECT	PAGE
<b>BASIC PRINCIPLES</b>		<b>BASIC PRINCIPLES (Cont'd.)</b>	
Effect of Pressure on Boiling or		Latent Heat of Vaporization .....	36-31-1
Condensation .....	36-31-1	<b>VEHICLE APPLICATION</b> .....	36-31-1
Heat Transfer .....	36-31-1		

## VEHICLE APPLICATION

Taurus/Sable.

### BASIC PRINCIPLES

Vehicle air conditioning is the cooling or refrigeration of the air in the passenger compartment. Refrigeration is accomplished by making practical use of three laws of nature. These laws of nature and their practical application are outlined.

#### Heat Transfer

**If two substances of different temperature are placed near each other, the heat in the warmer substance will always travel to the colder substance until both are of equal temperature.** For example, a cake of ice in an ice box does not communicate its coldness to the bottle of milk standing nearby. Rather, in obedience to nature's law, the heat in the warm milk automatically flows into the ice which has a lesser degree of heat. In order to determine the amount of heat that transfers from one substance to another, science has established a definite standard of measurement called the British Thermal Unit or BTU. One BTU is the amount of heat required to raise the temperature of one pound of water .55°C (1°F). For example, to raise the temperature of one pound of water from 0°C (32°F) to 100°C (212°F), one BTU of heat must be added for each 0.55°C (1°F) rise in temperature or a total of 180 BTU's of heat. Conversely, in order to lower the temperature of one pound of water from 100°C (212°F) to 0°C (32°F), 180 BTU's of heat must be removed from the water.

#### Latent Heat of Vaporization

**When a liquid boils (changes to a gas), it absorbs heat without raising the temperature of the resulting gas. When the gas condenses (changes back to a liquid), it gives off heat without lowering the temperature of the resulting liquid.**

For example, place one pound of water at 0°C (32°F) in a container over a flame. With each BTU of heat that the water absorbs from the flame, its temperature rises .55°C (1°F). Thus, after it has absorbed 180 BTU's of heat, the water reaches a temperature of 100°C (212°F). Here the law of nature is encountered. Even though the flame continues to give its heat to the water, the temperature of the water remains at 100°C (212°F). The water, however, starts to boil or change from the liquid to the gaseous state, and it continues to boil until the water has passed off into the atmosphere as vapor. If this vapor were collected in a container and checked with a thermometer, it also would show a temperature of 100°C (212°F). In other words, there was a rise of only 82°C

(180°F), from 0 to 100°C (32-212°F) in the water and vapor temperature even though the flame applied many more than 180 BTU's of heat. In this case, the heat is absorbed by the liquid in the process of boiling and disappears in the vapor. If the vapor were brought in contact with cool air, the hidden heat would reappear and flow into the cooler air as the vapor condensed back to water. Scientists refer to this natural law as the latent (hidden) heat of vaporization.

Water has a latent heat of vaporization of 970 BTU's and a boiling point of 100°C (212°F). This means that one pound of water at 100°C (212°F) will absorb 970 BTU's of heat in changing to vapor at 100°C (212°F). Conversely, the vapor will give off 970 BTU's of heat in condensing back to water.

This tremendous heat transfer that occurs when a liquid boils or a vapor condenses, forms the basic principle of all conventional refrigeration systems.

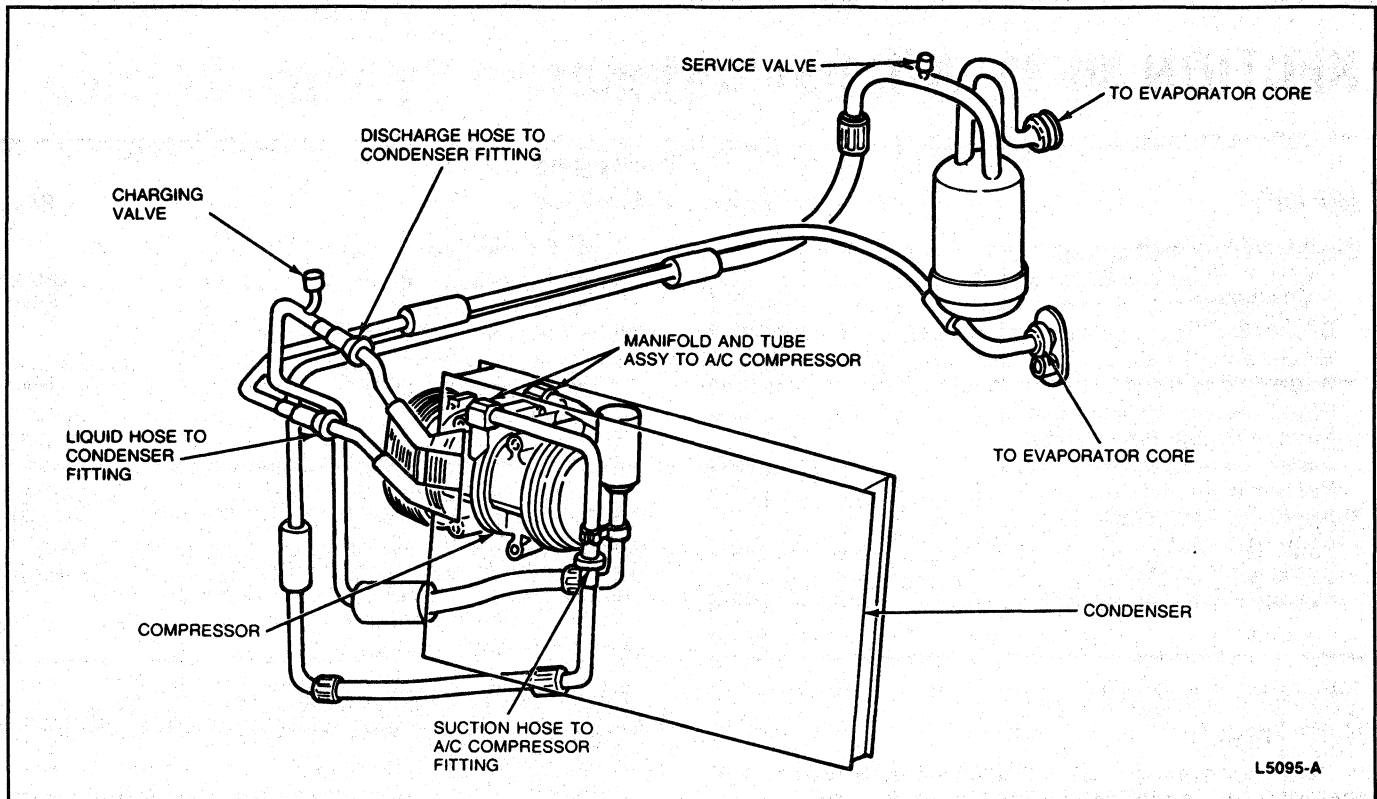
For a liquid to be a good refrigerant, the amount of heat that it absorbs when vaporizing is not the only factor. It must also have a low boiling point. That is, the temperature at which it boils must be lower than the substance to be cooled. To illustrate with water, place a bottle of milk at room temperature 21.6°C (70°F) next to boiling water 100°C (212°F). The heat would flow from the (higher temperature) water to the (lower temperature) milk. The milk would be heated rather than cooled, because the boiling point of water is too high.

In order to make practical use of the heat transfer that takes place when a liquid boils, we must choose a liquid with a low boiling point. Refrigerant 12 is the liquid most commonly used in automotive air conditioning systems because it boils at -29.85°C (21.7°F) below zero in an open container. Here is a liquid that boils or vaporizes well below passenger compartment temperatures and, in vaporizing, will absorb tremendous amounts of heat without getting any warmer itself.

#### Effect of Pressure on Boiling or Condensation

**The saturation temperature (the temperature where boiling or condensation occurs) of a liquid or vapor increases or decreases, according to the pressure exerted on it.**

In the fixed orifice tube refrigerant system, liquid refrigerant (R-12) is stored in the condenser under high-pressure (Fig. 1). When the liquid R-12 is released into the evaporator by the fixed orifice tube, the resulting decrease in pressure and partial boiling lowers its temperature to its new boiling point. As the R-12 flows through the evaporator, passenger compartment air passes over the outside surface of the evaporator coils.



**FIG. 1 A/C Refrigerating System**

As it boils, the R-12 absorbs heat from the air and thus cools the passenger compartment. The heat from the passenger compartment is absorbed by the boiling refrigerant and hidden in the vapor. The refrigeration cycle is now under way. To complete the cycle, the following remains to be done:

1. Dispose of the heat in the vapor.
2. Convert the vapor back to liquid for reuse.
3. Return the liquid to the starting point in the refrigeration cycle.

The compressor and condenser (Fig. 1) perform these functions. The compressor pumps the refrigerant vapor (containing the hidden heat) out of the evaporator and suction accumulator drier, then forces it under high-pressure into the condenser which is located in the outside air stream at the front of the vehicle. The increased pressure in the condenser raises the R-12 condensation or saturation temperature to a point higher than that of the outside air. As the heat transfers from the hot vapor to the cooler air, the R-12 condenses back to a

liquid. The liquid under high-pressure now returns through the liquid line to the fixed orifice tube for reuse.

It may seem difficult to understand how heat can be transferred from a comparatively cooler vehicle passenger compartment to the hot outside air. The answer lies in the difference between the refrigerant pressure that exists in the evaporator, and the pressure that exists in the condenser. In the evaporator, the compressor suction reduces the pressure and the boiling point below the temperature of the passenger compartment. Thus, heat transfers from the passenger compartment to the boiling refrigerant. In the condenser, the compressor raises the condensation point above the temperature of the outside air. Thus, the heat transfers from the condensing refrigerant to the outside air. The fixed orifice tube and the compressor simply create pressure conditions that permit the laws of nature to function.

Refer to Section 36-32 for additional Refrigerant System information.

# SECTION 36-32 A/C and Refrigerant System—Service

SUBJECT	PAGE	SUBJECT	PAGE	
DESCRIPTION AND OPERATION		GENERAL INFORMATION		
Clutch Cycling Pressure Switch .....	36-32-6	Safety Precautions .....	36-32-1	
Compressor and Magnetic Clutch .....	36-32-2	Service Precautions .....	36-32-1	
Condenser .....	36-32-2	REFRIGERANT SYSTEM SERVICE		
Evaporator Core .....	36-32-5	Accumulator/Drier .....	36-32-21	
Fixed Orifice Tube .....	36-32-3	Adding Refrigerant Oil .....	36-32-21	
High-Pressure Relief Valve .....	36-32-2	Condenser .....	36-32-21	
Service Gauge Port Valves .....	36-32-6	Evaporator Core .....	36-32-21	
Spring Lock Coupling .....	36-32-2	Other Refrigerant System Components .....	36-32-21	
Suction Accumulator/Drier .....	36-32-5	System Cleaning and Flushing .....	36-32-19	
DIAGNOSIS AND TESTING		SPECIAL SERVICE TOOLS .....		36-32-22
Diagnosis Charts .....	36-32-8	SPECIFICATIONS .....		36-32-22
Refrigerant System .....	36-32-8	VEHICLE APPLICATION .....		36-32-1
System Visual Inspection .....	36-32-8			

## VEHICLE APPLICATION

Taurus/Sable.

## GENERAL INFORMATION

The A/C refrigerant system is the fixed orifice tube—cycling clutch type. The system components are the compressor, magnetic clutch, condenser, evaporator, suction accumulator/drier and the necessary connecting refrigerant lines. System operation is controlled by the fixed orifice tube and the clutch cycling pressure switch.

**NOTE:** When diagnosing or servicing the A/C refrigerant system, time can be saved if the proper procedures are carefully followed.

### Safety Precautions

The refrigerant used in the air conditioner system is Refrigerant-12. Refrigerant-12 is non-explosive, non-flammable, non-corrosive, has practically no odor and is heavier than air. Although it is classified as a safe refrigerant, certain precautions must be observed to protect the parts involved and the person working on the unit. Use only Refrigerant-12 such as Motorcraft YN-1A or YN-7 or equivalent. Do not use refrigerant that was canned for pressure-operated accessories (such as boat air horns). This type is not pure Refrigerant-12 and will cause a malfunction. Liquid Refrigerant-12, at normal atmosphere pressures and temperatures, evaporates so quickly that it has the tendency to freeze anything it contacts. **For this reason, extreme care must be taken to prevent any liquid refrigerant from coming in contact with the skin and especially the eyes.**

Refrigerant-12 is readily absorbed by most types of oil. For this reason, a bottle of sterile mineral oil and a quantity of weak boric acid solution must always be kept nearby when servicing the air conditioning system. Should any liquid refrigerant get into the eyes, immediately use a few drops of mineral oil to wash them out, then wash the eyes clean with the weak boric acid solution. Seek a doctor's aid immediately even though irritation may have ceased. **Always wear safety goggles when servicing any part of the refrigerant system.** The Refrigerant-12 in the system is always

under pressure. Because the system is tightly sealed, heat applied to any part could cause this pressure to build up excessively.

**To avoid a dangerous explosion, never weld, use a blow torch, solder, steam clean, bake body finishes, or use any excessive amount of heat on or in the immediate area of any part of the refrigerant system or refrigerant supply tank, while they are closed to the atmosphere, whether filled with refrigerant or not.**

The liquid refrigerant evaporates so rapidly that the resulting refrigerant gas will displace the air surrounding the area where the refrigerant is released. **To prevent possible suffocation in enclosed areas, always discharge the refrigerant from the refrigerant system into a garage exhaust collector. Always maintain good ventilation surrounding the work area.**

Although Refrigerant-12 gas, under normal conditions, is non-poisonous, the discharge of refrigerant gas near an open flame can produce a very poisonous gas. This gas will also attack all bright metal surfaces. This poisonous gas is generated when the flame-type leak detector is used. **Avoid inhaling the fumes from the leak detector.** Ensure that Refrigerant-12 is both stored and installed in accordance with all state and local ordinances.

When admitting Refrigerant-12 gas into the cooling unit, always keep the tank in an upright position. If the tank is on its side or upside down, liquid Refrigerant-12 will enter the system and may damage the compressor.

### Service Precautions

1. **Never open or loosen a connection before discharging the system.**
2. **When loosening a connection, if any residual pressure is evident, allow it to leak off before opening the fitting.**
3. **A system which has been opened to replace a component or one which has discharged**

through leakage must be evacuated before charging.

4. Immediately after disconnecting a component from the system, seal the open fittings with a cap or plug.
5. Before disconnecting a component from system, clean outside of the fittings thoroughly.
6. Do not remove sealing caps from a replacement component until ready to install.
7. Refrigerant oil will absorb moisture from the atmosphere if left uncapped. Do not open an oil container until ready to use, and install cap immediately after using. Store oil only in a clean, moisture-free container.
8. Before connecting an open fitting, always install a new seal ring. Coat fitting and seal with refrigerant oil before connecting.
9. When installing a refrigerant line, avoid sharp bends. Position line away from exhaust or any sharp edges which may chafe the line.
10. Tighten fittings only to specified torque. The copper and aluminum fittings used in refrigerant system will not tolerate over-tightening.
11. When disconnecting a fitting use a wrench on both halves of the fitting to prevent twisting of refrigerant lines or tubes.
12. Do not open a refrigerant system or uncap a replacement component unless it is as close as possible to room temperature. This will prevent condensation from forming inside a component which is cooler than surrounding air.
13. Keep service tools and work area clean. Contamination of a refrigerant system through careless work habits must be avoided.

## DESCRIPTION AND OPERATION

### Compressor and Magnetic Clutch

An FS-6, Ford-built A/C compressor (Fig. 1) is used in all Taurus and Sable vehicles equipped with air conditioning. It is a 6-cylinder, swash plate design which is belt-driven by the engine crankshaft pulley. This compressor has a displacement of 171cc (104.4 cubic inches). Lubrication is provided by a charge of 500 viscosity refrigerant oil in the refrigerant system.

The suction and discharge manifold is made from extruded aluminum and is attached to the top of the compressor with two screws. The pressure relief valve is located on the side of the discharge manifold.

The clutch used on the FS-6 compressor consists of three basic components: the pulley, hub and the field coil. The pulley and field coil are attached to the front head of the compressor with tapered snap rings. The hub is keyed to the compressor shaft and is retained on the shaft with a self-locking nut. Special service tools are required to remove and install the clutch hub on the compressor shaft.

Refer to Section 36-37 for compressor and clutch service procedures.

### High-Pressure Relief Valve

A pressure relief valve is used to prevent excessive high-pressure buildups of 3102 kPa and above (450 psi and

above), and to prevent damage to the compressor and other system components. The pressure relief valve is located on the side of the discharge manifold on top of the compressor (Fig. 1).

### Condenser

The air conditioning condenser is an aluminum fin and tube design heat exchanger located in front of vehicle radiator. It cools compressed refrigerant gas by allowing air to pass over fins and tubes to extract heat, and condenses gas to liquid refrigerant as it is cooled.

The condenser inlet and outlet connections are the male part of a spring lock coupling and require a special service tool to disconnect the refrigerant lines from the condenser. The procedure to disconnect and reconnect the spring lock coupling is shown in Fig. 2.

### Spring Lock Coupling

The spring lock coupling (Fig. 2), is a refrigerant line coupling held together by a garter spring inside a circular cage. When the coupling is connected together, the flared end of the female fitting slips behind the garter spring inside the cage of the male fitting. The garter spring and cage then prevent the flared end of the female fitting from pulling out of the cage.

Two O-rings are used to seal between the two halves of the coupling. These O-rings are made of special material and **must** be replaced with an O-ring made of the same material. The O-rings normally used in refrigerant system connections **are not** the same material and should not be used with the spring lock coupling. Use only the O-rings listed in the Ford Master Parts Catalog for the spring lock coupling.

A plastic indicator ring is used on spring lock couplings to indicate, during vehicle assembly, that the coupling is connected. Once the coupling is connected, the indicator ring is no longer necessary but will remain captive by the coupling near the cage opening.

The indicator ring may also be used during service operations to indicate connection of the coupling. After the coupling has been cleaned, and a new O-ring installed and lubricated with clean refrigerant oil, insert the tabs of the indicator ring into the cage opening. Connect the coupling together by pushing with a slight twisting motion. When the coupling is connected, the indicator ring will snap out of the cage opening but will remain captured on the coupling by the refrigerant line.

### To Disconnect Coupling

1. Discharge refrigerant from system. Fit Spring Lock Coupling Tools T81P-19623-G1 (1/2-inch), T81P-19623-G2 (3/8-inch), T83P-19623-C (5/8-inch) or T85L-19623-A (3/4-inch) to the coupling (Fig. 2).
2. Close tool and push into open side of cage to expand garter spring and release female fitting.  
NOTE: The garter spring may not release if the tool is cocked while pushing it into the cage opening.
3. After garter spring is expanded, pull fitting apart.
4. Remove tool from disconnected coupling.

### To Connect Coupling

1. Check to ensure that garter spring is in cage of male fitting. If garter spring is missing, install a new spring by pushing it into cage opening. If garter spring is damaged, remove it from cage with a small wire

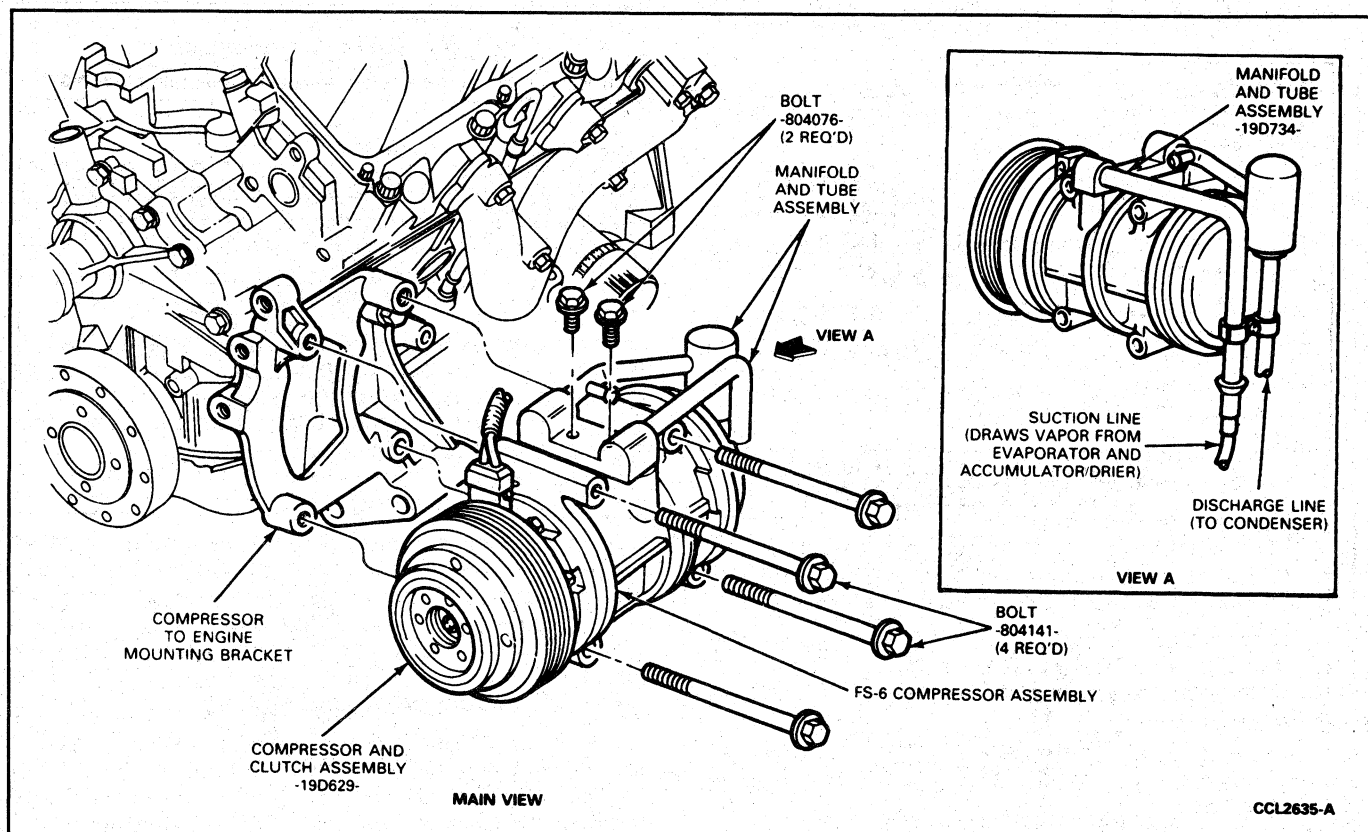


FIG. 1 Compressor and Magnetic Clutch Installation—3.0L Engine

hook (do not use a screwdriver) and install a new spring.

2. Clean all dirt or foreign material from both pieces of coupling.
3. Install new O-rings on male fitting.

**Use only the specified O-rings as they are made of a special material.** The use of any O-ring other than the specified O-ring may allow the connection to leak intermittently during vehicle operation. Refer to service parts list (Fig. 3).

4. Lubricate male fitting and O-rings and inside of female fitting with clean refrigerant oil.
5. Install plastic indicator ring into cage opening if indicator ring is to be used.
6. Fit female fitting to male fitting and push until garter spring snaps over flared end of female fitting.

If plastic indicator ring is used, it will snap out of cage opening when coupling is connected to indicate engagement.

7. If indicator ring is not used, ensure coupling engagement by visually checking to verify garter spring is over flared end of female fitting.

### Fixed Orifice Tube

The fixed orifice tube assembly (Fig. 4) is the restriction between the high and low-pressure liquid refrigerant, and meters the flow of liquid refrigerant into the evaporator core. Evaporator temperature is controlled by sensing the pressure within the evaporator with a pressure-operated electric switch. The pressure switch controls compressor operation as necessary to maintain the evaporator pressure within specified limits.

The fixed orifice tube is located in the liquid line near the condenser and has filter screens located on the inlet and outlet ends of the tube body. The filter screens act as a strainer for the liquid refrigerant flowing through the fixed orifice opening. O-rings, on the tube body, prevent the high-pressure liquid refrigerant from bypassing the orifice. Adjustment or services cannot be made to the fixed orifice tube assembly which cannot be removed from the liquid line. The liquid line must be replaced, or an Orifice Tube Replacement Kit Part No. E5VY-190695-A or equivalent installed if replacement of the orifice tube is necessary.

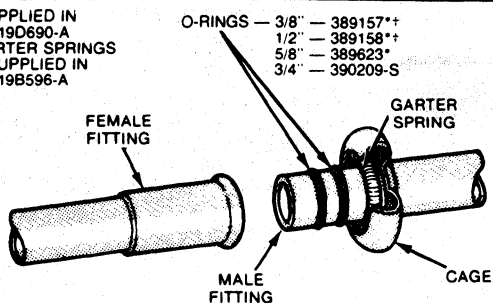
The fixed orifice tube should be replaced whenever a compressor is replaced. If high-pressure reads extremely high and low-pressure (suction) is almost a vacuum, the fixed orifice is plugged and must be replaced.

### Fixed Orifice Tube Replacement Kit Installation

1. Discharge the A/C refrigerant system. Refer to Discharging the System.
2. Remove the liquid line from the vehicle.
3. Locate the orifice tube by the three indented notches or a circular depression in the metal portion of the liquid line (Fig. 5).
4. Note the angular position of the ends of the liquid line so that it can be reassembled in correct position.
5. Cut a 63.5mm (2 1/2-inch) section from tube at orifice tube location (Fig. 7). Do not cut closer than 25.4mm (1-inch) from the start of a bend in tube.
6. Remove orifice tube from housing with pliers. The orifice tube removal tool cannot be used.
7. Flush the two pieces of liquid line to remove any contaminants.



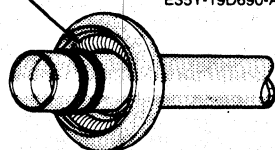
\*ALSO SUPPLIED IN  
KIT E35Y-19D690-A  
WITH GARTER SPRINGS  
\* ALSO SUPPLIED IN  
KIT E1ZZ-19B596-A



SPRING LOCK COUPLING DISCONNECTED

### TO CONNECT COUPLING

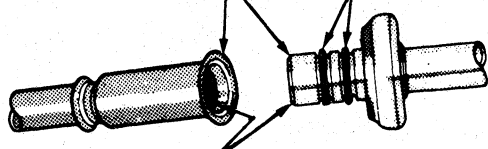
GARTER SPRING



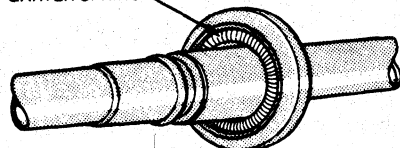
1 CHECK FOR MISSING OR DAMAGED GARTER SPRING — REMOVE DAMAGED SPRING WITH SMALL HOOKED WIRE — INSTALL NEW SPRING IF DAMAGED OR MISSING.

REPLACEMENT GARTER SPRINGS  
3/8 INCH — E1ZZ-19E576-A\*  
1/2 INCH — E1ZZ-19E576-B\*  
5/8 INCH — E35Y-19E576-A\*  
3/4 INCH — E69Z-19E576-A  
\*ALSO AVAILABLE IN  
E35Y-19D690-A KIT WITH O-RINGS

A — CLEAN FITTINGS  
B — INSTALL NEW O-RINGS — USE ONLY SPECIFIED O-RINGS  
C — LUBRICATE WITH CLEAN REFRIGERANT OIL  
D — ASSEMBLE FITTING TOGETHER BY PUSHING WITH A SLIGHT TWISTING MOTION



GARTER SPRING

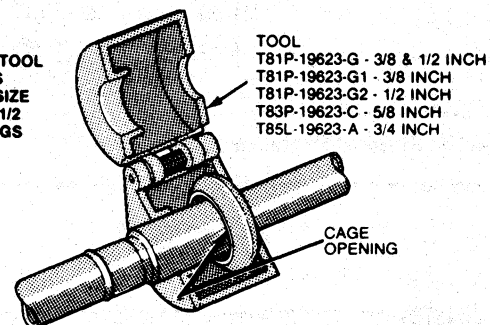


3 TO ENSURE COUPLING ENGAGEMENT, VISUALLY CHECK TO BE SURE GARTER SPRING IS OVER FLARED END OF FEMALE FITTING.

### TO DISCONNECT COUPLING

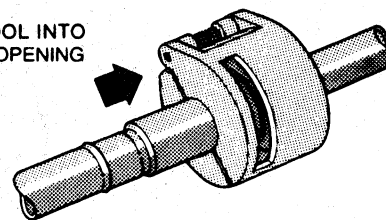
CAUTION — DISCHARGE SYSTEM BEFORE DISCONNECTING COUPLING

NOTE:  
EACH END OF TOOL  
T81P-19623-G IS  
A DIFFERENT SIZE  
TO FIT 3/8 and 1/2  
INCH COUPLINGS

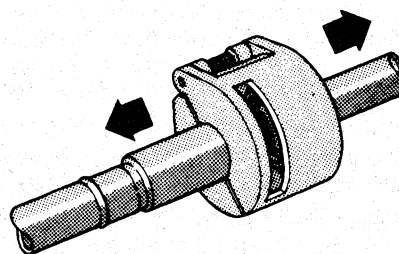


1 FIT TOOL TO COUPLING SO THAT TOOL CAN ENTER CAGE OPENING TO RELEASE THE GARTER SPRING.

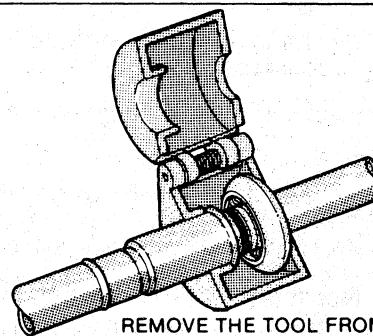
PUSH TOOL INTO  
CAGE OPENING



2 PUSH THE TOOL INTO THE CAGE OPENING TO RELEASE THE FEMALE FITTING FROM THE GARTER SPRING.



3 PULL THE COUPLING MALE AND FEMALE FITTINGS APART.



4 REMOVE THE TOOL FROM THE DISCONNECTED SPRING LOCK COUPLING.

CCL 1925-E

FIG. 2 Spring Lock Coupling

Part Number	Description
E35Y-19D690-A	O-ring Seal Kit — A/C Spring Lock Coupling (Kit contains 3/8, 1/2 and 5/8 inch coupling O-rings and 3/8, 1/2 and 5/8 inch coupling garter springs.)

CL3811-C

FIG. 3 Service Parts List

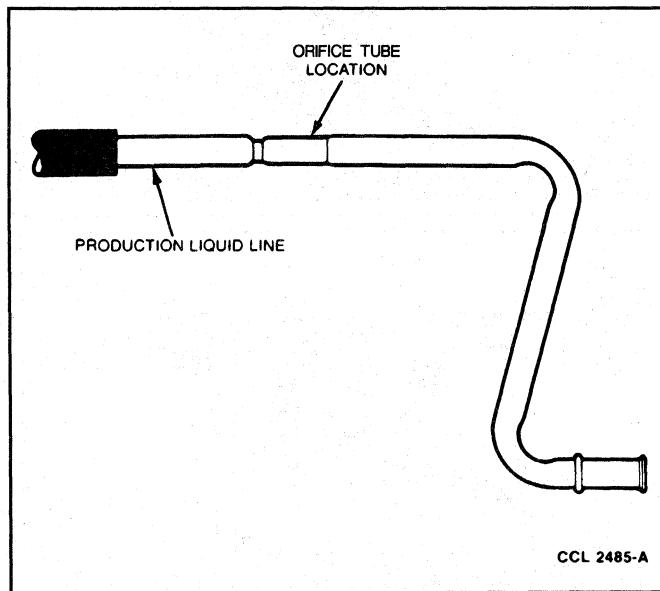


FIG. 4 Fixed Orifice Tube Location

8. Lubricate O-rings with clean refrigerant oil and assemble orifice tube kit (with orifice tube installed) to liquid line (Fig. 6). Ensure flow direction arrow is pointing toward evaporator end of liquid line, and taper of each compressor ring is toward compression nut.

NOTE: The inlet tube will be positioned against the orifice tube tabs when correctly assembled.

9. While holding hex of tube in a vise, tighten each compression nut to 88-94 N·m (65-70 lb-ft) with a crow foot wrench (Fig. 7).
10. Assemble liquid line to vehicle using new O-rings lubricated with clean refrigerant oil. Use only specified O-rings at spring lock coupling.
11. Leak test, evacuate and charge system following approved procedures.
12. Check system for proper operation.

### Evaporator Core

The evaporator core is the plate/fin type with a multi-pass refrigerant flow path. A mixture of refrigerant and oil enters the bottom of the core through the evaporator inlet tube and is routed so that it flows upward through the partitioned first three plate/fin sections. The next four plate/fin sections are partitioned to force the refrigerant to flow downward toward the bottom of the evaporator core. The refrigerant then continues over to the remaining five plate/fin sections and then moves upward and out of the evaporator via the evaporator outlet tube. This S-pass flow pattern eliminates the need for the liquid refrigerant and oil bleed line normally used on earlier model plate/fin evaporator cores because of increased refrigerant flow velocity.

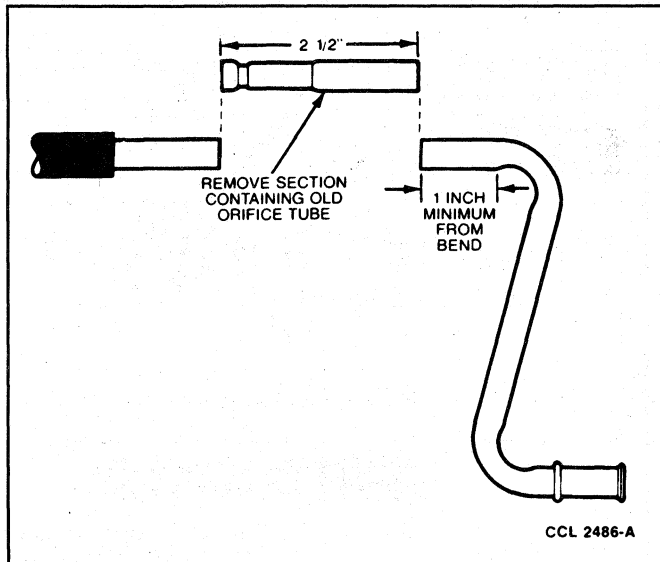


FIG. 5 Orifice Tube Section Removed From Liquid Line

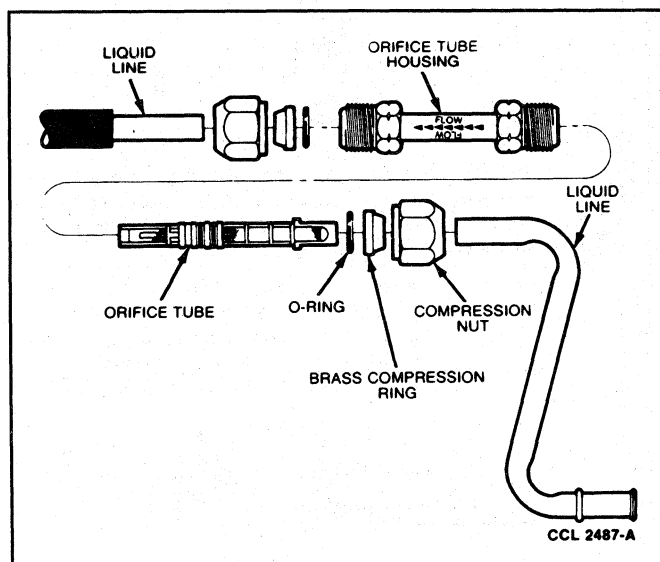


FIG. 6 Orifice Tube Kit Disassembled

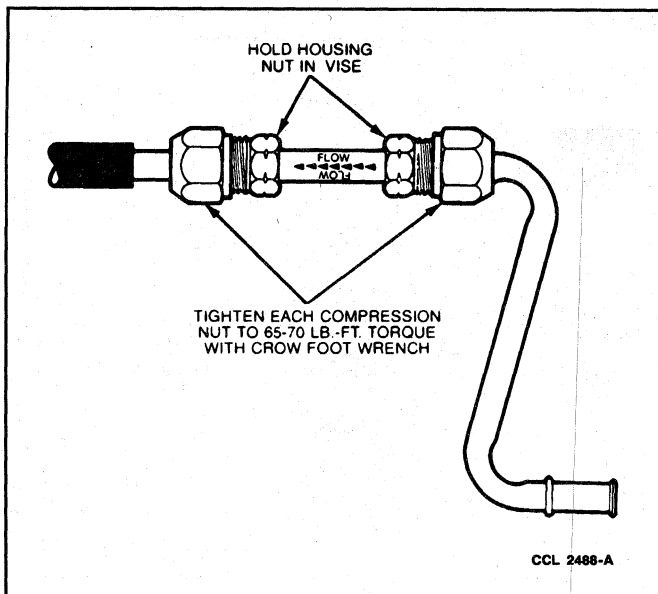
### Suction Accumulator/Drier

The suction accumulator/drier (Fig. 8) is mounted to the engine side of the dash panel on the RH side of the vehicle. The inlet tube of the accumulator/drier attaches directly to the evaporator core outlet tube.

Refrigerant enters the accumulator/drier canister through the inlet tube and the heavier, oil-laden refrigerant falls to the bottom of the canister (Fig. 8). A small diameter oil bleed hole is located in the side of the outlet tube near the bottom of the canister. This bleed hose is covered with a filter screen and allows a small amount of the heavier liquid refrigerant and oil mixture to re-enter the suction line at a controlled rate. When the heavier liquid refrigerant and oil mixture enters the compressor suction line, it has a second opportunity to vaporize and circulate through the compressor without causing damage to the compressor due to refrigerant slugging.

A desiccant bag is mounted inside the suction accumulator/drier canister to absorb any moisture which may be in the refrigerant system.





**FIG. 7 Orifice Tube Kit Installed**

A fitting located on the top of the canister is used to attach the clutch cycling pressure switch. A long-travel Schrader-type valve stem core is installed in the fitting opening to prevent refrigerant loss when the clutch cycling pressure switch is removed.

If it is necessary to check the suction accumulator/drier for excessive refrigerant oil, the oil must be poured from the accumulator through the pressure switch fitting when the Schrader valve stem is removed.

### Replacement Guidelines

#### Replace Accumulator/Drier when:

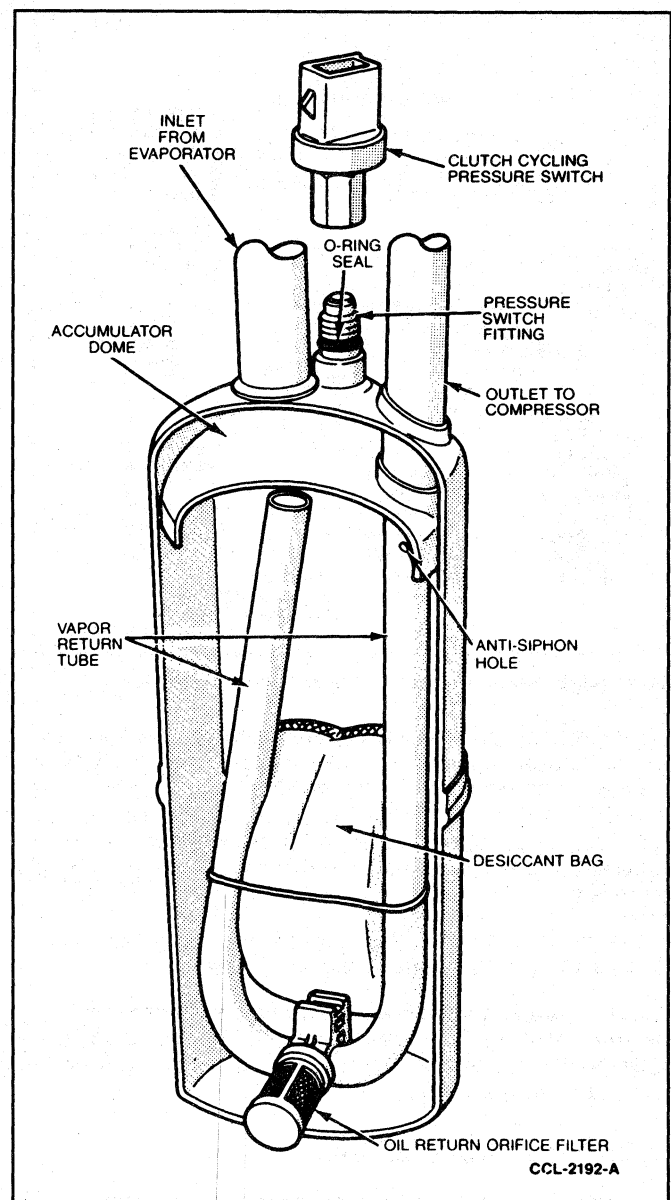
- The suction accumulator/drier is restricted, plugged or perforated.
- The system has been left open for more than 24 hours (system completely discharged).
- There is evidence of moisture in the system (i.e., internal corrosion of metal lines or dark thick refrigerant oil).
- A component such as a condenser, evaporator or a seized compressor is replaced. (Flush system and replace orifice tube when replacing a seized or damaged compressor.)

#### Do not replace Accumulator/Drier every time if:

- There is a partial loss of refrigerant charge.
- A component (except as described above) is charged.
- A dent is found in the outer shell of the suction accumulator/drier.

### Clutch Cycling Pressure Switch

The clutch cycling pressure switch is mounted on a Schrader valve-type fitting on the top of the suction accumulator/drier assembly (Fig. 8). A valve depressor, located inside the threaded end of the pressure switch, presses in on the Schrader valve stem as the switch is mounted and allows the suction pressure inside the accumulator/drier canister to control switch operation. The electrical switch contacts are normally open when the suction pressure is approximately 151 kPa (22 psi). They will close when the suction pressure rises to approximately 410 kPa (45 psi) or above. Lower ambient

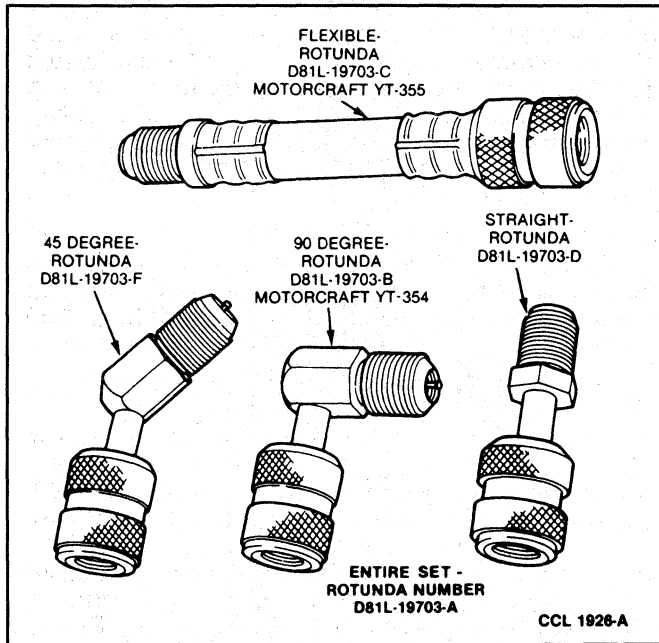


**FIG. 8 Suction Accumulator/Drier**

temperatures, below approximately 9°C (48°F), during cold weather seasons, will also open the clutch cycling pressure switch contacts due to the pressure/temperature relationship of the refrigerant in the system. The electrical switch contacts control the electrical circuit to the compressor magnetic clutch coil. When the switch contacts are closed, the magnetic clutch coil is energized and the A/C clutch is engaged to drive the compressor. When the switch contacts are open, the compressor magnetic clutch coil is de-energized, the A/C clutch is disengaged and the compressor does not operate. The clutch cycling pressure switch, when functioning properly, will control the evaporator core pressure at a point where the plate/fin surface temperature will be maintained slightly above freezing which prevents evaporator icing and the blockage of airflow.

### Service Gauge Port Valves

The refrigerant system has a high pressure (discharge) and a low pressure (suction) gauge port valve. These are Schrader-type valves which provide access to both sides



**FIG. 9 High Pressure Gauge Port Valve Adapters**

(high-pressure and low-pressure) of the system for service hoses and a manifold gauge set so system pressures can be read. Rotunda High Side Adapter Set D81L-19703-A or Motorcraft® Tool YT-354 or 355 or equivalent (Fig. 9), is required to connect a manifold gauge set or charging station to the high-pressure gauge port valve.

Always replace the protector caps on the gauge port valves after servicing the refrigerant system.

A service gauge port valve assembly is shown in Fig. 10 with the valve in the closed position. Fig. 11 shows a gauge port valve in the closed position with a manifold gauge set hose attached.

## DIAGNOSIS AND TESTING

Diagnosis is more than just following a series of interrelated steps in order to find the solution to a specific condition. It is a way of looking at systems that are not functioning the way they should and finding out why. Also, it is knowing how the system **should** work, and whether it is working correctly. All good diagnosticians use the same basic procedure.

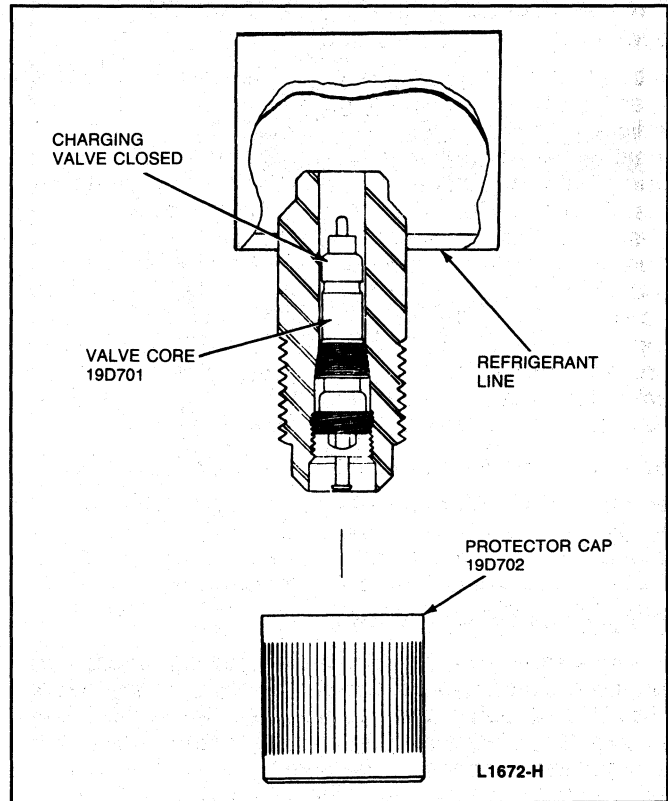
There are basic rules for diagnosis. If these rules are followed, the cause of the condition will usually be found the first time through the system.

### Know the System

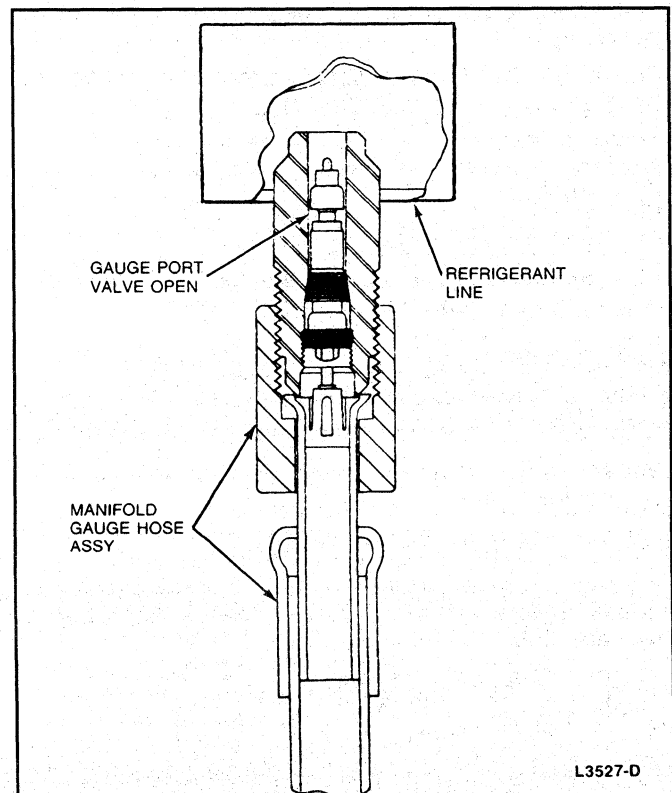
Know how the parts go together. Also, know how the system operates and its limits, and what happens when something goes wrong. Sometimes this means comparing a system that is working properly with the one you are servicing.

### Know the History of the System

How old or new is the system? What kind of treatment has it had? Has it been serviced in the past in such a manner that might relate to the present condition? What is the service history? A clue in any of these areas might save a lot of diagnosis time.



**FIG. 10 Service Gauge Port Valve**



**FIG. 11 Manifold Gauge Set Hose Connected to Gauge Port Valve**

### Know the Probability of Certain Conditions Developing

It is true that most conditions are caused by simple things rather than by complex ones, and they occur in a fairly predictable pattern. Electrical problem conditions, for instance, usually occur at connections rather than in components. An engine "no-start" is more likely to be caused by a loose wire or some component out of adjustment than a sheared-off camshaft. Know the difference between **impossible** and **improbable**. Many good technicians have spent hours diagnosing a system because they thought certain failures were "impossible," only to eventually find out the failures were just "improbable" and actually had happened. Remember, new parts are just that: new. It does **not** mean they are **good** functioning parts.

### Don't Cure the Symptom and Leave the Cause

Recharging a refrigerant system may correct the condition of insufficient cooling, but it does not correct the original problem unless a cause is found. A properly working system does not lose refrigerant over time.

### Be Sure the Cause is Found

Do not be fooled into thinking the cause of the problem has been found. Perform the proper tests, then double check the results. The system should have been checked for refrigerant leaks. If no leaks were found, perform a leak test with the system under extremely high pressure. If the system performed properly when new, it had to have a leak to be low in charge.

### Diagnosis Charts

No matter what form charts may take, they are simply a way of expressing the relationship between basic logic and a physical system of components. It is a way of determining the cause of a condition in the **shortest possible amount of time**. Diagnosis charts combine many areas of diagnosis into one visual display:

- **Probability** of certain things occurring in a system.
- **Speed** of checking certain components, or functions, before others.
- **Simplicity** of performing certain tests before others.
- **Elimination** of checking huge portions of a system by performing simple tests.
- **Certainty** of narrowing down the search to a small portion before performing in-depth testing.

The fastest way to find a condition is to work with the tools that are available, which means working with proven diagnosis charts and the proper special tools for the system being worked on.

### System Visual Inspection

It is often possible to detect problem causes by a careful visual inspection of the A/C refrigerant system. This includes broken belts, obstructed condenser air passages, a loose clutch, loose or broken mounting brackets, disconnected or broken wires and many refrigerant leaks.

A refrigerant leak will usually appear as an oily residue at the leakage point in the system. The oily residue soon picks up dust or dirt particles from the surrounding air and appears greasy. Through time, this will build up and appear to be a heavy, dirt-impregnated grease.

Most common leaks are caused by damaged or missing O-ring seals at the various hose and component

connections. When these O-rings are replaced, the new O-rings should be lubricated with refrigerant oil. Care should be taken to keep lint from shop towels or cloths from contaminating the internal surfaces of the connection. Leakage may occur at a spring lock coupling if the wrong O-rings are used at the coupling. Use **only** the O-rings listed in the Ford Master Parts Catalog for the spring lock coupling.

Another type of leak may appear at the internal Schrader-type A/C charging valve core in the service gauge port valve fittings. If tightening the valve core does not stop the leak, it should be replaced with a A/C Charging Valve Core Part No. 19D701 or equivalent.

Missing Service Gauge Port Valve Caps Part No. 19D702 or equivalent can also cause a refrigerant leak. If this important primary seal (the valve cap) is missing, dirt will enter the area of the A/C charging valve core. When the service hose is attached, the valve depressor in the end of the service hose forces the dirt into the valve seat area and the dirt will destroy the sealing surface of the A/C charging valve core. When a service gauge port valve cap is missing, the protected area of the A/C charging valve core should be cleaned and a new Service Gauge Port Valve Cap Part No. 19D702 or equivalent should be installed.

**CAUTION: Service gauge port valve cap must be installed finger-tight. If tightened with pliers, the sealing surface of the service gauge port valve may be damaged.**

### Refrigerant System

The best way to diagnose a problem in the refrigerant system is to note the system pressures (shown by the manifold gauges) and the clutch cycle rate and times. Then, compare the findings to the charts (Figs. 12 and 13).

- The system pressures are low (compressor suction) and high (compressor discharge).
- A clutch cycle is the time the clutch is engaged plus the time it is disengaged (time on plus time off).
- Clutch cycle times are the lengths of time (in seconds) that the clutch is ON and OFF.

The following procedure is recommended for achieving accurate diagnosis results in the least amount of time.

1. Connect a manifold gauge set, part of Rotunda Air Conditioning Service Kit 063-00010 or equivalent, to the system.

NOTE: The test conditions, specified at the top of each chart, must be met to obtain accurate test results.

2. As soon as the system is stabilized, record the high and low-pressure as shown by the manifold gauges.
3. Determine the clutch cycle rate per minute (clutch on time plus off time is a cycle).
4. Record clutch off time in seconds.
5. Record clutch on time in seconds.
6. Record center register discharge temperature.
7. Determine and record ambient temperatures.
8. Compare test readings with applicable chart (Figs. 13 and 14).

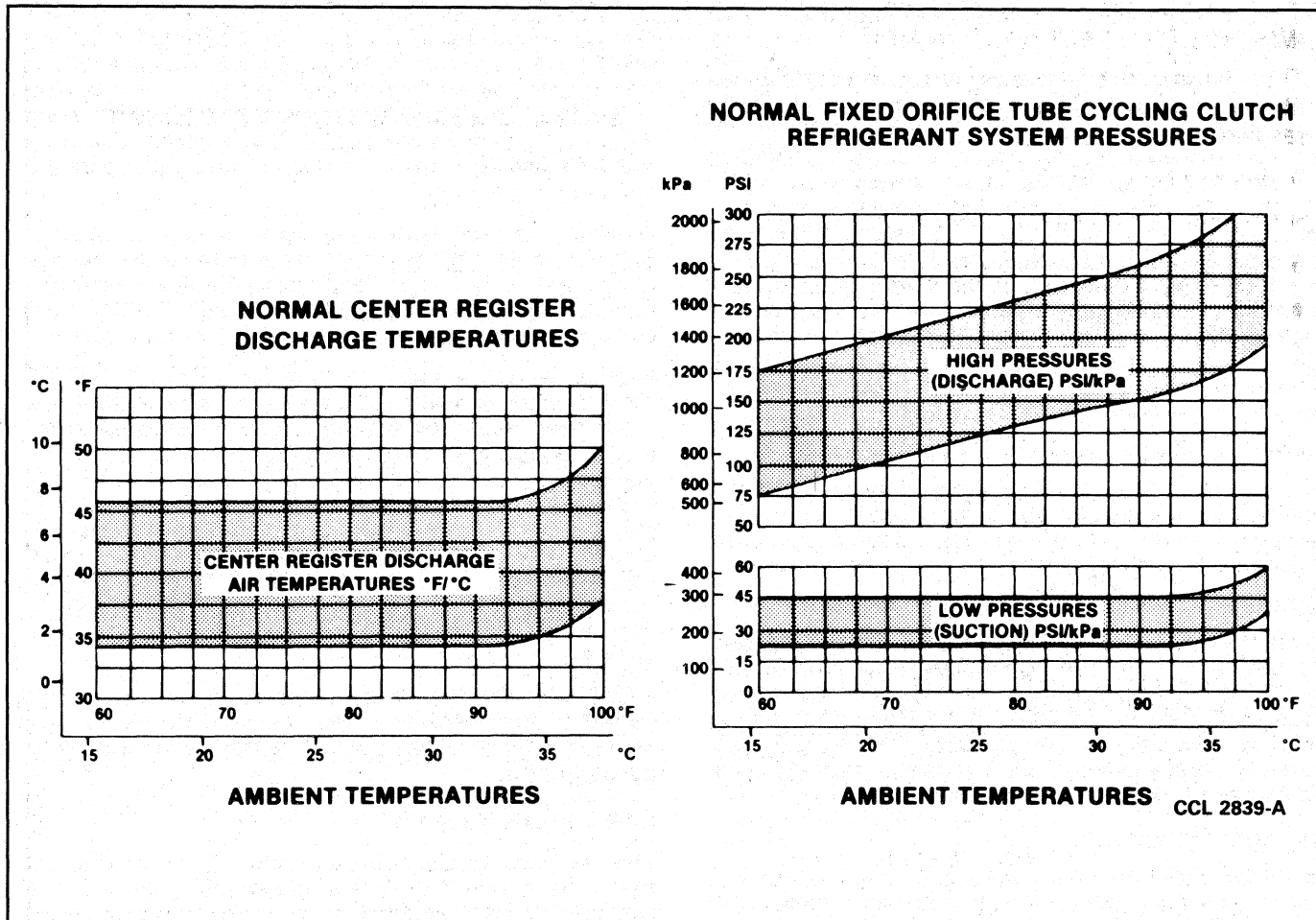


FIG. 12 Normal Fixed Orifice Tube Refrigerant System Pressure Temperature Relationships

- Plot a vertical line for recorded ambient temperature from scale at bottom of each chart to top of each chart.
- Plot a horizontal line for each of the other test readings from scale at LH side of appropriate chart.

If the point where the two lines cross on each of the charts falls within the dark band, the system is operating normally. If the lines cross outside the dark band on one or more of the charts, there is a problem and the specific cause must be determined. This is easily done by using the Refrigerant System and Clutch Cycle Timing Evaluation chart (Fig. 14).

Refer to the following five system operating conditions indicated by where the lines cross on the charts:

- System high (discharge) pressure is high, low or normal.
- System low (suction) pressure is high, low or normal.
- Clutch cycle rate is fast, slow or the clutch runs continuously.
- Clutch on time is long or short.
- Clutch off time is long or short.

Match these conditions to the conditions shown in the five columns toward the left in the System Pressure and Clutch Cycle Timing Evaluation chart (Fig. 14). All five system conditions will be indicated on one line. The most likely component or components causing the problem are listed in the column at the RH side of the chart.

#### Example:

- High (discharge) pressure is low.
- Low (suction) pressure is normal.
- Clutch cycle rate is very fast.
- Clutch on time is very short.
- Clutch off time is very short.

The component causing the problem is the clutch cycling pressure switch. The clutch cycling range is too close. Replace the switch and recheck the system:

#### Example:

- High (discharge) pressure is normal to low.
- Low (suction) pressure is normal.
- Clutch cycle rate is fast.
- Clutch on time is short.
- Clutch off time is short.

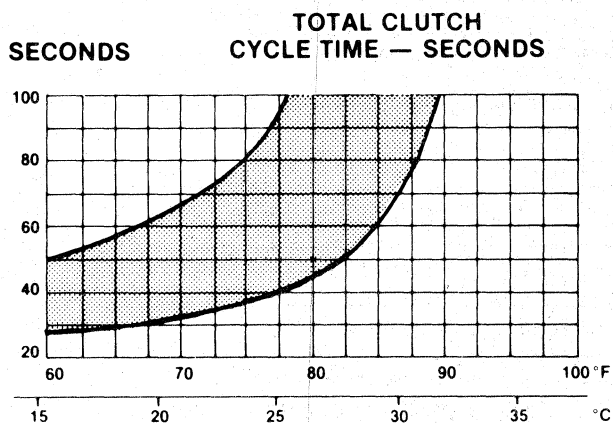
The component causing the problem is the evaporator core. Airflow is restricted, indicating debris entering through the cowl air inlet and plugging the core.

This condition can also be detected by checking the center register discharge temperature. An abnormally low temperature would mean air is spending more time in the evaporator and is very cold when discharged, although the volume is not enough to cool the vehicle properly.

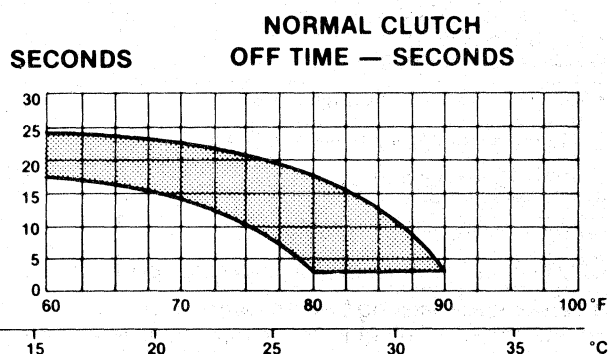
**IMPORTANT — TEST REQUIREMENTS**

The following test conditions must be established to obtain accurate clutch cycle rate and cycle time readings:

- Run engine at 1500 rpm for 10 minutes.
- Operate A/C system on max A/C (recirculating air).
- Run blower at max speed.
- Stabilize in car temperature @ 70°F to 80°F (21°C to 22°C).

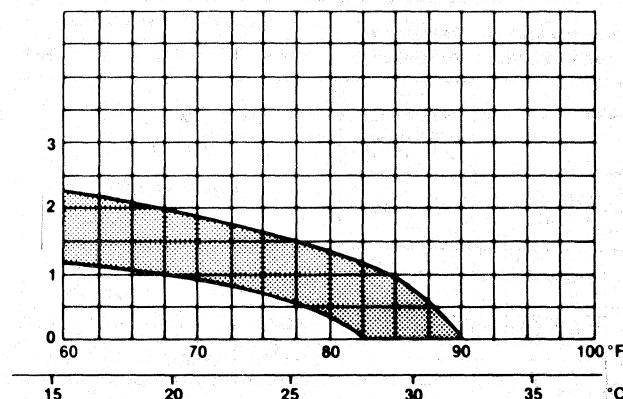


AMBIENT TEMPERATURES



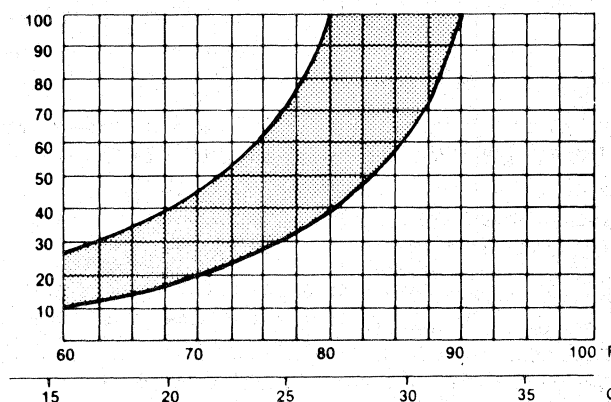
AMBIENT TEMPERATURES

**NORMAL CLUTCH CYCLE RATE PER MINUTE**  
CYCLES/MINUTE



AMBIENT TEMPERATURES

**NORMAL CLUTCH ON TIME — SECONDS**



AMBIENT TEMPERATURES

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**FIG. 13 Normal Fixed Orifice Tube Refrigerant System Clutch Cycle Timing Rates**

At the bottom of the chart (Fig. 14), additional cause components are listed for poor compressor operation or a damaged compressor condition.

The diagnosis charts provide the most direct and sure way to determine the cause of any problem in a poorly performing refrigerant system.

After servicing and correcting a refrigerant system problem, take additional pressure readings and observe the clutch cycle rate while meeting the conditional requirements (Fig. 14) to ensure the problem has been corrected.

In ambient temperatures above 38°C (100°F), the compressor clutch will not normally cycle off and in many instances, the clutch will not cycle off when

temperatures are above 32°C (90°F). This will depend on local conditions and engine/vehicle speed. Also, clutch cycling will normally not occur when the engine is operating at curb idle speed.

If the system contains no refrigerant or is extremely low on refrigerant, the clutch will not engage for compressor operation. A rapid cycling compressor clutch is usually an indication that the system is low on refrigerant. Refer to Insufficient or No A/C Cooling—Fixed Orifice Tube Cycling Clutch System Diagnosis chart.

**Checking for Leaks**

Attach the manifold gauge set (Fig. 15). Leave both manifold gauge valves at the maximum clockwise

# REFRIGERANT SYSTEM PRESSURE AND CLUTCH CYCLE TIMING EVALUATION CHART FOR FIXED ORIFICE TUBE CYCLING CLUTCH SYSTEMS

**NOTE:** System test requirements must be met to obtain accurate test readings for evaluation. Refer to the normal refrigerant system pressure/temperature and the normal clutch cycle rate and times charts.

HIGH (DISCHARGE) PRESSURE	LOW (SUCTION) PRESSURE	CLUTCH CYCLE TIME			COMPONENT — CAUSES
		RATE	ON	OFF	
HIGH	HIGH	CONTINUOUS RUN			CONDENSER — Inadequate Airflow
HIGH	NORMAL TO HIGH				ENGINE OVERHEATING
NORMAL TO HIGH	NORMAL				AIR IN REFRIGERANT. REFRIGERANT OVERCHARGE (a) HUMIDITY OR AMBIENT TEMP. VERY HIGH (b)
NORMAL	HIGH				FIXED ORIFICE TUBE — Missing O-Rings Leaking/Missing
NORMAL	HIGH	SLOW	LONG	LONG	CLUTCH CYCLING SWITCH — High Cut-In
NORMAL	NORMAL	SLOW OR NO CYCLE	LONG OR CONTINUOUS	NORMAL OR NO CYCLE	MOISTURE IN REFRIGERANT SYSTEM. EXCESSIVE REFRIGERANT OIL
		FAST	SHORT	SHORT	CLUTCH CYCLING SWITCH — Low Cut-In or High Cut-Out
NORMAL	LOW	SLOW	LONG	LONG	CLUTCH CYCLING SWITCH — Low Cut-Out
NORMAL TO LOW	HIGH	CONTINUOUS RUN			Compressor — Low Performance
NORMAL TO LOW	NORMAL TO HIGH				A/C SUCTION LINE — Partially Restricted or Plugged (c)
NORMAL TO LOW	NORMAL	FAST	SHORT	NORMAL	EVAPORATOR — Restricted Airflow
			SHORT TO VERY SHORT	NORMAL TO LONG	CONDENSER, FIXED ORIFICE TUBE, OR A/C LIQUID LINE — Partially Restricted or Plugged
			SHORT TO VERY SHORT	SHORT TO VERY SHORT	LOW REFRIGERANT CHARGE
			SHORT TO VERY SHORT	LONG	EVAPORATOR CORE — Partially Restricted or Plugged
NORMAL TO LOW	LOW	CONTINUOUS RUN			A/C SUCTION LINE — Partially Restricted or Plugged (d) CLUTCH CYCLING SWITCH — Sticking Closed
LOW	NORMAL	VERY FAST	VERY SHORT	VERY SHORT	CLUTCH CYCLING SWITCH — Cycling Range Too Close
ERRATIC OPERATION OR COMPRESSOR NOT RUNNING		—	—	—	CLUTCH CYCLING SWITCH — Dirty Contacts or Sticking Open. POOR CONNECTION AT A/C CLUTCH CONNECTOR OR CLUTCH CYCLING SWITCH CONNECTOR A/C ELECTRICAL CIRCUIT ERRATIC — See A/C Electrical Circuit Wiring Diagram
ADDITIONAL POSSIBLE CAUSE COMPONENTS ASSOCIATED WITH INADEQUATE COMPRESSOR OPERATION					
<ul style="list-style-type: none"> <li>• COMPRESSOR DRIVE BELT — Loose</li> <li>• COMPRESSOR CLUTCH — Slipping</li> <li>• CLUTCH COIL Open — Shorted, or Loose Mounting</li> <li>• CONTROL ASSEMBLY SWITCH — Dirty Contacts or Sticking Open</li> <li>• CLUTCH WIRING CIRCUIT — High Resistance, Open or Blown Fuse</li> </ul>					
ADDITIONAL POSSIBLE CAUSE COMPONENTS ASSOCIATED WITH A DAMAGED COMPRESSOR					
<ul style="list-style-type: none"> <li>• COMPRESSOR CLUTCH — Seized</li> <li>• CLUTCH CYCLING SWITCH — Sticking Closed</li> <li>• SUCTION ACCUMULATOR DRIER — Refrigerant Oil Bleed Hole Plugged</li> <li>• REFRIGERANT LEAKS</li> </ul>					
(a) Compressor may make noise on initial run. This is slugging condition caused by excessive liquid refrigerant.					
(b) Compressor clutch may not cycle in ambient temperatures above 80°F depending on humidity conditions.					
(c) Low pressure reading will be <b>normal to high</b> if pressure is taken at accumulator and if restriction is downstream of service access valve.					
(d) Low pressure reading will be <b>low</b> if pressure is taken near the compressor and restriction is upstream of service access valve.					

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**FIG. 14 Refrigerant System Pressure and Clutch Cycle Timing Evaluation Chart—Fixed Orifice Tube/Clutch Cycling Pressure Switch**

## INSUFFICIENT OR NO A/C COOLING — FIXED ORIFICE TUBE CYCLING CLUTCH SYSTEM

TEST STEP		RESULT	ACTION TO TAKE
<b>A1</b>	VERIFY THE CONDITION		
	<ul style="list-style-type: none"> <li>Check system operation.</li> </ul>	System cooling properly System not cooling properly	INSTRUCT vehicle owner on proper use of the system. GO to <b>A2</b> .
<b>A2</b>	CHECK COOLING FAN		
	<ul style="list-style-type: none"> <li>Does vehicle have an electro-drive cooling fan?</li> </ul>	Yes No	GO to <b>A3</b> . GO to <b>A5</b> .
<b>A3</b>	CHECK A/C COMPRESSOR CLUTCH		
	<ul style="list-style-type: none"> <li>Does the A/C compressor clutch engage?</li> </ul>	Yes No	GO to <b>A4</b> . REFER to clutch circuit diagnosis in this section.
<b>A4</b>	CHECK OPERATION OF COOLING FAN		
	<ul style="list-style-type: none"> <li>Check to ensure electro-drive cooling fan runs when the A/C compressor clutch is engaged.</li> </ul>	Yes No	GO to <b>A5</b> . REFER to engine cooling fan circuit diagnosis, Section 27-10.
<b>A5</b>	COMPONENT CHECK		
	Under-hood check of the following: <ul style="list-style-type: none"> <li>Loose, missing or damaged compressor drive belt.</li> <li>Loose or disconnected A/C clutch or clutch cycling pressure switch wires/connectors.</li> <li>Disconnected resistor assembly.</li> <li>Loose vacuum lines or misadjusted control cables.</li> </ul> Inside vehicle check for: <ul style="list-style-type: none"> <li>Blown fuse/proper blower motor operation.</li> <li>Vacuum motors/temperature door movement — full travel.</li> <li>Control electrical and vacuum connections.</li> </ul>	OK but still not cooling Not OK	GO to <b>A7</b> . REPAIR and GO to <b>A6</b> .
<b>A6</b>	CHECK SYSTEM		
	<ul style="list-style-type: none"> <li>Check system operation.</li> </ul>	(OK) (X)	Condition Corrected. GO to <b>A1</b> . GO to <b>A7</b> .



## INSUFFICIENT OR NO A/C COOLING — FIXED ORIFICE TUBE CYCLING CLUTCH SYSTEM — Continued

TEST STEP		RESULT	ACTION TO TAKE
<b>A7</b>	<b>CHECK COMPRESSOR CLUTCH</b>		
<ul style="list-style-type: none"> <li>Use refrigerant system pressure/clutch cycle rate and timing evaluation charts.</li> </ul> After preparing car as follows: <ol style="list-style-type: none"> <li>Hook up manifold gauge set.</li> <li>Set function lever at max. A/C</li> <li>Set blower switch on high.</li> <li>Set temperature lever full cold.</li> <li>Close doors and windows.</li> <li>Use a thermometer to check temperature at center discharge register, record outside temperature.</li> <li>Run engine at approximately 1500 RPM with compressor clutch engaged.</li> <li>Stabilize with above conditions for 10-15 minutes.               <ul style="list-style-type: none"> <li>Check compressor clutch off/on time with watch. Refer to charts for normal clutch cycle timing rates.</li> </ul> </li> </ol>		Compressor cycles very rapidly (1 second on) (1 second off)	GO to <b>A8</b> .
		Compressor runs continuously (normal operation in ambient temperature above 27°C (80°F) depending on humidity conditions)	GO to <b>A9</b> .
		Compressor cycles slow	GO to <b>A8</b> .
<b>A8</b>	<b>CHECK CLUTCH CYCLING PRESSURE SWITCH</b>		
<ul style="list-style-type: none"> <li>Bypass clutch cycling pressure switch with jumper wire. Compressor on continuously.</li> <li>Hand feel evaporator inlet and outlet tubes.</li> </ul>		Outlet tube same temperature approximately -2°C - 4°C (28°F - 40°F) or slightly colder than inlet tube (after fixed orifice)	REPLACE clutch cycling pressure switch. Do not discharge system. Switch fitting has Schrader Valve. GO to <b>A9</b> .
		Inlet tube warm or (after fixed orifice) colder than outlet tube	GO to <b>A10</b> .
<b>A9</b>	<b>CHECK SYSTEM PRESSURES</b>		
<ul style="list-style-type: none"> <li>Compare readings with normal system pressure ranges.</li> </ul>		Clutch cycles within limits, system pressure within limits	System OK. GO to <b>A1</b> .
		Compressor runs continuously (normal operation in ambient temperature above 27°C (80°F) depending on humidity conditions).	GO to <b>A11</b> .
		Compressor cycles high or low ON above 359 kPa (52 psi) OFF below 144 kPa (21 psi).	REPLACE clutch cycling pressure switch. Do not discharge system. Switch fitting has Schrader valve. CHECK system. OK — GO to <b>A1</b> . NOT OK — GO to <b>A10</b> .



## INSUFFICIENT OR NO A/C COOLING — FIXED ORIFICE TUBE CYCLING CLUTCH SYSTEM — Continued

TEST STEP		RESULT	ACTION TO TAKE
<b>A10</b>	<b>CHECK SYSTEM</b>		
<ul style="list-style-type: none"> <li>Leak Check system.</li> </ul>		Leak found	▶ REPAIR, discharge, evacuate and charge system. System OK, GO to <b>A1</b> .
		No leak found	▶ Low refrigerant charge or moisture in system. Discharge, evacuate and charge system. System OK.
<b>A11</b>	<b>CHECK CLUTCH CYCLING</b>		
<ul style="list-style-type: none"> <li>Disconnect blower motor wire and check for clutch cycling off at 144 kPa (21 psi) (suction pressure).</li> </ul>		Clutch cycles OFF at 144-179 kPa (21-26 psi)	▶ Connect blower motor wire. System OK, GO to <b>A1</b> .
		Pressure falls below 144 kPa (21 psi)	▶ REPLACE clutch cycling pressure switch. Do not discharge system. Switch fitting has Schrader valve. System OK, GO to <b>A1</b> .

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## COMPRESSOR CLUTCH CIRCUIT DIAGNOSIS

TEST STEP		RESULT	ACTION TO TAKE
<b>B1</b>	<b>CHECK SYSTEM OPERATION</b>		
	<ul style="list-style-type: none"> <li>• Turn blower switch On.</li> <li>• Depress A/C push-button.</li> <li>• Turn ignition switch to Run position.</li> <li>• Compressor clutch should engage and engine cooling fan should operate.</li> </ul>	Clutch and fan operate ► Clutch and fan do not operate ► Only clutch operates ► Only fan operates ►	System OK. GO to <b>B2</b> . REFER to Section 27-11, Powertrain Shop Manual, Vol. E. GO to <b>B5</b> .
<b>B2</b>	<b>CHECK FOR VOLTAGE</b>		
	<ul style="list-style-type: none"> <li>• Check for voltage at circuit 348 (LG/P) wire at the clutch cycling pressure switch connector.</li> </ul>	Voltage present ► No voltage ►	GO to <b>B3</b> . GO to <b>B8</b> .
<b>B3</b>	<b>BY-PASS PRESSURE SWITCH</b>		
	<ul style="list-style-type: none"> <li>• Disconnect connector at clutch cycling pressure switch.</li> <li>• Jumper connector pins.</li> <li>• Clutch should engage.</li> </ul>	OK ► <del>OK</del> ►	GO to <b>B4</b> . GO to <b>B5</b> .
<b>B4</b>	<b>CHECK SYSTEM PRESSURE</b>		
	<ul style="list-style-type: none"> <li>• Connect manifold gauge set and check system pressure.</li> </ul>	Pressure above 55 psi. ► Pressure below 55 psi (ambient temperature above 50°F) ►	REPLACE clutch cycling pressure switch. GO to <b>A1</b> . CHECK refrigerant system for leaks. REPAIR and CHARGE system as necessary. GO to <b>A1</b> .
<b>B5</b>	<b>CHECK VOLTAGE AT CLUTCH</b>		
	<ul style="list-style-type: none"> <li>• Check for voltage at clutch field coil.</li> </ul>	Voltage present ► No voltage ►	GO to <b>B7</b> . GO to <b>B6</b> .
<b>B6</b>	<b>CHECK VOLTAGE AT CONTROLLER</b>		
	<ul style="list-style-type: none"> <li>• Check for voltage at Pin 23 at cooling fan controller.</li> </ul>	Voltage present ► No voltage ►	CHECK for open in circuit 347 (BK/Y H). SERVICE as necessary. GO to <b>A1</b> . GO to <b>B7</b> .

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## COMPRESSOR CIRCUIT CLUTCH DIAGNOSIS — Continued

TEST STEP		RESULT	ACTION TO TAKE
<b>B7</b>	CHECK VOLTAGE		
	<ul style="list-style-type: none"> <li>Check for voltage at pin 16 of cooling fan controller.</li> </ul>	Voltage present No voltage	GO to <b>B9</b> . REPLACE clutch field coil. GO to <b>B1</b> .
<b>B8</b>	CHECK FUSE		
	<ul style="list-style-type: none"> <li>Check Fuse 17 in fuse panel for continuity.</li> </ul>	OK OK	GO to <b>B9</b> . CHECK for short. SERVICE as necessary. REPLACE fuse. GO to <b>B1</b> .
<b>B9</b>	CHECK A/C CONTROLS		
	<ul style="list-style-type: none"> <li>Move Function selector lever to DEFROST position.</li> <li>Check for voltage at circuit 348 (LG/P) wire at the clutch cycling pressure switch connector.</li> </ul>	Voltage present No voltage	GO to <b>B11</b> . GO to <b>B10</b> .
<b>B10</b>	CHECK CIRCUIT 296		
	<ul style="list-style-type: none"> <li>Remove connector from A/C push-button switch.</li> <li>Check for voltage at circuit 296 (W/LB).</li> </ul>	Voltage present No voltage	GO to <b>B11</b> . CHECK for open in Circuit 296. SERVICE as necessary. GO to <b>B1</b> .
<b>B11</b>	CHECK A/C CONTROLS		
	<ul style="list-style-type: none"> <li>Check A/C push button switch and Function switch for continuity. <b>NOTE: A/C push-button switch must be depressed. Function switch must be in DEFROST position.</b></li> </ul>	No continuity through function switch Continuity through function switch	REPLACE Function switch. GO to <b>B1</b> . CHECK for open in circuit 348 (LG/P) between control assembly and clutch cycling pressure switch. SERVICE as necessary. GO to <b>B1</b> .

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(closed) position. Both gauges should show approximately 413-551 kPa (60-80 psi) at 24°C (75°F) with engine not running. If very little or no pressure is indicated, leave the vacuum pump valve closed, open the Refrigerant-12 tank valve, and set the low-pressure (suction) manifold gauge valve to the counterclockwise position. This opens the system to tank pressure.

**CAUTION: Avoid inhaling fumes from Rotunda Flame-Type Leak Detector 023-0006 or equivalent (Fig. 16).**

The smaller the flame the more sensitive it is to leaks. Therefore, to ensure accurate leak indication, keep the flame as small as possible. The copper element must be red hot. If it is burned away, replace the element. Hold the open end of the hose just below each suspected leak point for two or three seconds. The flame normally will be almost colorless. The slightest leak will be indicated by a

bright green-blue color to the flame. Check the manifold gauge set and hoses for leaks as well as the rest of the system.

**If the surrounding air is contaminated with refrigerant gas, the leak detector will indicate this gas all the time. Good ventilation is necessary to prevent this situation. A fan, even in a well-ventilated area, is very helpful in removing small traces of refrigerant vapor.**

Another testing device can be used to detect leaking refrigerant gas. This device is called the Rotunda Electronic Leak Detector 055-00014, 055-00015 or equivalent (Fig. 17).

The electronic leak detector is operated by moving the control switch to the ON position. The detector automatically calibrates itself when it is turned on. Move the probe approximately 25mm (1-inch) per second in

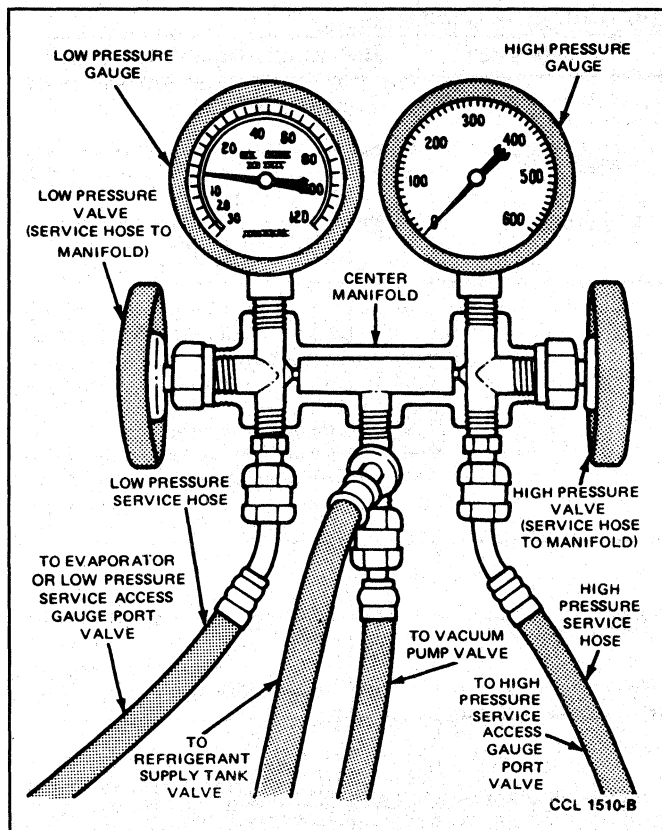


FIG. 15 Manifold Gauge Set

the suspected area. When escaping refrigerant gas is located, the ticking/beeping signal will increase in ticks/beeps per second. If the gas is relatively concentrated the signal will be increasingly shrill. Follow the instructions included with the detector to improve handling and operating techniques.

## REFRIGERANT SYSTEM SERVICE

Test equipment must be connected to the refrigerant system in order to make system tests. If a charging station is used, follow the instructions of the station manufacturer. If a manifold gauge set is used, connect it as outlined.

### Connecting the Manifold Gauge Set

1. Turn both manifold gauge set valves all the way to the right, to close the high and low pressure hoses to the center manifold and hose. A Rotunda Adapter D81L-19703-A (Motorcraft® Tool YT-354 or 355) (Fig. 9) or equivalent must be used to connect the manifold gauge set or charging station to the high pressure service gauge port valve.
2. Remove the caps from the high and low pressure service (Schrader) gauge port valves.
3. If the manifold gauge set or charging station hoses do not have valve depressing pins in them, install Fitting Adapters T71P-19703-S and R or equivalent (which have pins) on the low and high-pressure hoses.
4. Connect the high and low-pressure hoses, or adapters, to the respective high and low-pressure service gauge port valves (Fig. 10). The adapter shown in Fig. 12 must be used on the high-pressure gauge port valve.

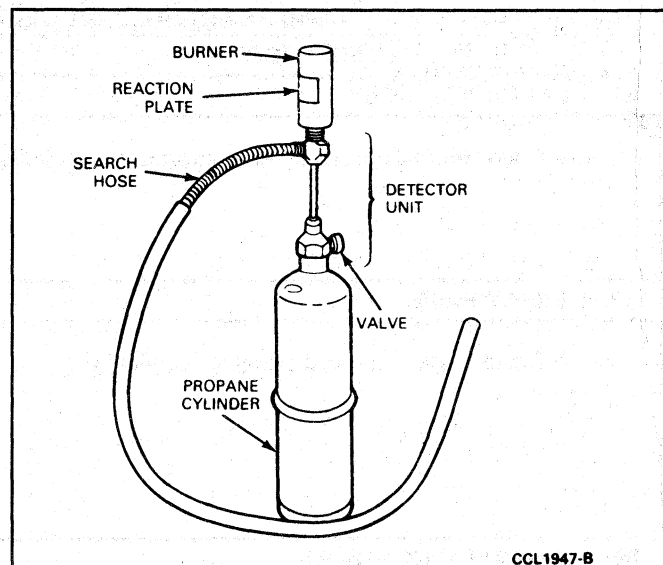


FIG. 16 Leak Detector—Flame Type

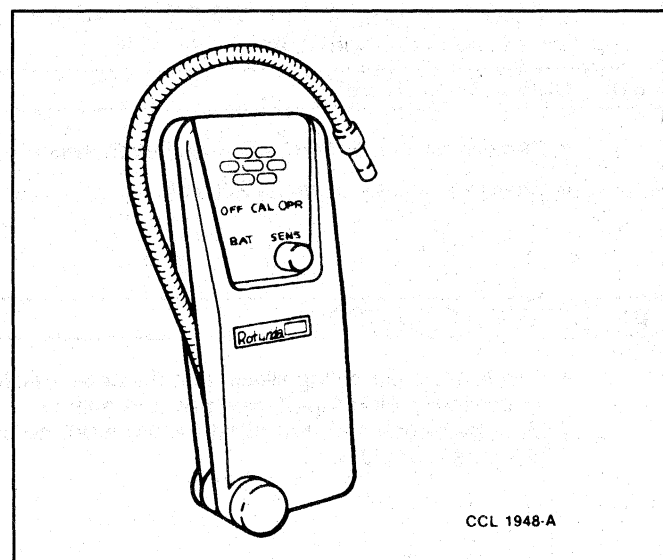


FIG. 17 Leak Detector—Electronic

### System Discharging

Discharge the refrigerant from the system before replacing any system component, except the clutch cycling pressure switch.

1. Ensure the manifold gauge set valves are turned all the way to the right, then attach the manifold gauge set as outlined.
2. Ensure the center hose connection at the manifold gauge set is tight.
3. Place the open end of the center hose in a garage exhaust outlet.
4. Open the low pressure valve of the manifold gauge set a slight amount and let the refrigerant discharge from the system slowly.
5. When the system is nearly discharged, open the high pressure gauge valve. Do so slowly to avoid refrigerant oil loss. This will allow any refrigerant trapped in the compressor and high pressure discharge line to discharge.

6. As soon as the system is completely discharged, close both the high and low pressure valves to prevent moisture from entering the system.

### System Evacuating

1. Connect manifold gauge set as outlined, if not yet connected.
2. Leak test the system as outlined.
3. Discharge the refrigerant system as outlined.
4. Ensure both manifold gauge valves are turned all the way to the right.
5. Ensure the center hose connection at the manifold gauge is tight.
6. Connect manifold gauge set center hose to a vacuum pump.
7. Open manifold gauge set valves and start the vacuum pump.
8. Evacuate the system with the vacuum pump until low-pressure gauge reads at least 84.2 kPa (25 in.-Hg) (vacuum) or as close to 101.04 kPa (30 in.-Hg) as possible. Continue to operate the vacuum pump for 15 minutes. If a part of the system has been replaced, continue to operate the vacuum pump for another 20 to 30 minutes.
9. When evacuation of system is complete, close the manifold gauge set valves and turn the vacuum pump off.
10. Observe low pressure gauge for 5 minutes to ensure system vacuum is held. If vacuum is held, charge the system. If vacuum is not held for 5 minutes, leak test the system, service the leaks, and evacuate the system again.

### System Charging

1. With the manifold gauge set valves closed to the center hose, disconnect the vacuum pump from the manifold gauge set.
2. Connect the center hose of the manifold gauge set to a refrigerant drum or a small can refrigerant dispensing valve Motorcraft Tool YT-280 or Tool YT-1034 or equivalent. If a small can dispensing valve is used, install the small can(s) on the dispensing valve.

NOTE: Use only a safety type dispensing valve.

3. Loosen the center hose at the manifold gauge set and open the refrigerant drum valve or small can dispensing valve. Allow refrigerant to escape to purge air and moisture from the center hose. Then, tighten the center hose connection at the manifold gauge set.
4. Disconnect the wire harness snap-lock connector from the clutch cycling pressure switch and install a jumper wire across the two terminals of the connector.
5. Open the manifold gauge set low side valve to allow refrigerant to enter system. Keep refrigerant can in an upright position if the vehicle low pressure service gauge port is not on the suction accumulator/drier or suction accumulator fitting.
6. When no more refrigerant is being drawn into the system, start the engine and move the air door lever to the VENT/HEAT/AC position, the blower switch to HI and depress the A/C ON-OFF push button to draw the remaining refrigerant into the system.

Continue to add refrigerant to the system until the specified weight of Refrigerant-12 is in the system. Then, close the manifold gauge set low pressure valve and the refrigerant supply valve.

7. Remove the jumper wire from the clutch cycling pressure switch snap-lock connector. Connect the connector to the pressure switch.
8. Operate the system until the pressures stabilize to verify normal operation and system pressures.
9. In high ambient temperatures, it may be necessary to operate a high volume fan positioned to blow air through the radiator and condenser to aid in cooling the engine and prevent excessive refrigerant system pressures.
10. When charging is completed and system operating pressures are normal, disconnect the manifold gauge set from the vehicle. Install protective caps on the service gauge port valves.

### Charging From Small Containers

Refrigerant-12 is available in cans as small as 392g (14 ounces). **Do not open the manifold gauge set high pressure (discharge) gauge valve when charging with small container. To do so can cause the small refrigerant container to explode.**

1. A special refrigerant dispensing valve and valve retainer such as Motorcraft YT-280 or equivalent is required for connecting the small can to the A/C system. Use only a safety type refrigerant dispensing valve and follow the manufacturer's instructions when attaching the valve to the refrigerant container.
2. Connect the manifold gauge set to the system. Connect the hose (normally connected to the large Refrigerant-12 tank) to the special valve on the small can adapter. Make sure that the valve is closed (full clockwise position).
3. Once the can is connected, charge the system as outlined. When the can is empty, close the valve and remove the empty can. Connect a new can, open the valve again and continue charging until the specified weight of Refrigerant-12 has entered the system.

Note the capacity of the refrigerant cans. If they contain less than 448g (16 ounces) of refrigerant, compensation for the weight less than 448g(16 ounces) must be made for each can of refrigerant used. For example, when a 226.8g (8 ounces) of refrigerant is needed such as with a 2-1/2 pound charge capacity and 392g (14-ounce) cans of refrigerant are used, all but 56g (2 ounces) of the third 392g (14-ounce) can of refrigerant should be installed in the system. Weigh the can to make sure the correct amount of refrigerant is installed.

### Refrigerant System Purging to Remove Air and Moisture Vapor

The triple evacuation procedures should be used when there are definite indications of moisture in the system. This procedure is effective in removing small amounts of moisture from the refrigerant system. However, if system is contaminated with a large quantity of water, complete system flushing will be required.

The principle of the three evacuations is simple. The first pulldown removes approximately 90 percent of the air and moisture vapors.

The first purge with new, dry Refrigerant-12 mixes with the remaining 10 percent.

With the next evacuation, this mixture will be drawn out so that only approximately 10 percent of the remaining air and moisture vapors remain.

The second purge with new, dry Refrigerant-12 will mix with this 10 percent and the third evacuation will finish the job by drawing out practically all the remaining vapors.

If any water was present in the system at the start of this procedure, most of it will still be there. A short period of vacuum is not long enough to boil and vaporize the water. The Refrigerant-12 purges, in passing over the liquid, will absorb only a relatively small amount of water.

This procedure is effective only when no water is in the system, and should not be used if there is any indication of water in the system.

### Cleaning a Badly Contaminated Refrigerant System

A refrigerant system can become badly contaminated for a number of reasons.

- The compressor may have failed due to damage or wear.
- The compressor may have been run for some time with a severe leak or an opening in the system.
- The system may have been damaged by a collision and left open for some time.
- The system may not have been cleaned properly after a previous failure.
- The system may have been operated for a time with water or moisture in it.

A badly contaminated system contains water, carbon and other decomposition products. When such a condition exists, the system must be flushed with a special flushing agent using equipment designed especially for this purpose. Follow the suggestions and procedures outlined for proper cleaning.

### Flushing Agents

A refrigerant, to be suitable as a flushing agent, must remain in liquid state during the flushing operation, in order to wash the inside surfaces of the system components. Refrigerant vapor will not remove contaminant particles. They must be flushed with a liquid. Some refrigerants are better suited for this purpose than others (Fig. 18).

The chart Fig. 18, reflects pressure/temperature relationship and the vaporization temperature for four refrigerants. Neither Refrigerant-12 nor Refrigerant-114 is suitable for flushing a system because of low vaporization (boiling) points: -29.8°C (-21.6°F) for Refrigerant-12 and 3.5°C (38.4°F) for Refrigerant-114. Both of these refrigerants would be difficult to use and would not do a sufficient job because of the tendency to vaporize rather than remain in a liquid state, especially in high ambient temperatures.

The two remaining refrigerants listed in the chart (Refrigerant-11 and Refrigerant-113) are much better suited for use with special flushing equipment. Both have rather high vaporization points: 23.7°C (74.7°F) for Refrigerant-11 and 47.5°C (117.6°F) for Refrigerant-113. Both refrigerants also have low closed container pressures. This reduces the danger of an accidental system discharge due to a ruptured hose or fitting. Refrigerant-113 will do the best job and is recommended as a flushing refrigerant. Both Refrigerant-11 and Refrigerant-113 require a propellant or pump-type flushing equipment due to their low closed container pressures. Refrigerant-12 can be used as a propellant with either flushing refrigerant. Refrigerant-11 is available in pressurized containers. Although not recommended for regular use, it may become necessary to use Refrigerant-11 if special flushing equipment is not available. It is more toxic than other refrigerants and should be handled with extra care.

**CAUTION: Use extreme care and adhere to all safety precautions related to the use of refrigerants when flushing a system.**

### Special Flushing Equipment

Special refrigerant system flushing equipment is available from a number of air conditioning equipment manufacturers and usually comes in kit form. A flushing kit consists of a cylinder for the flushing agent, a nozzle to introduce the flushing agent into the system and a connecting hose (Fig. 19).

Another type of equipment, which must be connected into the system, allows for the continuous circulation of the flushing agent through the system with the contaminants being trapped by an external filter/drier. If equipment other than Refrigerant System Flushing Kit is used, follow the manufacturer's instructions and safety precautions carefully.

### System Cleaning and Flushing

When it is necessary to flush a refrigerant system, the suction accumulator/drier must be removed and

REFRIGERANT FLUSHING INFORMATION CHART

Refrigerant	Vaporizes °C(°F)①	Approximate Closed Container Pressure① kPa (psi)②					Adaptability
		15.57°C (60°F)	21.13°C (70°F)	26.69°C (80°F)	32.25°C (90°F)	37.81°C (100°F)	
R-12	-29.80 (-21.6)	393 (57)	483 (70)	579 (84)	689 (100)	807 (117)	Self Propelling
F-114	3.56 (38.4)	55.16 (8)	89.63 (13)	131 (19)	172 (25)	221 (32)	
F-11③	23.74 (74.7)	27 (8 in Hg)	10 (3 in Hg)	7 (1)	34 (5)	62 (9)	
F-113	47.59 (117.6)	74 (22 in Hg)	64 (19 in Hg)	54 (16 in Hg)	44 (13 in Hg)	27 (8 in Hg)	Pump Required

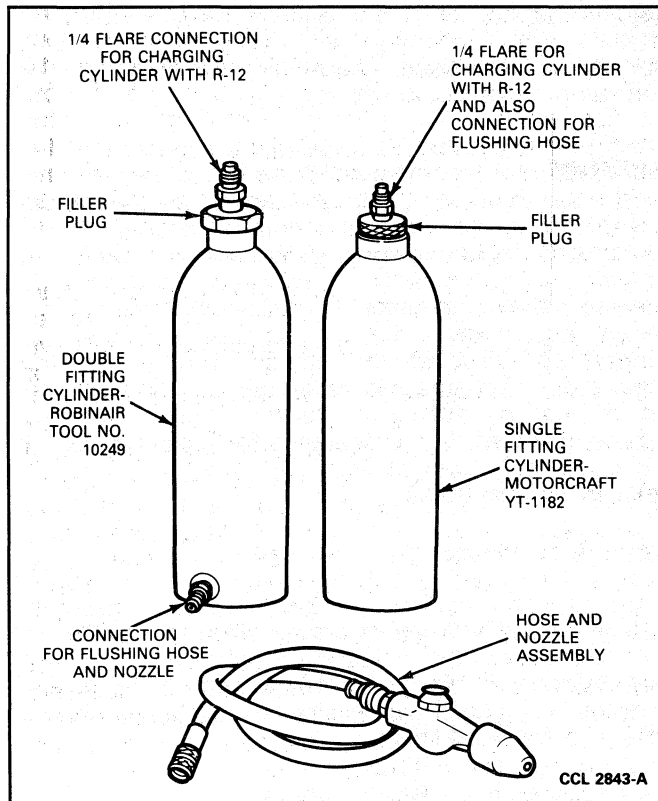
① At sea level atmospheric pressure.

② kPa (psi) unless otherwise noted.

③ F-11 is also available in pressurized containers. This makes it suitable for usage when special flushing equipment is not available. However, it is more toxic than R-12 and F-114.

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FIG. 18 Refrigerant Flushing Chart



**FIG. 19 Refrigerant System Flushing Kit**

replaced, as it is impossible to clean. Remove the fixed orifice tube. If a new tube is available, replace the contaminated one. Otherwise, wash it carefully in flushing refrigerant or mineral spirits and blow it dry. If it does not show signs of damage or deterioration, it may be reused. Install new O-rings.

Any moisture in the evaporator core will be removed during leak testing and system evacuation following the cleaning job. Perform each step of the cleaning procedure carefully as outlined:

1. Check hose connections at flushing cylinder outlet and flushing nozzle to ensure they are secure.
2. Ensure flushing cylinder is filled with approximately one pint of Refrigerant-113 and valve assembly on top of the cylinder is tightened securely.
3. Connect a can of Refrigerant-12 to Schrader valve at the top of charging cylinder. A refrigerant hose and a special safety-type refrigerant dispensing valve, such as Motorcraft YT-280 refrigerant dispensing valve and a valve retainer or equivalent, are required for connecting the small can to the cylinder. Ensure all connections are secure.
4. Connect a gauge manifold and discharge system. Disconnect gauge manifold.
5. Remove and discard suction accumulator/drier. Install a new accumulator/drier and connect it to evaporator. Do not connect it to suction line from compressor. Ensure protective cap is in place on suction line connection.
6. Replace fixed orifice tube. Install a protective cap on evaporator inlet tube as soon as new orifice tube is in place. Liquid line will be connected later.
7. Remove compressor from vehicle for cleaning and service or replacement, whichever is required. If compressor is cleaned and serviced, add specified amount of refrigerant oil prior to installing in vehicle. Place protective caps on compressor inlet and outlet connections and install it on mounting brackets in vehicle. If compressor is replaced, adjust oil as outlined in Section 36-39. Install shipping caps on compressor connections. Install new compressor on mounting brackets in vehicle.
8. Back-flush condenser and liquid line as follows:
  - a. Remove two O-rings from condenser inlet tube spring lock coupling.
  - b. Remove discharge hose from condenser and clamp a piece of (1/2-inch ID) heater hose to condenser inlet line. Ensure hose is long enough to insert free end into a suitable waste container to catch the flushing refrigerant.
  - c. Move flushing equipment into position and open valve on can of Refrigerant-12 (fully counterclockwise).
  - d. Back-flush condenser and liquid line by introducing flushing refrigerant into supported end of liquid line with flushing nozzle. Hold nozzle firmly against open end of liquid line.
  - e. After liquid line and condenser have been flushed, lay charging cylinder on its side so that Refrigerant-12 will not force more flushing refrigerant into liquid line. Press nozzle firmly to liquid line and admit Refrigerant-12 to force all flushing refrigerant from liquid line and condenser.
  - f. Remove (1/2-inch) hose and clamp from condenser inlet connection.
  - g. Stand flushing cylinder upright and flush compressor discharge hose. Secure it so flushing refrigerant goes into waste container.
  - h. Close dispensing valve of Refrigerant-12 can (full clockwise). If there is any flushing refrigerant in cylinder, it may be left there until next flushing job. Put flushing kit and Refrigerant-12 can in a suitable storage location.
  - j. Install new lubricated O-rings on spring lock coupling male fittings on both condenser inlet and liquid lines. Assemble couplings.
9. Connect all refrigerant lines. All connections should be cleaned and new O-rings should be used. Lubricate new O-rings with clean refrigerant oil.
10. Connect a charging station or manifold gauge set and charge system with one pound of Refrigerant-12. (Do not evacuate system until after it has been leak tested).
11. Leak-test all connections and components with a flame-type leak detector (such as Rotunda Flame-Type Leak Detector 023-00006 or equivalent) or an electronic leak detector (such as Rotunda Electronic Leak Detector 055-00014 or 055-00015 or equivalent). If no leaks are found, go to Step 12. If leaks are found, service as necessary, check system and then go to Step 12.
12. Evacuate and charge system with specified amount of Refrigerant-12. Operate system to ensure it is cooling properly.



**Accumulator/Drier**

Drain the oil from the removed accumulator/drier through the inlet fitting. Drain the oil into a calibrated measuring container. Add the same amount of clean refrigerant oil plus 1 fluid ounce (29.5ml) to the new accumulator/drier before it is installed.

NOTE: If more than 5 fluid ounces (147ml) of refrigerant oil is removed from an accumulator/drier, it is an indication that the oil drain hole in the accumulator/drier is plugged. Always check the accumulator/drier for excessive oil if the compressor has been replaced for lack of performance.

**Evaporator Core**

Add 3 fluid ounces (88.7ml) of clean refrigerant oil to the accumulator/drier inlet tube whenever the evaporator core is replaced. This will compensate for the refrigerant oil lost in the replaced evaporator core.

**Condenser**

Add 1 fluid ounce (29.5ml) of clean refrigerant oil to the condenser or the accumulator/drier if the condenser is replaced.

**Other Refrigerant System Components**

Replacement of other refrigerant system components such as hoses, compressor valves, and pressure switches does not require the addition of refrigerant oil.

**Adding Refrigerant Oil**

The FS-6 compressor uses a 500 viscosity refrigerant oil (C9AZ-19557-B or Motorcraft YN-2 or equivalent). An oil charge of 300ml (10 fluid ounces) is required in a new system. It is important that only the specified type and quantity of refrigerant oil be used in the compressor. If

there is surplus oil in the system, too much oil will circulate with the refrigerant, reducing the cooling capacity of the system. Too little oil will result in poor lubrication of the compressor.

When it is necessary to replace a component of the refrigeration system, the procedures in this Section must be followed to ensure the total oil charge on the system is correct after the new component is installed. During normal A/C operation, some refrigerant oil is circulated through the system with the refrigerant and some is retained in the compressor. If certain components of the system are removed for replacement, some of the refrigerant oil will go with the component. To maintain the original total oil charge, it is necessary to compensate for the oil lost by adding oil to the system with the replacement part. The procedures for replacing lost oil follow. Do not exceed the total oil charge for the system. Refer to Section 36-37.

**During Compressor Replacement**

A new service replacement FS-6 compressor contains 10 fluid ounces (300ml) of the specified refrigerant oil. Prior to installing the replacement compressor, drain 4 fluid ounces (118ml) of refrigerant oil from the compressor. This will maintain the total system oil charge within the specified limits.

**During Component Replacement**

When replacing other components of the A/C refrigerant system, measured quantities of 500 viscosity refrigerant oil should be added to the component to ensure the total oil charge in the system is correct before the system is operated. Clean refrigerant oil should be poured directly into the replacement component.



## SPECIFICATIONS

## REFRIGERANT SYSTEM COMPONENTS AND CAPACITIES

Vehicle ②	Compressor FS-6	Clutch Cycling Pressure Switch ①	Fixed Orifice Tube	Refrigerant Capacity*	
				(oz.)	(kg.)
Taurus/Sable	X	X	X	40	1.134

\*Plus (2 oz.) (.056 kg.) minus (2 oz.) (.056 kg.)

① Pressure switch opens at 169 kPa (24.5 psi)

② All models equipped with Suction Accumulator Drier

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## SPECIAL SERVICE TOOLS

Part Number	Motorcraft Part Number	Description	Part Number	Motorcraft Part Number	Description
T63L-8620-A	YT-371	Belt Tension Gauge	T81P-19623-G1	—	Spring-Lock Coupling Disconnect Tool — 3/8 inch
D81L-19703-A	YT-367	Service Access Adapter (High Pressure)	T81P-19623-G2	—	Spring-Lock Coupling Disconnect Tool — 1/2 inch
Rotunda 055-00014	YT-288	Electronic Leak Detector	T83P-19623-C	—	Spring-Lock Coupling Disconnect Tool — 5/8 inch
Rotunda 023-00006	YT-202	Flame Type Leak Detector	T85L-19623-A	—	Spring-Lock Coupling Disconnect Tool — 3/4 inch
Rotunda 023-00007	YT-227	Dial Thermometer	T57L-500-B	—	Bench Mounted Holding Fixture
—	YT-204	Safety Shield Goggles	T83P-18532-AH	—	Control Cable Removal Tool
Rotunda 023-00009	YT-229	Small Can Adapter	—	YT-280	Dispensing Valve
Rotunda 063-00010	YT-201	Manifold Gauge Set			

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# SECTION 36-37 Compressor and Clutch—FS-6

SUBJECT	PAGE	SUBJECT	PAGE
DESCRIPTION AND OPERATION .....	36-37-1	REMOVAL AND INSTALLATION (Cont'd.)	
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MAJOR SERVICE OPERATIONS		SPECIAL SERVICE TOOLS .....	36-37-11
Head Gasket and O-Ring, Rear .....	36-37-9	SPECIFICATIONS .....	36-37-10
Head Replacement .....	36-37-10	TESTING	
Shaft Seal and/or Front Head Gasket and O-Ring .....	36-37-7	Compressor External Leak Test .....	36-37-2
Valve Plates and Inlet Reeds .....	36-37-9	Compressor Manifold Leak Test .....	36-37-2
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## VEHICLE APPLICATION

Taurus/Sable.

## DESCRIPTION AND OPERATION

A swash plate design six-cylinder compressor is used on all models. The compressor is designated as the FS-6 (Fig. 1).

The compressor main shaft is driven by a belt from the engine crankshaft pulley. Three double-acting pistons, positioned axially around the compressor shaft, operate in a front and rear cylinder assembly. The pistons are actuated by a swash plate that is pressed on the compressor shaft. The swash plate changes the rotating action of the shaft to provide a reciprocation driving force to each of the three pistons. This driving force is applied, through shoes and balls, to the midpoint of each of the double ended pistons.

Reed-type suction and discharge valves are mounted in valve plates between the cylinder assembly and the head at each end of the compressor. The heads are

connected with each other by gas-tight passageways which direct refrigerant gas to a common output.

A magnetic clutch is used to drive the compressor shaft. When voltage is applied to the clutch field coil, the clutch plate and hub assembly (which is solidly coupled to the compressor shaft) is drawn rearward by magnetic force toward the pulley which rotates freely on the compressor front head casting. The magnetic force locks the clutch plate and hub assembly and the pulley together as one unit. The compressor shaft then turns with the pulley. When voltage is removed from the clutch field coil, springs in the clutch plate and hub assembly move the clutch plate away from the pulley and the clutch plate, hub assembly and compressor shaft cease to rotate.

## MAINTENANCE

### Adding Refrigerant Oil

The FS-6 compressor uses a 500 viscosity refrigerant oil C9AZ-19557-B or Motorcraft YN-2 or equivalent. An oil charge of 300ml (10 fluid ounces) is required in a new system. It is important that only the specified type and quantity of refrigerant oil be used in the compressor. If there is a surplus of oil in the system, too much oil will circulate with the refrigerant, reducing the cooling capacity of the system. Too little oil will result in poor lubrication of the compressor.

When it is necessary to replace a component of the refrigerant system, the procedures in this Section must be followed to ensure that the total oil charge in the system is correct after the new part is installed. When the compressor is operated, oil gradually leaves the compressor and is circulated through the system with the refrigerant. Eventually a balanced condition is reached in which a certain amount of oil is retained in the compressor and a certain amount is continually circulated. If a component of the system is removed after the system has been operated, some oil will go with it. To maintain the original total oil charge, it is necessary to compensate for this by replacing the oil in the new replacement part.

The procedures for replacing oil follow.

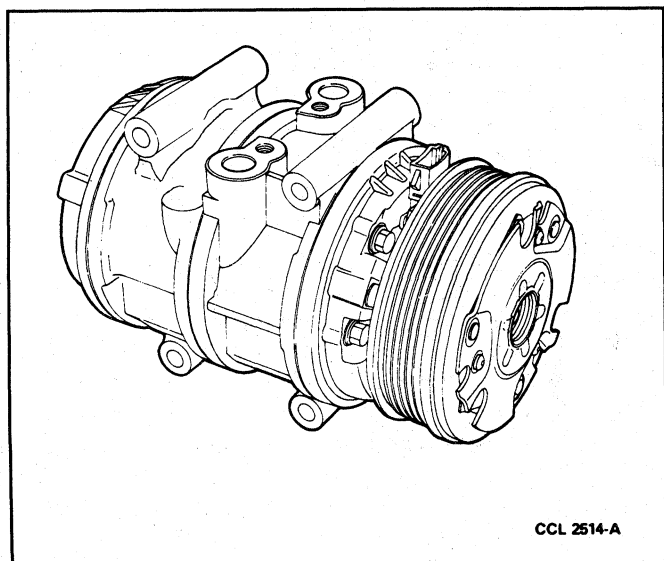


FIG. 1 Tangential Mount FS-6 Compressor

### During Compressor Replacement

A new service replacement FS-6 compressor contains 300ml (10 fluid ounces) of the specified refrigerant oil. Prior to installing the replacement compressor, drain 120ml (4 fluid ounces) of refrigerant oil from the compressor. This will maintain the total system oil charge within the specified limits.

### During Component Replacement

When replacing other components of the air conditioning refrigerant system, measured quantities of 500 viscosity refrigerant oil should be added to the component to ensure that the total oil charge in the system is correct before the system is operated.

Clean refrigerant oil should be added to the replacement components as follows:

- **Evaporator Core:** Add 90ml (3 fluid ounces).
- **Condenser:** Add 30ml (1 fluid ounce).
- **Accumulator:** Drain oil from removed accumulator/drier. Add same amount plus 30ml (1 fluid ounce) of clean refrigerant oil to new accumulator.

Clean refrigerant oil should be poured directly into the replacement component.

If any other components, such as valves or hoses are replaced, no additional refrigerant oil is necessary.

## TESTING

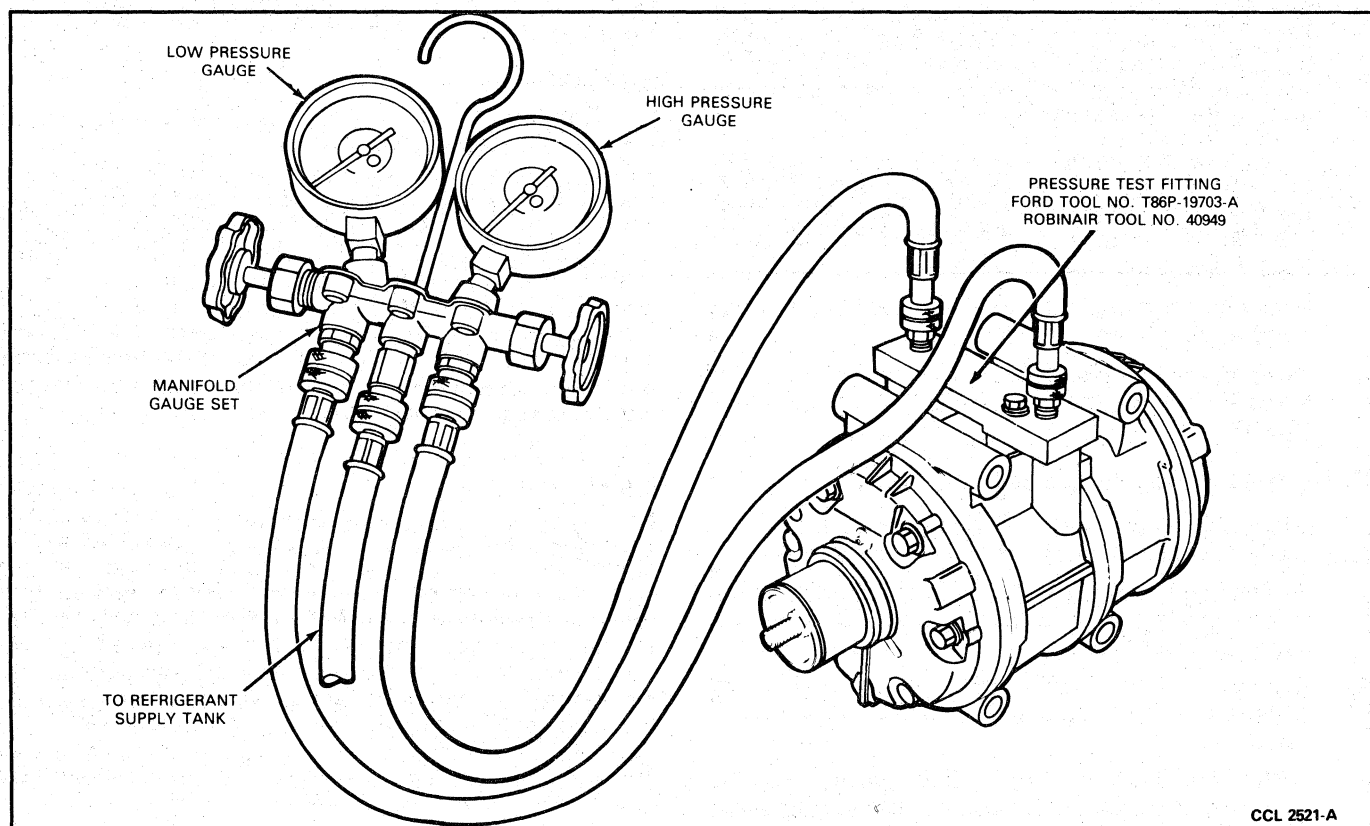
### Compressor Manifold Leak Test

1. Tighten manifold retaining bolts to 18-23 N·m (13-17 lb-ft).
2. Leak test manifold O-ring seals.

3. If no leaks are found during the leak test, the manifold O-ring seals are good.
4. If a leak is found at the manifold and the manifold bolts are tightened to 18-23 N·m (13-17 lb-ft), install new manifold O-ring seals and repeat the leak test procedure.

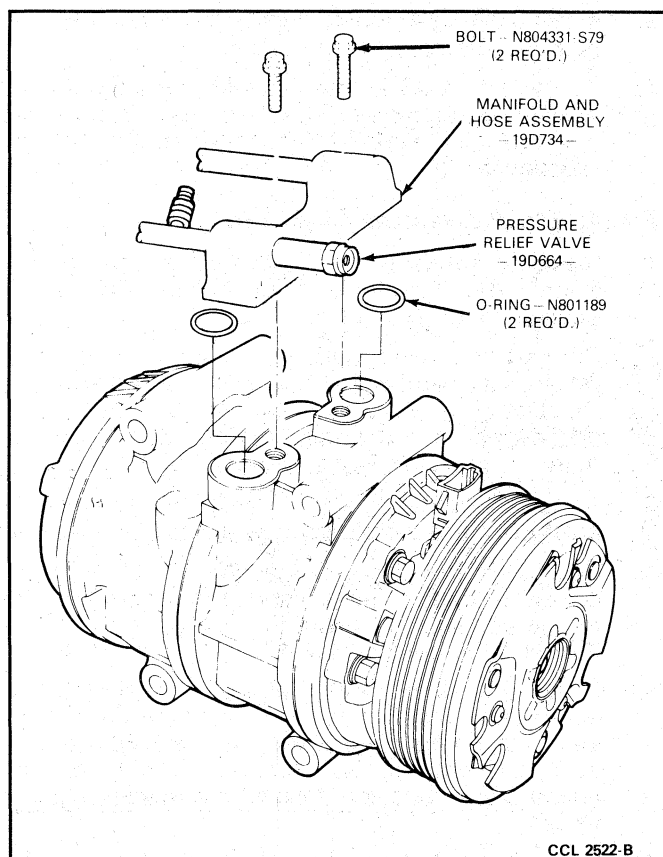
### Compressor External Leak Test

1. Remove the hose and manifold assembly and install the Pressure Test T86P-19703-A or equivalent, on the compressor.
2. Connect the high and low-pressure lines of a manifold gauge set such as Rotunda Air Conditioning Service Tool Kit 063-00010 or equivalent, to the corresponding fittings on the manifold pressure test adapter (Fig. 2).
3. Attach the center hose of the manifold gauge set to a refrigerant drum standing in an upright position.
4. Open the low-pressure gauge valve, the high-pressure gauge valve, and the valve on the refrigerant drum to allow the refrigerant vapor to flow into the compressor.
5. Using a leak detector, check for leaks at the compressor rear head seal, compressor front head seal, the compressor shaft seal, the center joint seal and around the compressor cylinder bolt heads. After checking, turn off the manifold gauge valves.
6. If an external leak is found at either head, manifold or at the shaft seal, service as necessary. If an external leak is found at the center joint of the compressor body, install a new compressor assembly.



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FIG. 2 Compressor Testing for External Leaks—Typical



**FIG. 3 FS-6 Single Port Manifold and Hose Assembly Installation**

7. If a refrigerant leak is found at a cylinder bolt head, remove the bolt and inspect the underside of the bolt head and the sealing surface around the bolt hole in the head for any damage. Replace the bolt if damage is found on the underside of the bolt head. Replace the compressor front head if damaged around the bolt hole (Fig. 3).

If no damage is found to either the bolt head or the bolt hole sealing surface, install a new bolt. Tighten the bolt approximately 5 N·m (3.7 lb-ft) tighter than the specified torque. Do not exceed the maximum torque. Leak test the compressor as outlined.

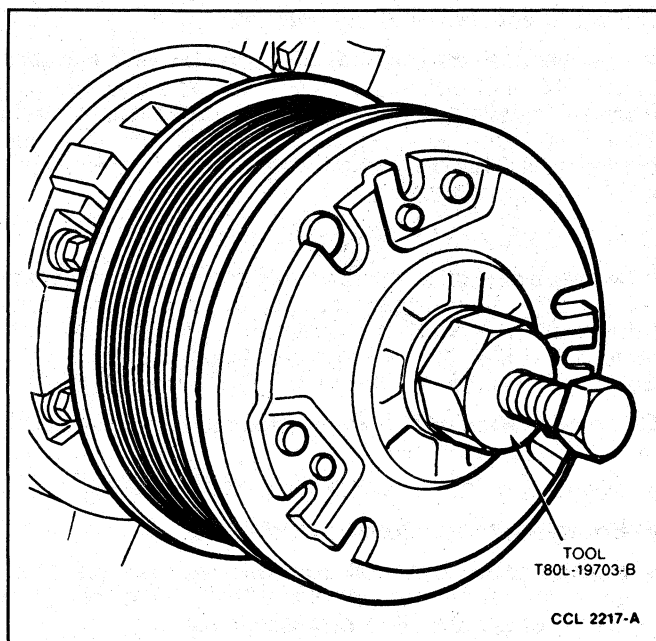
If the bolt head still leaks, install a new front cylinder head and leak test as outlined.

8. Disconnect the manifold gauge hoses from the Pressure Test Adapter T86P-19703-A or equivalent (Fig. 4).

### Compressor Rotating Torque Check

The rotational torque of a used compressor should be checked if excessive compressor drag is suspected.

1. Discharge refrigerant system following recommended service procedures. Observe all safety precautions.
2. Remove refrigerant hose manifold from compressor. Use care not to allow dirt to enter compressor.
3. With compressor clutch disengaged, rotate compressor clutch shaft and note the torque while rotating the compressor shaft not the starting torque.



**FIG. 4 Clutch Hub—Removal**

4. If the rotational torque exceeds specification, replace the compressor assembly.
5. If the rotational torque is less than the specified rotational torque, excessive drag does not exist in the compressor. Install the hose manifold and leak test, evacuate and charge the system.
6. Check the system for proper operation.

## REMOVAL AND INSTALLATION

### Suction or Discharge Manifold and Hose Assembly

#### Removal

1. Discharge refrigerant from system following recommended procedures.
2. Disconnect the manifold suction line fitting at the spring lock coupling near the bottom of radiator with Tool T85L-19623-A (3/4 inch—color coded white). Refer to Section 36-32.
3. Disconnect the manifold discharge line at the condenser using Spring Lock Coupling Disconnect Tool T81P-19623-G2 (1/2 inch—color coded blue).
4. Remove two bolts attaching the manifold and hose assembly to the compressor, and remove the manifold and O-rings (Fig. 5).

#### Installation

1. Lubricate new O-rings with clean refrigerant oil and position them in the O-ring grooves of the manifold.
2. Apply Loctite sealer D8AZ-19554-A or equivalent to the threads of the manifold attaching bolts.  
NOTE: When installing a compressor, use the manifold attaching bolts removed from the old (removed) compressor. Do not use the bolts from the new compressor.
3. Position manifold and hose assembly with O-rings to the vehicle and to the compressor.
4. Connect the suction and discharge lines to the condenser and suction line at the spring lock

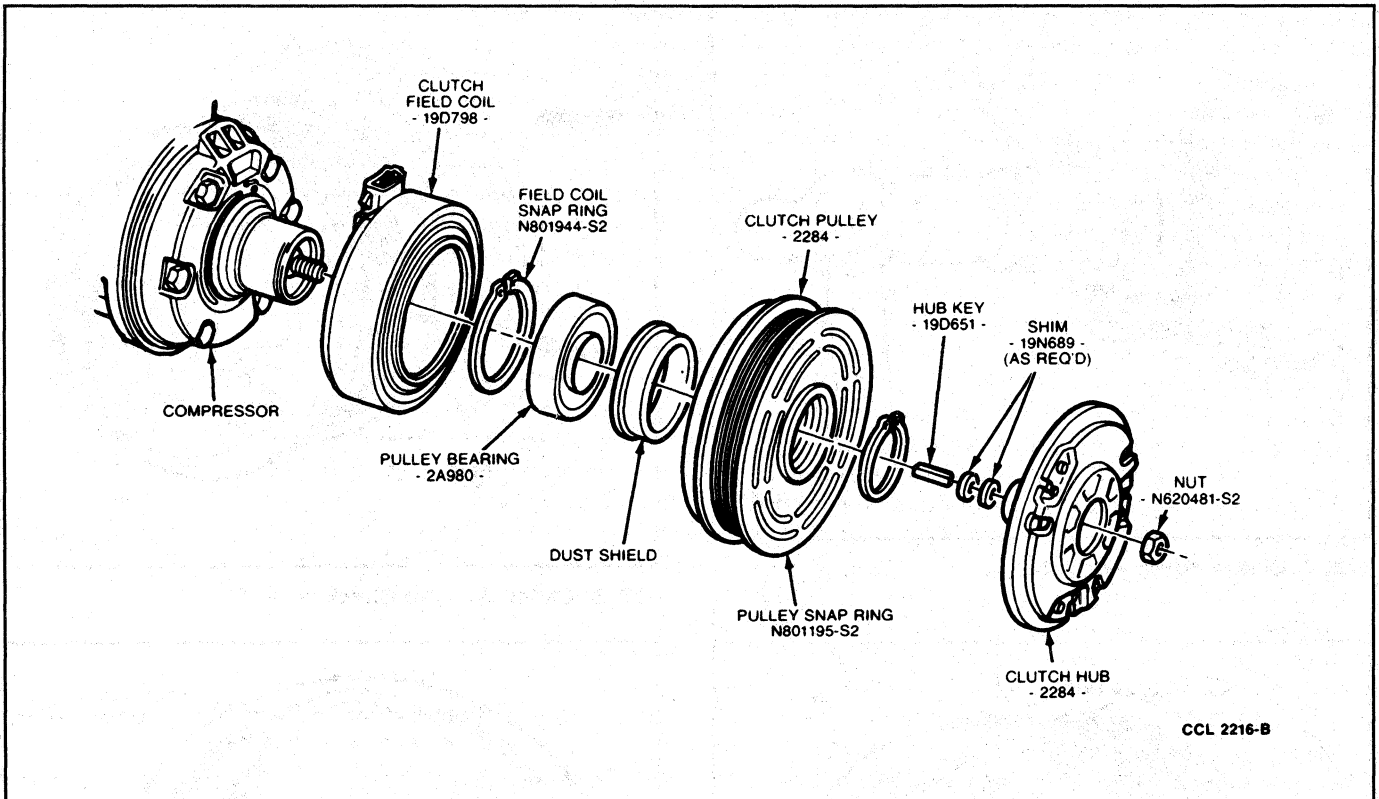


FIG. 5 Clutch Assembly Disassembled

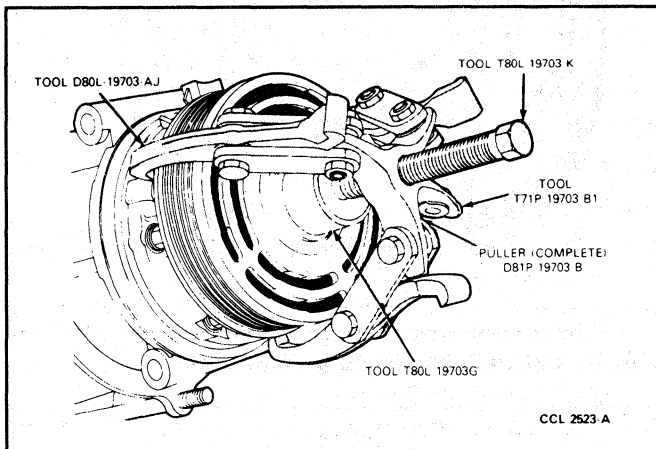


FIG. 6 Clutch Pulley—Removal

couplings. Use new O-rings and lubricate with clean refrigerant oil.

NOTE: Use only the specified O-rings.

5. Install two bolts to attach the manifold assembly to the compressor. Tighten bolts to specification.
6. Leak test, evacuate and charge the system following the recommended procedures. Observe all safety precautions.

### Clutch Hub and Pulley

#### Removal

1. Remove the clutch hub retaining nut. Use Spanner Wrench T70P-4067-A or equivalent, if necessary.
2. Remove the hub and shim(s) from the compressor shaft with Hub Remover T80L-19703-B or equivalent (Fig. 4). Hold the tool with a 1-inch

wrench and tighten the bolt with a 1/2-inch wrench to pull the hub from the compressor shaft.

3. Remove the pulley retaining snap ring (Fig. 5).
4. Pull pulley and bearing assembly from compressor. Use Compressor Shaft Protector T80L-19703-G and Complete Puller D81P-19703-B or equivalent (Fig. 6), if the pulley cannot be removed from compressor by hand.

#### Installation

1. Clean the pulley bearing surface of the compressor head to remove any dirt or corrosion.
2. Install the pulley and bearing on the compressor. The bearing is a slip fit on the compressor head and, if properly aligned, should slip on the compressor head. If difficulty is encountered installing the pulley, gently tap the pulley on the compressor using Pulley Replacer T80L-19703-J or equivalent (Fig. 7). Ensure the pulley bearing is aligned with the compressor head.
3. Install the pulley retaining snap ring with the bevel side of the snap ring out.
4. Using the two thickest shims between the hub and the end of the compressor shaft, align the shaft key with the keyway in the hub and install the hub on the compressor shaft. Use Hub Replacer T80L-19703-F or equivalent to press the hub on the shaft if necessary (Fig. 8). Do not attempt to drive the hub on the compressor shaft as damage to the compressor will result. Use only the specified tool if the hub will not easily slide on the shaft.
5. Install the hub retaining nut on the compressor shaft. Tighten the hub retaining nut to specification.

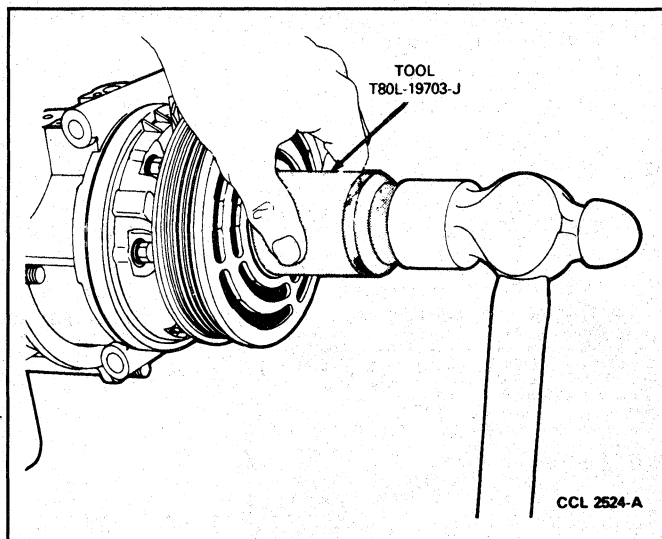


FIG. 7 Clutch Pulley—Installation

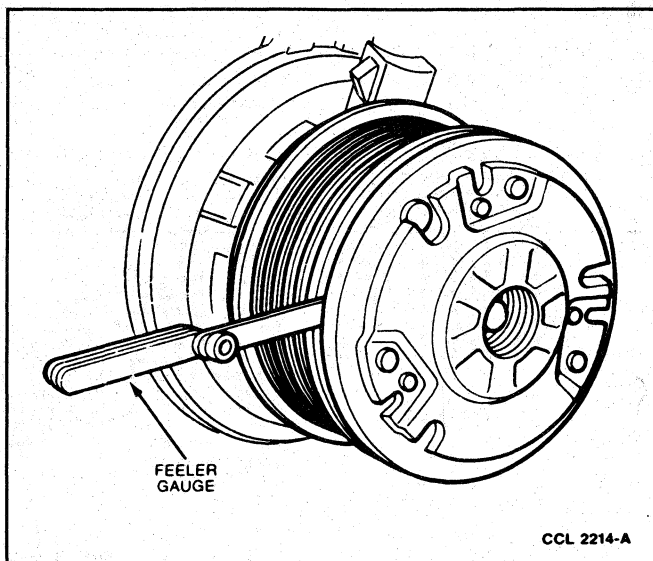


FIG. 9 Clutch Air Gap Check

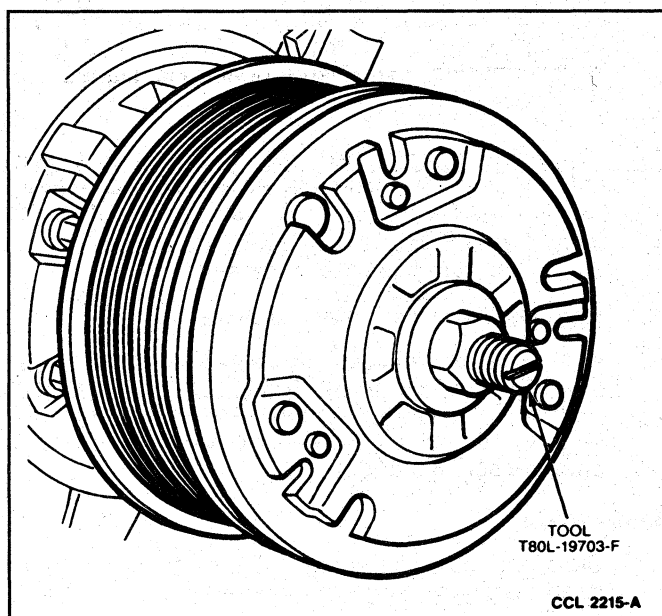


FIG. 8 Clutch Hub—Installation

6. Check and record the air gap between the hub and the mating pulley surfaces in three locations equally spaced around the pulley (Fig. 9).
7. Rotate the compressor pulley one-half turn (180 degrees) and again check the air gap in three equally spaced locations. The smallest air gap must be within the limits of the specified air gap. Add or remove shims as necessary until the smallest air gap is within specification.

### Clutch Field Coil

#### Removal

1. Remove the clutch hub and pulley as outlined.
2. Remove the snap ring connecting the clutch field coil to the front of the compressor.
3. Remove the clutch field coil from the compressor.

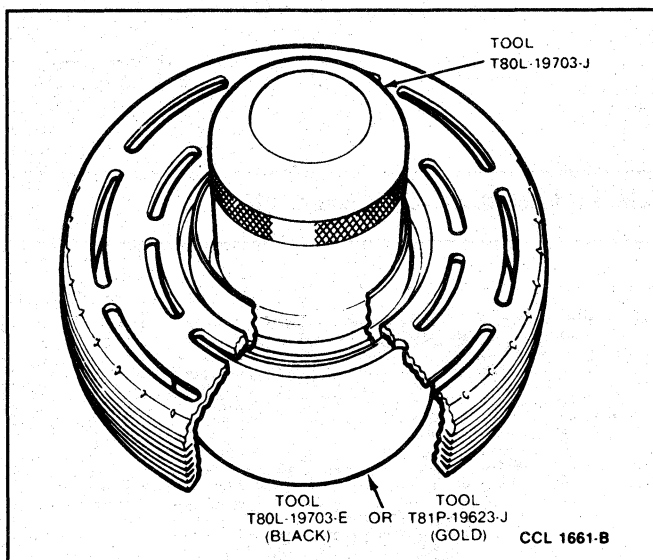


FIG. 10 Clutch Pulley Bearing—Removal

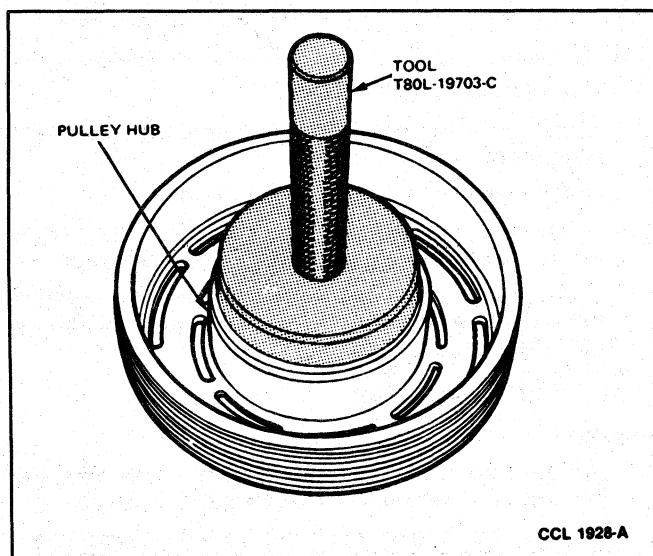
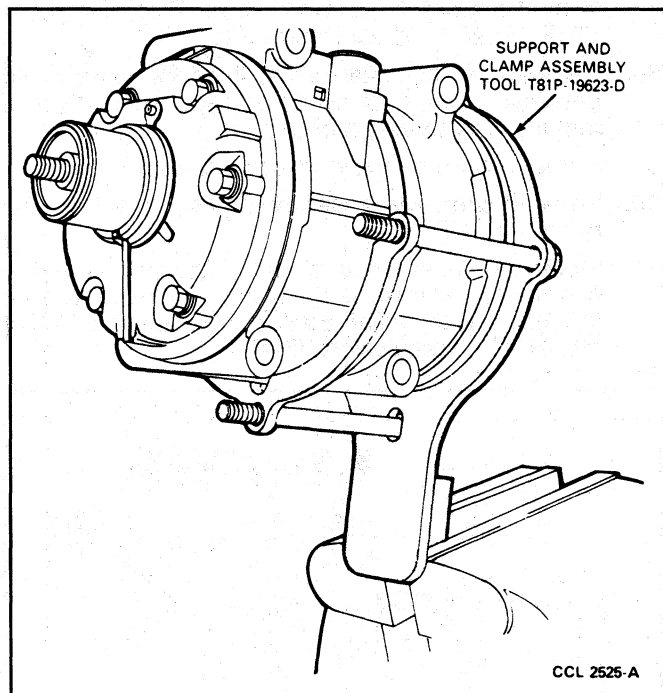


FIG. 11 Clutch Pulley Bearing—Installation

### Installation

1. Position the clutch field coil to the compressor, engaging the locator pin on the compressor head with the hole in the clutch field coil.
2. Install snap ring to retain clutch field coil on the compressor with bevel side of snap ring out.



**FIG. 12 Support and Clamp Assembly Installed for Front Head Removal**

3. Install clutch pulley and hub assemblies on the compressor as outlined.

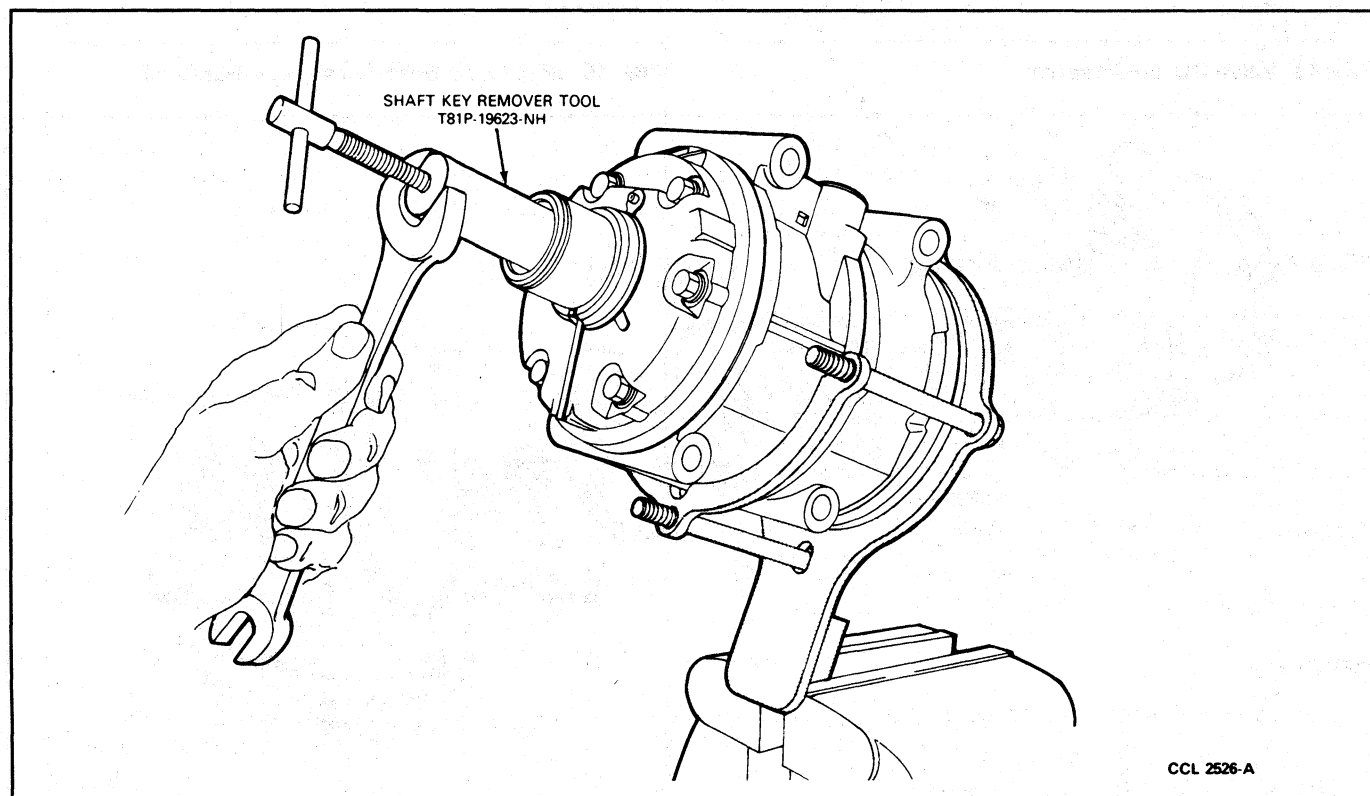
### Pulley Bearing Clutch

#### Removal

1. Remove clutch hub and pulley from compressor.
2. Position largest opening of Pulley Support T80L-19703-E or equivalent over the hub of the pulley to support the pulley. Drive bearing from pulley with Pulley Replacer T80L-19703-J or equivalent (Fig. 10).

#### Installation

1. Place clutch pulley friction face on small opening of Pulley Support T80L-19703-E or equivalent (Fig. 11).
2. Position new bearing to the clutch bearing bore. Install the bearing in the bore until seated with Pulley Bearing Replacer T80L-19703-C or equivalent (Fig. 11). Ensure bearing is aligned with the bearing bore.
3. Stake the bearing in the bearing bore with a blunt drift four equally spaced places around the bearing. Do not use the same locations used to retain the removed bearing.
4. Install pulley and hub on the compressor as outlined.



**FIG. 13 Compressor Shaft Key—Removal**

## MAJOR SERVICE OPERATIONS

### Shaft Seal and/or Front Head Gasket and O-Ring

#### Removal

1. Remove clutch assembly following the procedure for Clutch Field Coil Removal.
2. Invert the compressor and pour refrigerant oil from the suction opening.
3. Install Shaft Seal Seat Installer T81P-19623-D or equivalent on the compressor to retain the cylinder assembly and the rear head in position (Fig. 12). Then, clamp the tool in a vise.
4. Remove the key from the compressor shaft with Shaft Key Remover T81P-19623-NH or equivalent (Fig. 13).
5. Remove the six through bolts from the compressor using a 10mm socket. Then, pull the front head from the compressor. The valve plate assembly, inlet reed, shaft seal and cylinder gasket normally will come off with the head assembly.
6. Carefully lift the inlet reed valve from head assembly.
7. Remove front valve plate assembly and gasket from the front head with Valve Plate Remover T81P-19623-B or equivalent (Fig. 14).
8. Carefully remove the gasket from the valve plate assembly using care not to damage the surface of the valve plate assembly.
9. Remove two dowel pins from the front head.
10. Remove shaft seal assembly and felt seal from the head (Fig. 15).
11. Place the head on a piece of clean corrugated cardboard and remove the seal seat assembly from the head with Shaft Seal Seat Remover T81P-19623-OH or equivalent (Fig. 16).

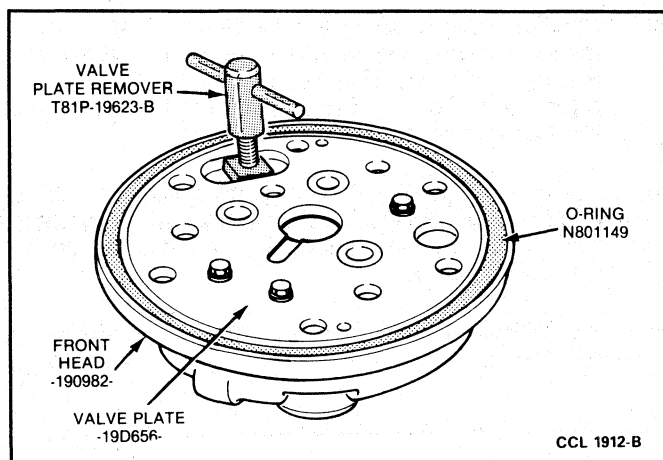


FIG. 14 Valve Plate—Removal

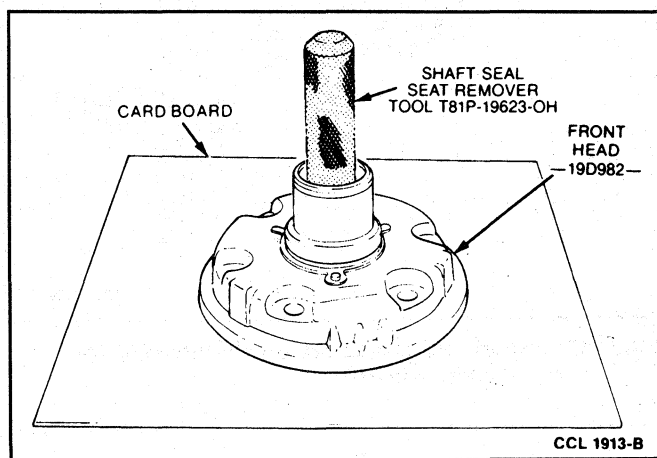


FIG. 16 Shaft Seal Seat Assembly—Removal

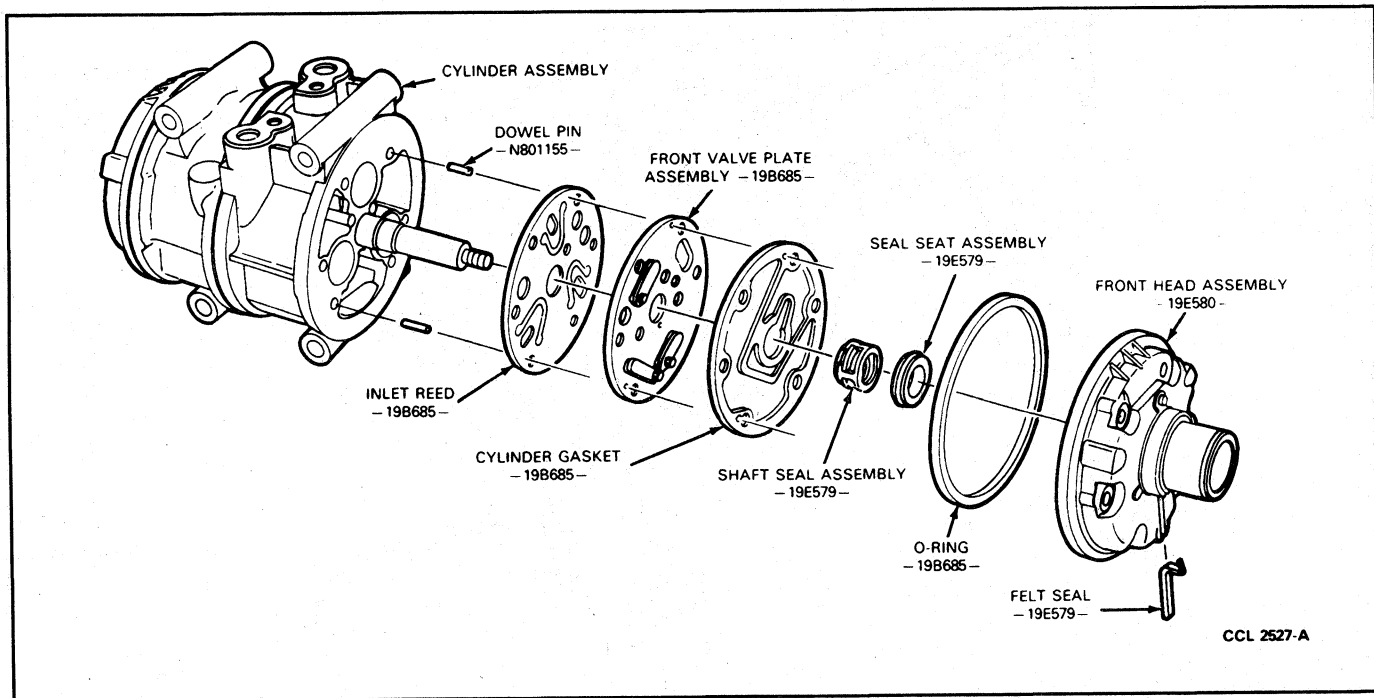


FIG. 15 Front Head and Valve Plate—Disassembled



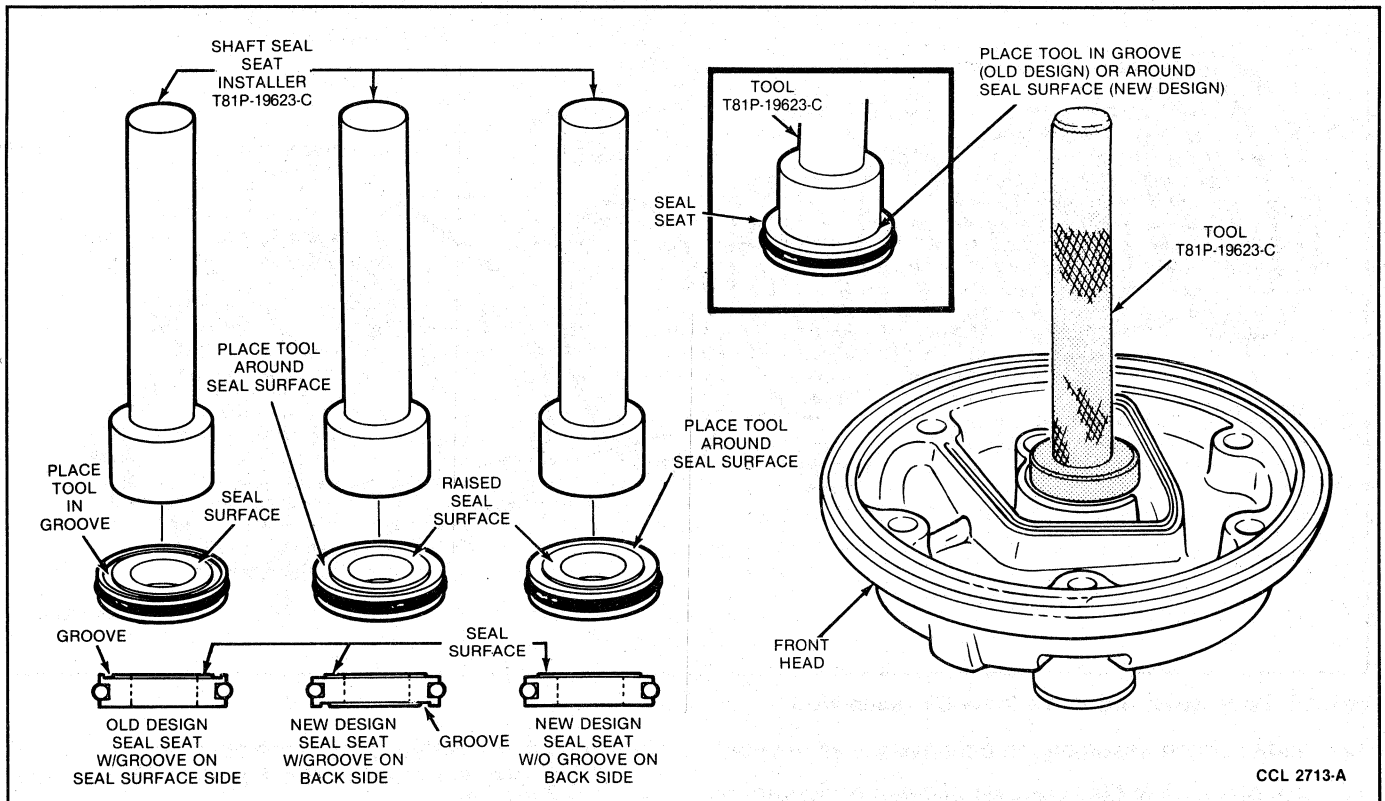


FIG. 17 Shaft Seal Seat Assembly—Installation

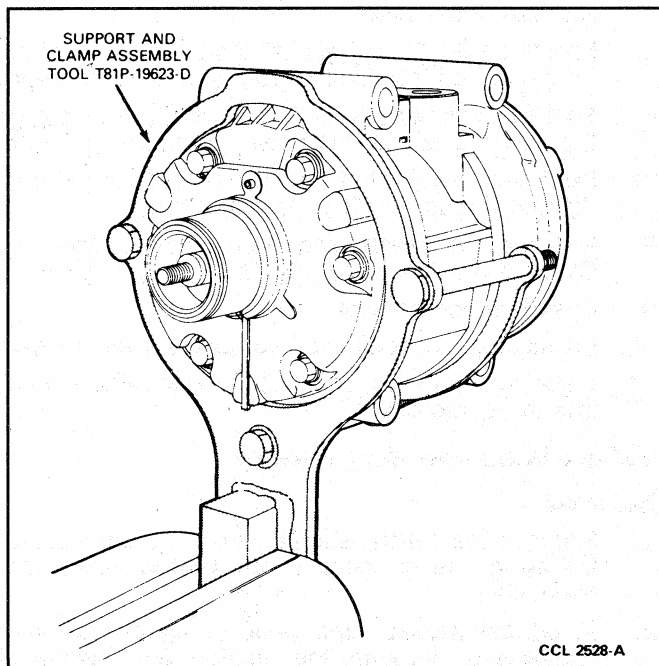
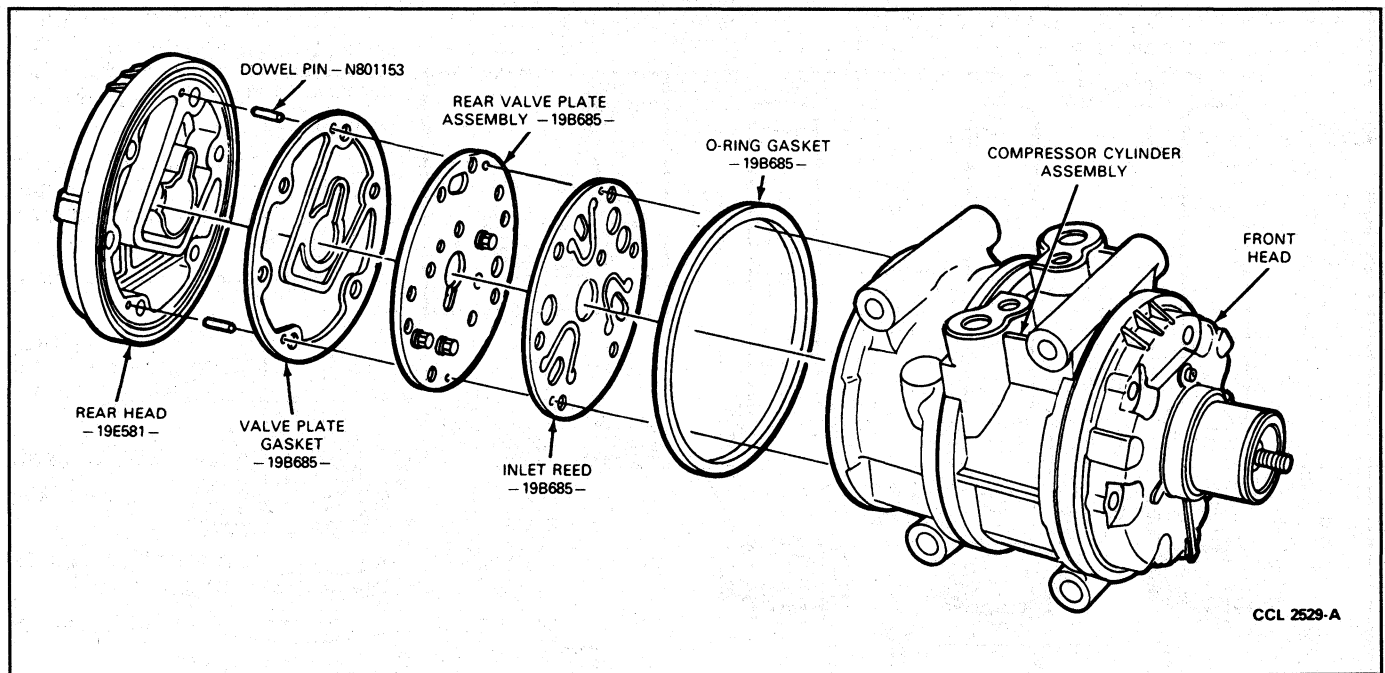


FIG. 18 Compressor Clamped for Rear Head Removal

12. Clean front head, valve plate assembly and inlet reed with clean cleaning solvent. Dry the parts with compressed air.

#### Installation

1. Inspect inlet reed, valve plate assembly and front head for damage. Replace any damaged parts.
  2. Install the two dowel pins in the dowel pin holes of the cylinder assembly (Fig. 15).
  3. Lubricate the inlet reed with a light coating of clean refrigerant oil. Position the inlet reed to the cylinder assembly aligning the holes in the inlet reed with the dowel pins.
  4. Assemble valve plate assembly to cylinder assembly aligning dowel pin holes with dowel pins.
  5. Assemble a new cylinder gasket to the head side of the valve plate assembly aligning the dowel pin holes with the dowel pins.
  6. Lubricate new shaft seal seat with clean refrigerant oil and install seat in the front head with the groove on the seat sealing surface up. Use Shaft Seal Seat Installer T81P-19623-C or equivalent positioned in the groove of the seat to install the seat in the head (Fig. 17).
  7. Lubricate new shaft seal with clean refrigerant oil and assemble seal to the compressor with the sealing surface toward the end of the shaft. Engage the internal flats of the seal with the two flats notched into the shaft.
- NOTE:** Avoid handling the carbon sealing surface of seal assembly to prevent damaging surface. Use extreme care to keep seal and seal seat clean at all times.
8. Install a new lubricated O-ring in O-ring groove of the front head (Fig. 15).
  9. Position front head to the cylinder assembly aligning the dowel pin holes in the head with the dowel pins. Install six through bolts and tighten them to specification.
  10. Leak test compressor as outlined.
  11. Install the key in the slot of compressor shaft.



**FIG. 19 Rear Head and Valve Plate Disassembled**

12. Install clutch assembly on compressor as outlined.
13. Install 180ml (6 fluid ounces) of clean refrigerant oil in the compressor.

### Head Gasket and O-Ring, Rear

#### Removal

1. Remove clutch assembly from the compressor as outlined.
2. Invert the compressor and pour the refrigerant oil from the suction manifold opening.
3. Install Support and Clamp Assembly T81P-19623-D or equivalent on the front of the compressor to retain the cylinder assembly and the front head in position (Fig. 18). Then, clamp the tool in a vise.
4. Hold the rear head and remove six through bolts from the cylinder assembly.
5. Separate rear head assembly from cylinder assembly. Remove the O-ring from the head.
6. Remove the two dowel pins (Fig. 19).
7. Remove inlet reed from the rear head and valve plate assembly.
8. Remove valve plate assembly from rear head with Valve Plate Remover T81P-19623-B or equivalent (Fig. 14).
9. Carefully remove the cylinder gasket from the head and/or valve plate assembly.
10. Wash the rear head, valve plate assembly and inlet reed with clean cleaning solvent and dry with compressed air.

#### Installation

1. Install the two dowel pins in the dowel pin holes of the rear head.
2. Install cylinder gasket on the head taking care to align the dowel pin holes with the dowel pins.

3. Install the valve plate assembly on the cylinder head aligning the dowel pin holes with the dowel pins (Fig. 19).
4. Lubricate inlet reed with clean refrigerant oil. Install inlet reed on valve plate aligning the dowel pin holes with the dowel pins.
5. Install a new O-ring gasket lubricated with clean refrigerant oil into O-ring groove of the rear head.
6. Position rear head to cylinder assembly and align the dowel pins with the dowel pin holes.
7. Hold rear head in place and install six through bolts. Tighten through bolts to specification.
8. Remove the compressor from the Support and Clamp Assembly T81P-19623-D or equivalent.
9. Leak test compressor.
10. Install clutch assembly on compressor as outlined.
11. Install 180ml (6 fluid ounces) of clean refrigerant oil into the compressor.

### Valve Plates and Inlet Reeds

#### Removal

1. Remove the clutch assembly from the compressor following the procedure for Clutch Field Coil Removal.
2. Invert compressor and pour refrigerant oil from compressor through the suction and discharge manifold openings.
3. Install Support and Clamp Assembly T81P-19623-D or equivalent on the compressor to retain the front head and the cylinder assembly assembled together (Fig. 18). Then, clamp the tool in a vise.
4. Remove six through bolts from compressor using a 10mm wrench. Remove the rear head from compressor. The valve plate assembly, inlet reed and cylinder gasket will be normally removed with the rear head.
5. Remove O-ring and inlet reed from the rear head.

6. Remove valve plate assembly from the rear head with Valve Plate Remover T81P-19623-B or equivalent (Fig. 14). Use care not to lose the two dowel pins.
7. Clean rear head with clean cleaning solvent. Dry the head with compressed air.
8. Install the two dowel pins in the dowel pin holes of cylinder assembly (Fig. 19).
9. Position inlet reed (lightly lubricated with refrigerant oil) to cylinder assembly aligning the dowel pin holes with the dowel pins.
10. Position valve plate assembly to inlet reed and align the dowel pin holes with the dowel pins.
11. Install cylinder gasket over valve plate assembly aligning the dowel pin holes with the dowel pins.
12. Install a new O-ring lubricant with clean refrigerant oil into O-ring groove of the rear head. Position rear head to cylinder assembly aligning the dowel pin holes in the head with the dowel pins.
13. Hold the rear head against the cylinder assembly and install two through bolts into opposite holes to hold the rear head in place. Tighten the two bolts just snug.
14. Remove Support and Clamp Assembly T81P-19623-D or equivalent from front half of compressor and install the tool to clamp the rear head to the cylinder assembly (Fig. 12).
15. Remove the key from the compressor shaft with Shaft Key Remover T81P-19623-NH or equivalent (Fig. 13).
16. Remove two through bolts from compressor.
17. Pull the front head from compressor assembly. The valve plate assembly, inlet reed and shaft seal assembly will come off with the front head (Fig. 15).
18. Remove O-ring and inlet reed from the front head.
19. Remove valve plate assembly from front head with Valve Plate Remover T81P-19623-B or equivalent, (Fig. 14).
20. Remove two dowel pins, shaft seal and felt seal from the front head.
21. Place the front head on a piece of clean corrugated cardboard and remove seal seat assembly from the front head with Shaft Seal Seat Remover T81P-19623-OH or equivalent (Fig. 16).
22. Clean the front head with clean cleaning solvent and dry with compressed air.
23. Install the two dowel pins in the dowel pin holes of the cylinder assembly.
24. Lubricate inlet reed with a light coating of clean refrigerant oil. Position inlet reed to cylinder assembly aligning the dowel pin holes of the inlet reed with the dowel pins.
25. Assemble valve plate assembly to cylinder assembly aligning the dowel pin holes with the dowel pins.
26. Assemble cylinder gasket to valve plate assembly aligning the dowel pin holes with the dowel pins.
27. Lubricate new shaft seal seat with clean refrigerant oil and install the seat in the front head (groove side up). Use Shaft Seal Seat Installer T81P-19623-C or equivalent positioned in the groove of the seat in the head (Fig. 17).

28. Lubricate new shaft seal with clean refrigerant oil and assemble seal on the compressor shaft with the sealing surface toward the end of the shaft. Engage the internal flats of the seal with the two flats notched into the shaft.

NOTE: Avoid handling the carbon sealing surface of the seal assembly to prevent damaging the surface. Use extreme care to keep the seal and seal seat clean at all times.

29. Install a new lubricated O-ring in the O-ring groove of the front head.
30. Position the front head to the cylinder assembly aligning the dowel pin holes in the head with the dowel pins. Install six through bolts and tighten them to specification.
31. Install the key in the slot of the compressor shaft.
32. Leak test compressor following procedures in this Section.
33. Install clutch assembly on compressor following the procedure for Clutch Field Coil Installation.
34. Install 180ml (6 fluid ounces) of clean refrigerant oil in the compressor.

### Head Replacement

If it is necessary to replace the front or rear head, follow the procedure for head gasket replacement.

## SPECIFICATIONS

### COMPRESSOR SPECIFICATIONS

Type	Swash Rate, 3 Double Acting Pistons — Axial Type
Displacement	10.4 CID
Cylinder Bore (Dia.)	1.4 inch
Stroke	1.2 inch
Rotation	Clockwise
Rotational Torque (Maximum, Manifold Removed)	10 N·m — (7 Lb·Ft)
Refrigerant Oil Type	ESA-M2C31-A — 500 Viscosity
Capacity (System Total)	300 ml (10 Fluid Ounces)
Part Number	C9AZ-19577-B Motorcraft YN-2
Magnetic Clutch Air Gap Between Pulley and Hub	0.021-0.036 inch
Current Draw	4.67 Amps @ 12.8 Volts
Run-Out (Maximum)	0.02 inch — Radial or Axial
Torque Limits	
Hose Manifold to Compressor	24-34 N·m (18-25 Lb·Ft)
Clutch Hub Nut	13-23 N·m (10-14 Lb·Ft)
Compressor Cylinder Bolts (Max. to Correct Freon Leak)	24.5-26.5 N·m (18-19 Lb·Ft) 34 N·m (25 Lb·Ft)

CL4942-A

### DRIVE BELT TENSION

Belt Type	New	Used Minimum*	Used Reset Limits
6 Rib	140-170	90	140-160

\*Used is any belt in operation 10 minutes or more.

CL4943-A

**SPECIAL SERVICE TOOLS**

Rotunda Number	Motorcraft Number	Robinair Number	Draf Number	Description
T80L-19703-B	YT-1011	10884	1011	Hub Remover
T80L-19703-C	YT-1059	40938	1059	Pulley Bearing Replacer
T80L-19703-E	YT-1064	18010	1064	Pulley Support
T80L-19703-F	YT-1052	18020	1052	Hub Replacer
T80L-19703-G	YT-1012	41358	1012	Compressor Shaft Protector
T80L-19703-J	YT-1059	40938	1059	Pulley Replacer
D81P-19703-B	—	10501	—	Complete Puller
T70P-4067-A	YT-499	10546	499	Spanner Wrench
T81P-19623-B	YT-1069	10967	1069	Valve Plate Remover
T81P-19623-C	YT-1061	40945	1061	Shaft Seal Seat Installer
T81P-19623-D	YT-1067	18009	1067	Support and Clamp Assembly
T81P-19623-NH	YT-1062	18005	—	Shaft Key Remover
T81P-19623-F	YT-1066	40941/40942	1066	Pressure Test Adapter
T81P-19623-OH	YT-1060	40945	—	Shaft Seal Seat Remover
T71P-19703-B1	YT-457	40710	457	Pulley Puller Hub
D80L-19703-AJ	YT-1058	40679	1058	Puller Jaws
T81P-19623-G1	—	41098	—	3/8 Inch Spring Lock Disconnect Tool
T81P-19623-G2	—	41099	—	1/2 Inch Spring Lock Disconnect Tool
T83P-19623-C	—	41100	—	5/8 Inch Spring Lock Disconnect Tool
T85L-19623-A	—	41101	—	3/4 Inch Spring Lock Disconnect Tool
T80L-19703-K	YT-451	40568	451	Pulley Puller Center Bolt
T85L-19703-A	—	40947	—	Pressure Test Adapter
063-00010	—	—	—	Air Conditioning Service Kit

CK9686-A

# SECTION 36-45 A/C-Heater System, Manual

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## VEHICLE APPLICATION

Taurus/Sable.

## DESCRIPTION AND OPERATION

The manual A/C-heater system is a vibration welded, split-case design integral blower system that controls the temperature and reduces the relative humidity of air inside the vehicle (Fig. 1). Control knobs are provided to adjust the desired temperature and system functions. The system will deliver heated or cooled air to maintain the vehicle interior temperature and comfort level. Blower speeds can be adjusted for more or less airflow as desired.

Manual control of the passenger compartment temperature may be maintained in all function control settings (Fig. 2), except when the system is turned off. In hot weather, it will cool the vehicle to a comfortable level. Cooling or heating can then be adjusted as required to maintain the desired temperature.

For cold weather conditions, the system may be turned off by placing the function selector knob in the OFF position. This will minimize the discharge of cold air and delay the operation of the system while the engine coolant warms. After the engine is warm, the function selector knob can be turned on, and the system will heat the vehicle to the desired temperature.

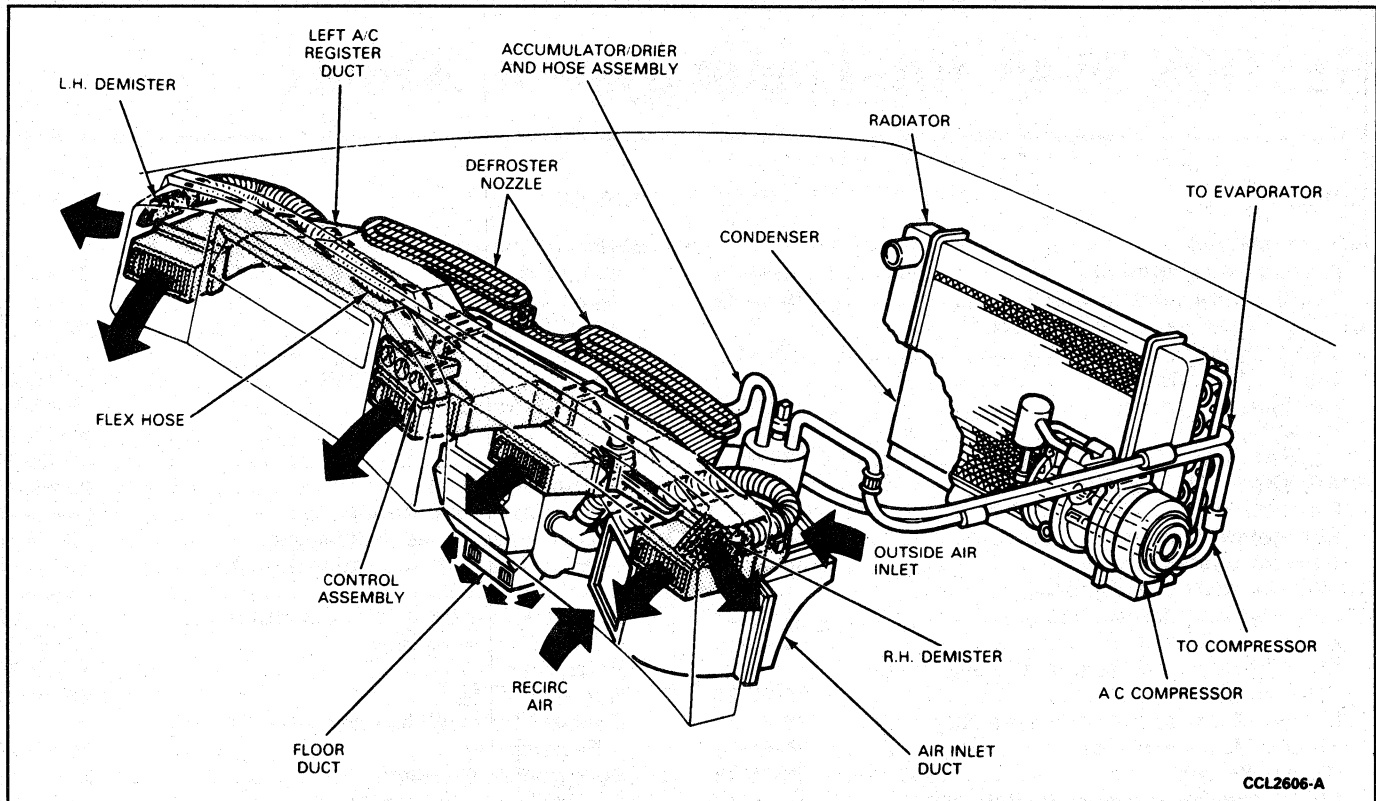
Outside air is drawn from the cowl vent just below the windshield during all system operations except MAX-A/C cooling, when recirculated air is used.

## Control Operation

The manual A/C-heater control includes a function selector knob which has positions: OFF, MAX-A/C, NORM-A/C, VENT, FLOOR or MIX and DEFROST. The position of the knob determines the manner in which the system will operate. A temperature control knob manually sets the desired comfort temperature, and a fan control knob controls the volume of air movement. Each position of the function selector knob and fan control knob is detented for positive engagement. The fan control knob provides four manually selected blower speeds, and may be operated in any position of the function selector knob to select the desired amount of airflow.

## Temperature Control

Temperature control of the manual A/C-heater system is determined by the position of the temperature control knob on the control assembly (Fig. 2) and is accomplished by means of a control cable between the control assembly and the temperature blend door. System airflow is manually controlled by the control assembly. A vacuum selector valve, controlled by the function selector knob, distributes vacuum to the various



**FIG. 1 A/C System Installation and Airflow**

door vacuum motors, which in turn direct the airflow through the system.

The system utilizes what is called a "reheat" method to provide conditioned air to the vehicle interior. With this method, all airflow from the blower passes through the evaporator core, where it is cooled and dehumidified. Temperature is then regulated by reheating a portion of the cooled dry air and blending it with the remaining cool air to the desired temperature. Temperature blending is varied by the temperature blend door, which controls the amount of cooled air that flows through or around the heater core, where it is mixed and directed into the distribution plenum. The air is finally directed to the heater ducts, the defroster nozzles, or the instrument panel registers according to function selector knob position.

### System Airflow

Figs. 3, 4 and 5 correlate the action which takes place when the function select knob is rotated to each of its seven detent locations: MAX A/C, NORM A/C, VENT, OFF, FLOOR, MIX, and DEFROST. Fig. 3 shows the control assembly with its function selector knob in the OFF position, and its temperature control knob midway between its maximum WARM and maximum COOL settings. The fan knob is set at a low blower speed. Other blower speed settings include: MEDIUM LOW, MEDIUM HIGH, and HIGH. Fig. 3 also provides a schematic of the manual A/C-heater system and the doors which respond to full vacuum, partial vacuum, and no vacuum when supplied by a separate vacuum motor for each door. These doors are: Air outside/recirc door, a panel-defrost door in the plenum chamber and a floor-panel door which is designed to provide full, partial or no vacuum positions. The blend door is manually controlled by a cable and moves according to the position of the temperature control knob.

- The blend door may be positioned anywhere within the range of its cable travel, from full heat to full cold.
- The blower motor is off.

### MAX A/C (Recirculated Air)

When the function selector knob is in the MAX A/C position:

- The outside/recirc door is at full vacuum, closing off outside air.
- The floor-panel door is at no vacuum, blocking airflow to the floor registers.
- The panel-defrost door is at full vacuum, closing off airflow to the defrosters.
- Temperature control is usually set for maximum cold, but may be heated if desired.
- Air will be picked up at the recirc opening by the blower motor. Airflow across the evaporator core will be diverted past the heater core and then directed into the passenger compartment through the instrument panel registers.

Fig. 3 shows the Function Selector Valve Detent Position chart and a schematic of mode selector knob functions.

Figs. 4 and 5 correlate specific airflow conditions which occur when a given function selector knob setting is made.

### OFF

When the function selector knob is in the OFF position:

- The outside/recirc door is at full vacuum. As a result, outside air is closed off, and recirc air is admitted to the system.
- The panel-defrost door and the floor-panel door are both at full vacuum, closing off the passages to the defrosters.

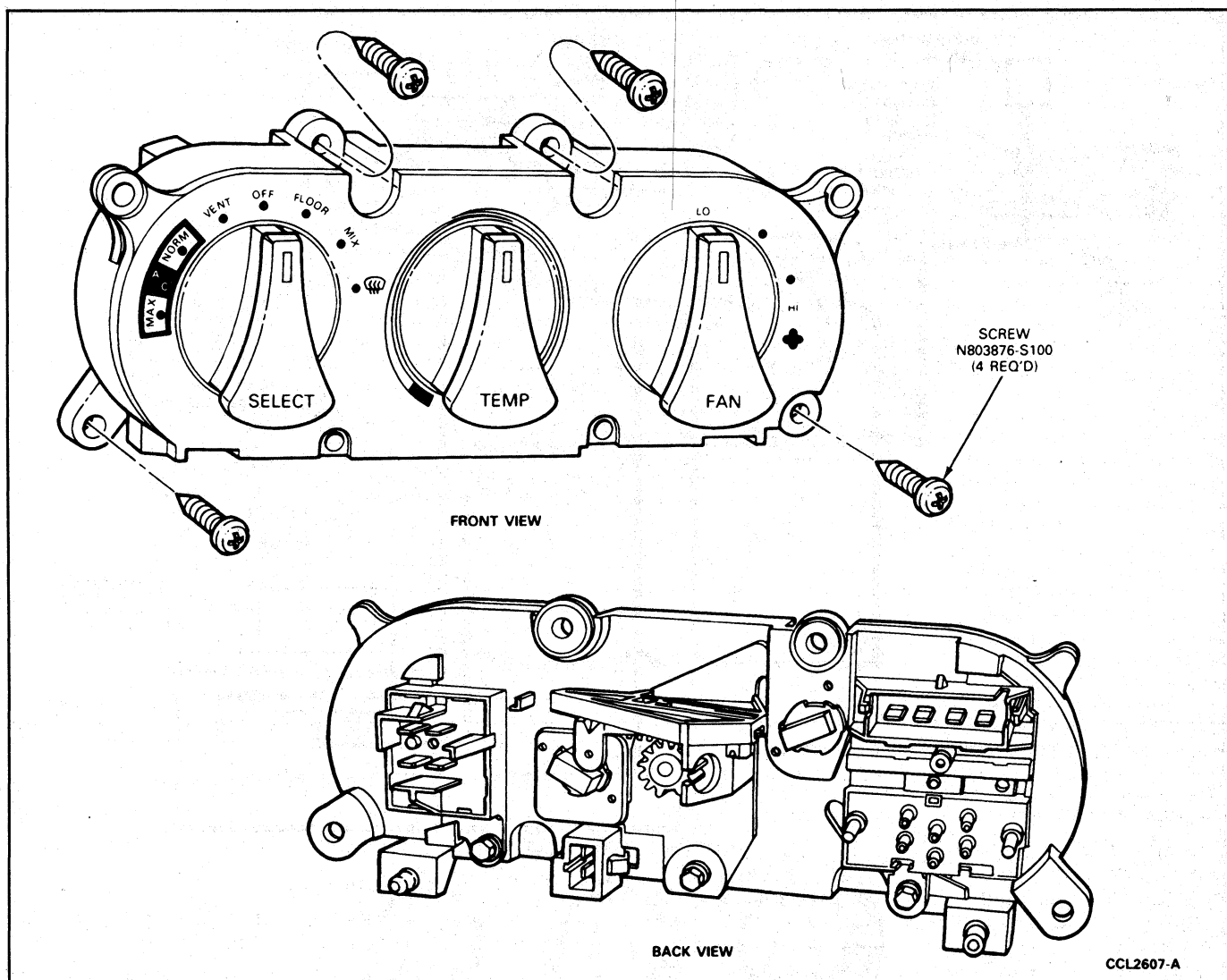


FIG. 2 Control Assembly

**NORM A/C (Outside Air)**

When the function selector knob is in the NORM A/C position:

- The outside/recirc door is set at no vacuum. This blocks the recirc passage and allows the admittance of outside air.
- All other door positions are the same as those previously described for the MAX A/C setting.
- Temperature setting can be changed manually as desired.
- The compressor will be operating when NORM A/C is selected.

**VENT**

When the function selector knob is in the VENT position:

- The outside/recirc door, with no vacuum being applied, will block recirculated air and admit outside air. From there, air flows through the system to the instrument panel registers.
- The floor-panel door is at "no vacuum" to block airflow to the floor registers.
- The panel-defrost door is at full vacuum, closing off airflow to the defrosters.

- The air conditioned airflow is admitted into the system when the function selector knob is in the VENT position, but the temperature control knob may be adjusted to heat the air, if desired.

**FLOOR**

When the function selector knob is in the FLOOR position:

- The outside/recirc door is in the "no vacuum" position, blocking recirc air and admitting outside air.
- The floor-panel door is in the vacuum position, closing off all but a minimum of airflow to the defrosters.
- The blend door is positioned to mix air flowing through the heater core and air from outside to achieve the desired temperature level.
- The panel-defrost door is in the "no vacuum" position, blocking air circulation to the panel registers.

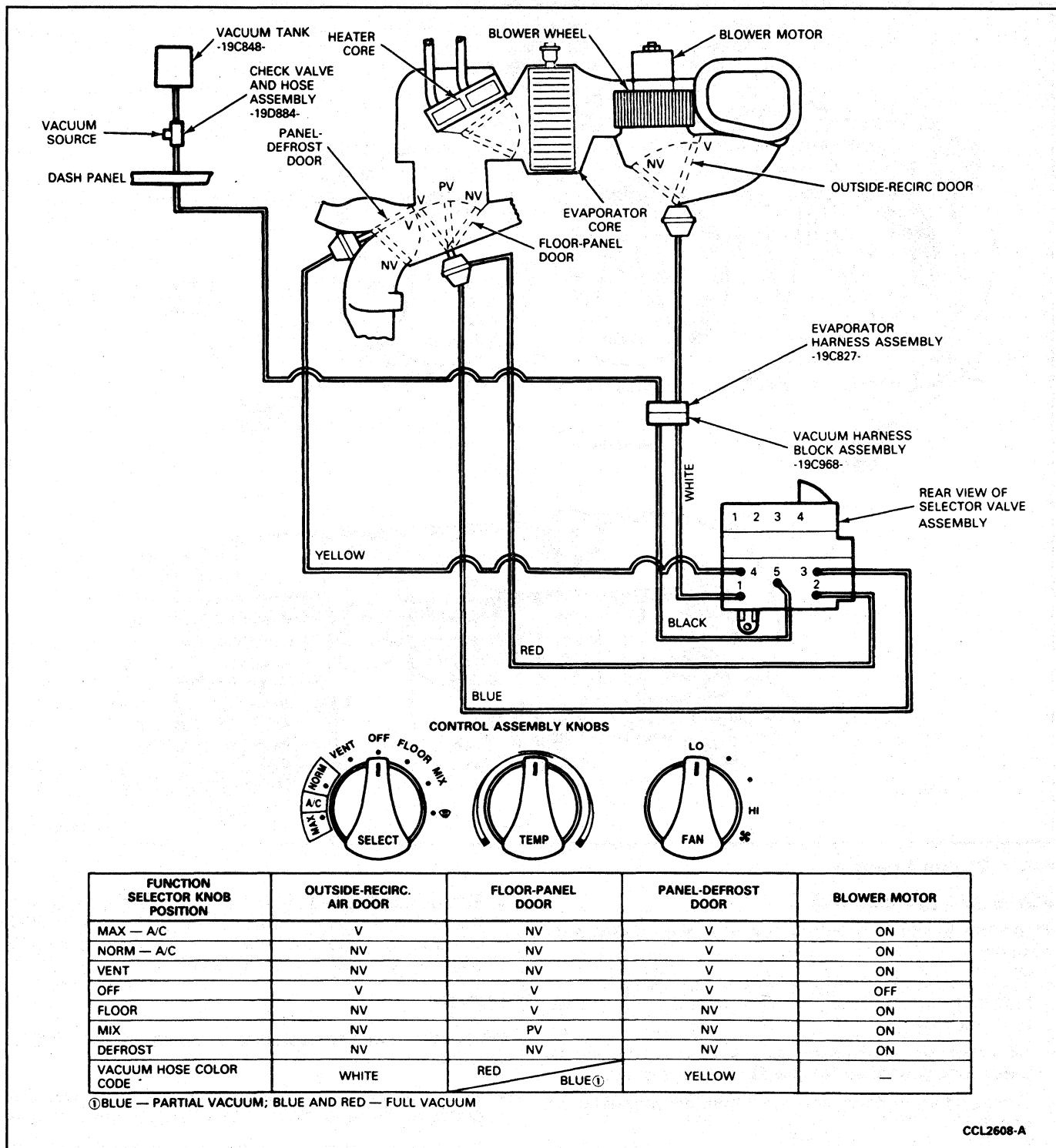
**MIX**

When the function selector knob is in the MIX position:

- The outside/recirc air door and the panel-defrost door are in the "no vacuum" position.

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FIG. 3 A/C System Schematic and Vacuum Control Chart

- The floor-panel door is in the "partial vacuum" position, allowing airflow to both panel registers and floor duct.
- The A/C compressor operates to dehumidify the air and reduce windshield fogging.

### DEFROST

When the function selector knob is in the DEFROST position:

- The outside/recirc door is in the "no vacuum" position, admitting outside air.

- Both the floor-panel and the panel-defrost doors are in the "no vacuum" position, so that the most of the incoming air is directed to the defroster nozzles. There is a slight air bleed to the floor registers.
- The temperature control knob setting will determine the amount of heat introduced into the airflow.
- The A/C clutch will also operate when the DEFROST position is selected. This dehumidifies incoming air and reduces windshield fogging.



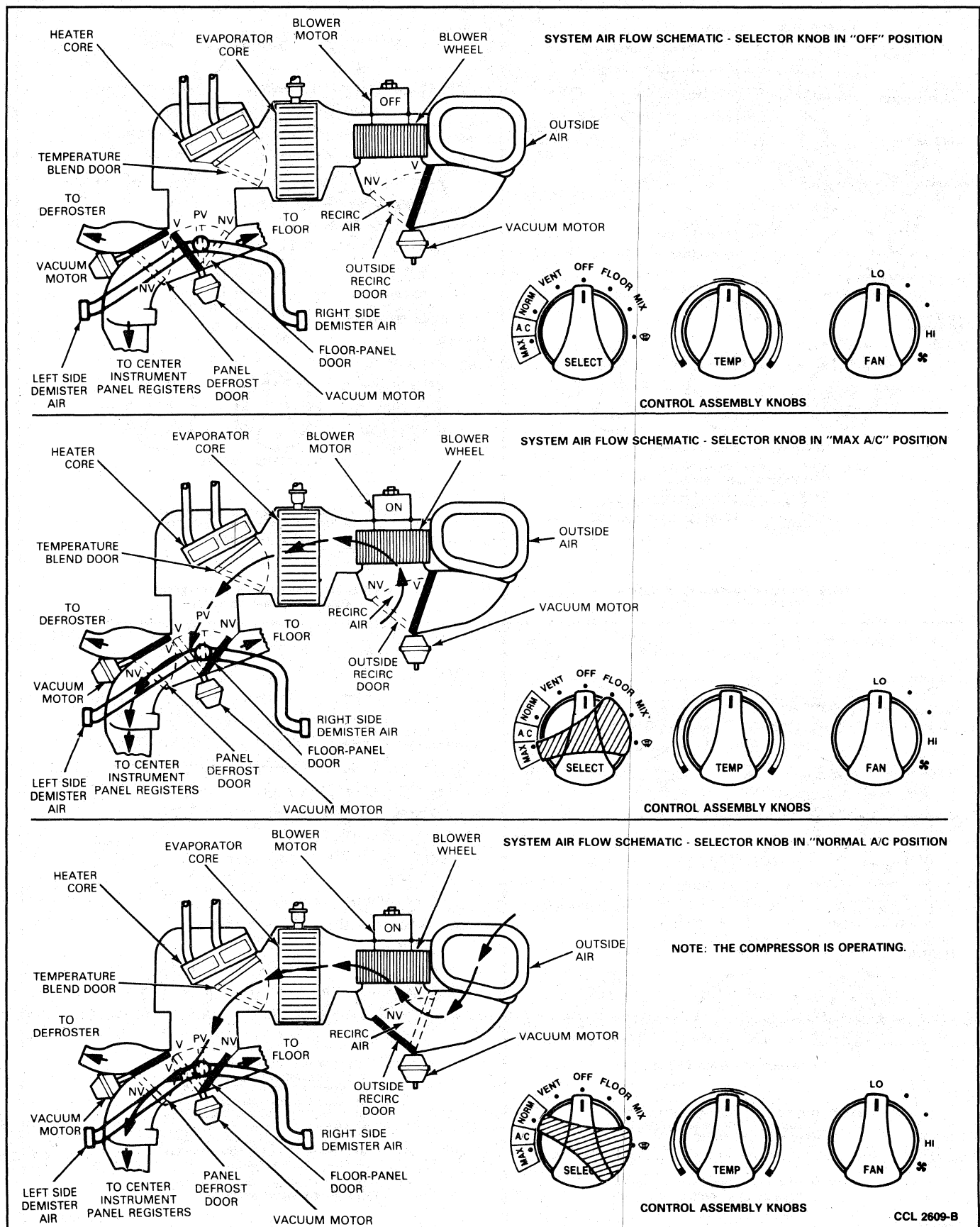
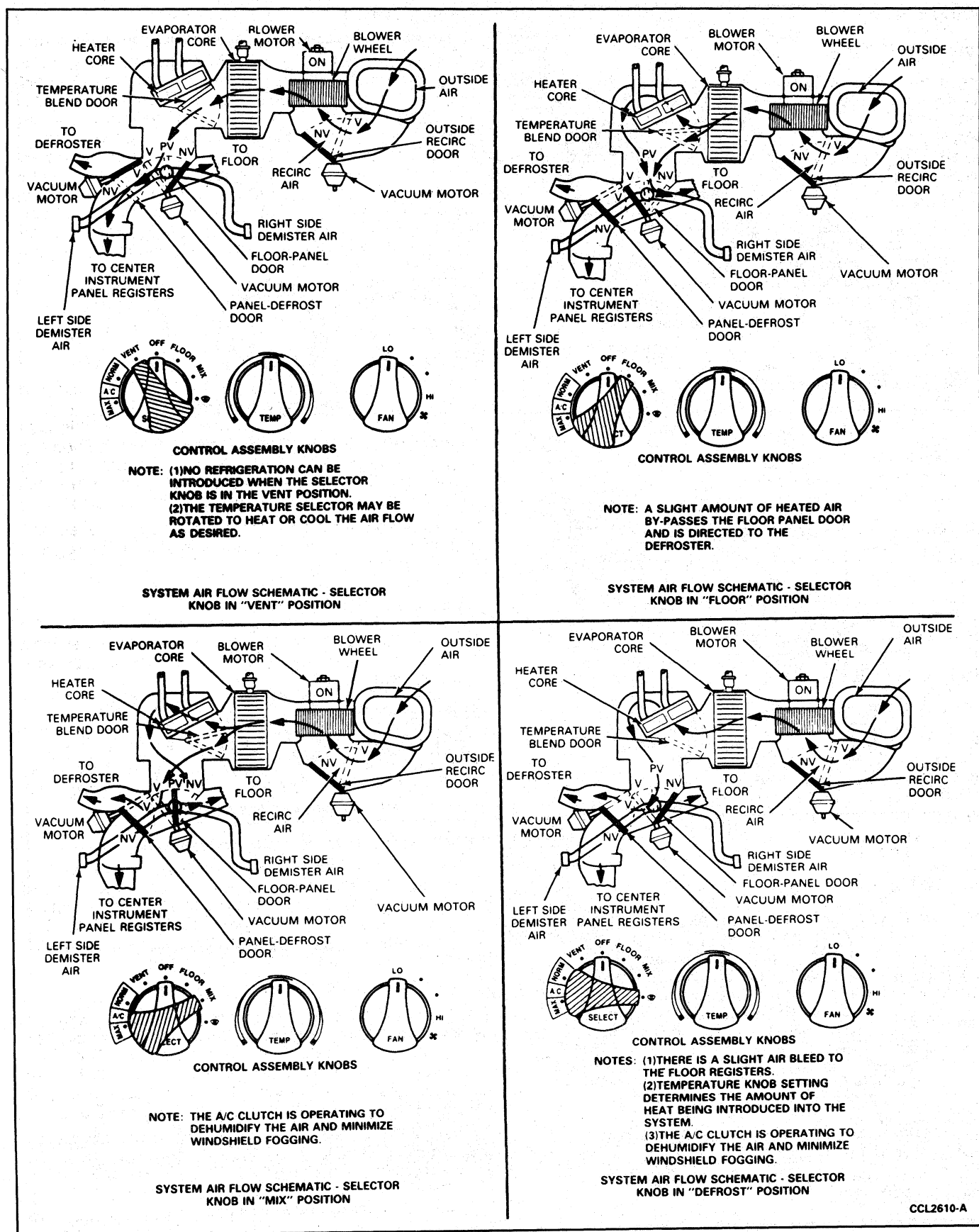


FIG. 4 Airflow Chart 1 (OFF, MAX A/C, NORM A/C)



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FIG. 5 Airflow Chart 2 (VENT, FLOOR, MIX, DEFROST)

## Components

### Control Assembly

The control assembly consists of three main parts: (1) the function selector knob, a vacuum selector valve combined with an internal electrical switch (2) blower switch, an electrical switch that provides four speeds of blower operation and (3) the temperature control knob, which connects through a control cable assembly to the temperature blend door in the evaporator assembly.

1. The vacuum selector valve directs source vacuum to various vacuum motors, refer to vacuum diagram, Fig. 3. Two internal single pole electrical switches are also controlled by the selector. The combination of these electrical switches controls the electrical supply to the A/C clutch and blower switch (Fig. 6).
2. The four-position blower switch is shown in Fig. 6.
3. The temperature control knob is connected to the temperature blend door by a control cable assembly. Movement of the control knob from COOL to WARM causes a corresponding movement on the temperature blend door and determines the temperature that the system will maintain.

### Self-Adjust Temperature Control Cable

The temperature control cable is self-adjusting with the rotation of the temperature control knob to the extreme clockwise position (toward WARM) in the face of the control assembly. To prevent damage of the control cable wire, a preset adjustment (Fig. 13) must be made before attempting to perform the self-adjust procedure. Refer to Adjustments.

### Mini-Tube Vacuum Hoses

Mini-tube vacuum hoses are used in the vacuum harness assemblies. They provide greater flexibility with less tendency to collapse and are less susceptible to pinching. Repairs are easily made using a short piece of standard 3mm (1/8-inch) ID vacuum hose and inserting the cut ends of the mini-tube into the ends of the standard 3mm (1/8-inch) ID vacuum hose (Fig. 14).

### Thermal Limiter Resistor Assembly

The blower motor thermal limiter resistor assembly (Fig. 7) is located on the passenger side of the evaporator case behind the glove compartment. There are three resistance elements mounted on the resistor board to provide four blower speeds. Depending on the blower switch position, series resistance is added or bypassed in the blower motor circuit to decrease or increase blower motor speed.

The thermal limiter resistor assembly is similar to a standard resistor assembly, except an overheating protective device (thermal limiter) has been added to prevent heat damage to the evaporator case assembly. Overheating of the resistor coil(s) will occur when the system airflow is stopped as a result of the blower wheel being locked.

When the thermal limiter resistor circuit has opened as a result of excessive heat, it should be replaced only with an identical replacement thermal limiter resistor assembly. It must not be substituted with a standard resistor assembly which does not include a thermal limiter device.

### Thermal Limiter

The thermal limiter, used in the thermal limiter resistor assembly, serves as a temperature protecting fuse. Located a predetermined distance from the resistor coils and in series with the coil circuit, it will open the resistor coil circuit when the temperature of the thermal limiter reaches 121°C (250°F) interrupting blower operation in all speeds except high blower. Internal spring-loaded contacts are held closed with wax material which has a melting point of 121°C (250°F). When the wax softens, the spring contacts separate, opening the resistor circuit. The spring contacts cannot be closed again. It will be necessary to replace the entire thermal limiter resistor assembly.

### Register Assemblies

#### Rectangular Registers

##### Sable

The rectangular register assemblies have retaining pins on each end of the louver assembly that lock into pivot holes in the housing. The housing has four flexible tabs (two on top and two on the bottom) that lock the housing into the instrument panel register assembly opening. The louver assembly swivels, directing outlet air up or down while the louvers allow side-to-side air distribution.

A knob located on the LH front of the register assembly controls an air outlet shut-off door installed in the register housing assembly.

##### Taurus

Retaining tabs lock the register assemblies to the instrument panel applique. The louver assembly swivels and directs the air up or down while the louvers provide side-to-side air distribution.

#### Round Registers

##### Sable

The round registers used in the Sable instrument panel applique are secured by a round retainer which holds the register assembly in the register housing.

### Refrigerant System

The manual A/C-heater refrigerant system uses an A/C compressor, a condenser, an evaporator core, a fixed orifice tube in the liquid line near the condenser, a suction accumulator/drier, a pressure switch, Schrader-type service access gauge port valves, and the necessary refrigerant lines for the system.

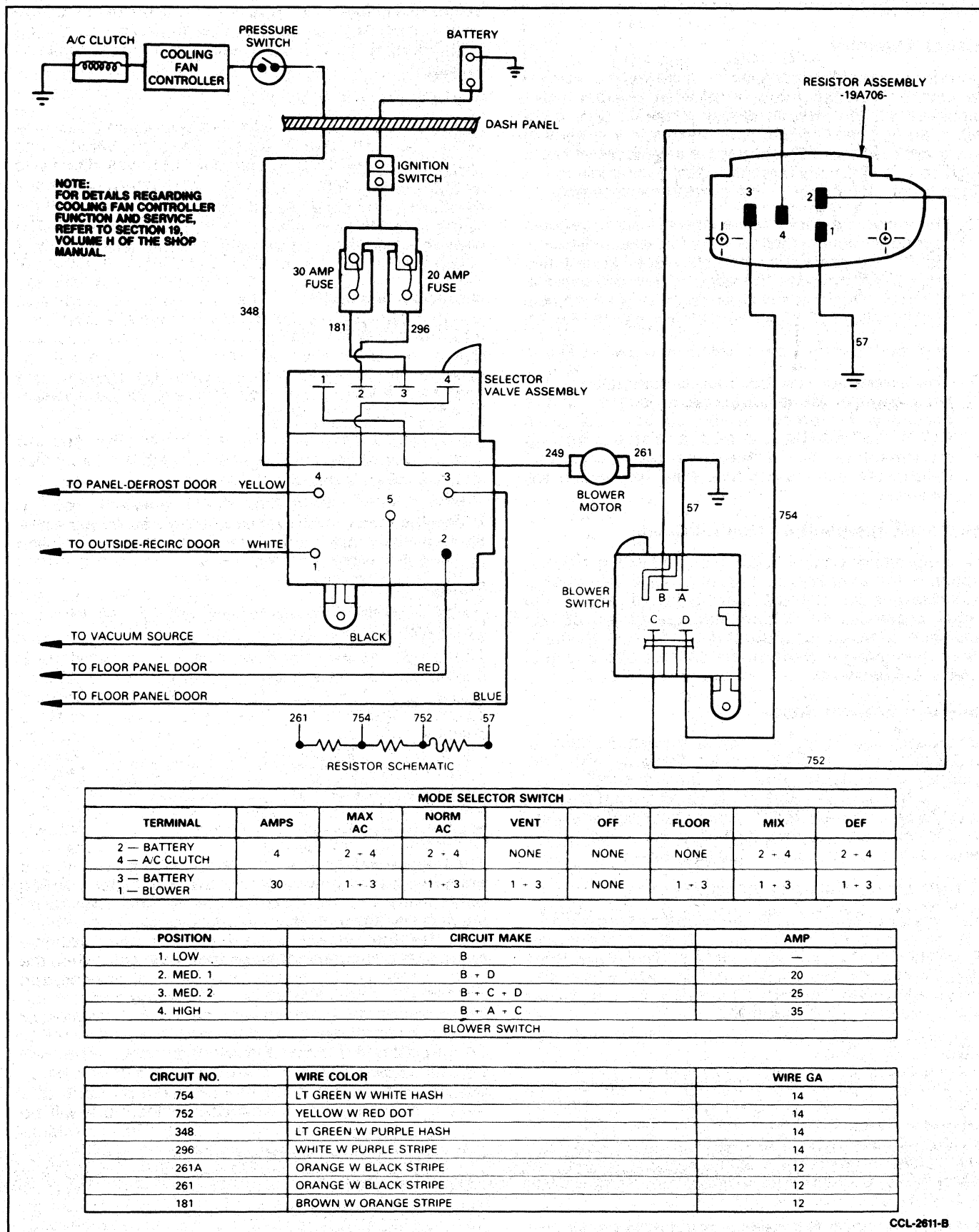
#### Service Access Gauge Port Valves

Two Schrader-type service access gauge port valves are used with the refrigerant system. Both valves are located on the refrigerant lines near the compressor. The high-pressure service access gauge port valve requires an adapter to attach a refrigerant service hose to it. The various new adapters available are shown in Fig. 8.

Always replace the caps on the service access gauge port valves after servicing the refrigerant system.

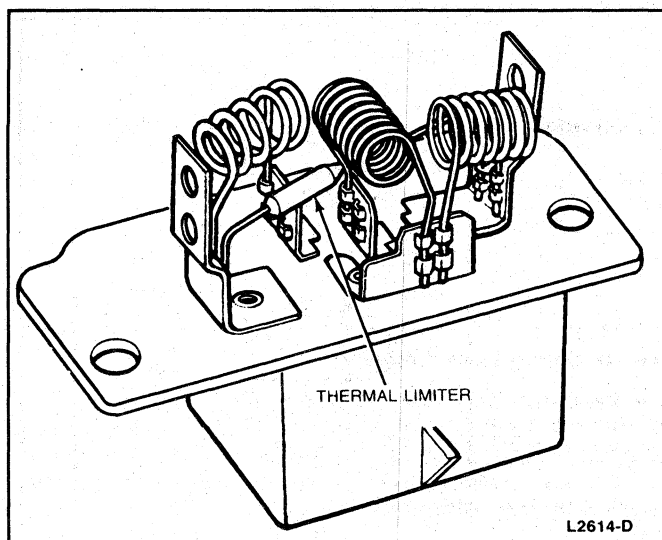
#### Evaporator Core

The evaporator core is a multipass plate/fin-type core mounted in a vertical position. Vaporized refrigerant enters the core at the lower corner and flows through the first three plate/fin sections to the other end of the core. The refrigerant flow then reverses and flows through the next three plate/fin sections to the opposite end of the core where the flow again reverses and flows through

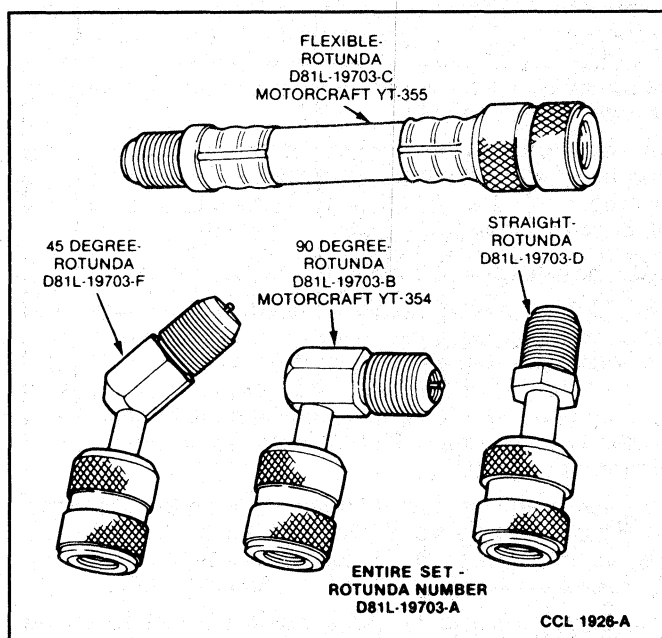


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FIG. 6 Electrical Wiring Diagram and Continuity Tests



**FIG. 7 Thermal Limiter Resistor Assembly**



**FIG. 8 Service Access Gauge Port Valve High-Pressure Adapter**

the remaining four plate/fin sections to the inserted suction tube. This S-pass flow pattern accelerates the flow of refrigerant through the evaporator core which does not have a liquid bleed line.

### Fixed Orifice Tube

The fixed orifice tube assembly is the restriction between the high and low-pressure liquid refrigerant which meters the flow of liquid refrigerant into the evaporator core. Evaporator temperature is controlled by sensing the pressure within the evaporator with a pressure operated electric switch. The pressure switch controls compressor operation as necessary to maintain the evaporator pressure between 169 and 324 kPa (24.5 and 47 psi).

The fixed orifice tube is located in the liquid line near the condenser and has filter screens located on the inlet and outlet ends of the tube body. The filter screens act as a strainer for the liquid refrigerant flowing through the fixed orifice opening. O-rings on the tube body prevent the high-pressure liquid refrigerant from bypassing the

orifice. Adjustment or repairs cannot be made to the fixed orifice tube assembly. Therefore, the liquid line (with integral fixed orifice tube assembly) must be replaced.

### Suction Accumulator/Drier

The suction accumulator/drier is mounted on the engine side of the dash panel on the RH side of the vehicle. The inlet tube of the accumulator/drier attaches directly to the evaporator core outlet tube. Refrigerant enters the accumulator/drier canister through the inlet tube and the heavier oil-laden refrigerant falls to the bottom of the canister (Fig. 9). A small diameter oil bleed hole is located in the side of the outlet tube near the bottom of the canister. This bleed hole is covered with a filter and allows a small amount of the heavier liquid refrigerant and oil mixture to re-enter the suction line at a controlled rate. When the heavier liquid refrigerant and oil mixture enters the compressor suction line, it has a second opportunity to vaporize and circulate through the compressor without causing damage to the compressor due to refrigerant slugging.

A desiccant bag is mounted inside the suction accumulator/drier canister to absorb any moisture which may be in the refrigerant system.

A fitting located on the top of the canister is used to attach the clutch cycling pressure switch. A long travel Schrader-type valve stem core is installed in the fitting opening to prevent refrigerant loss when the clutch cycling pressure switch is removed.

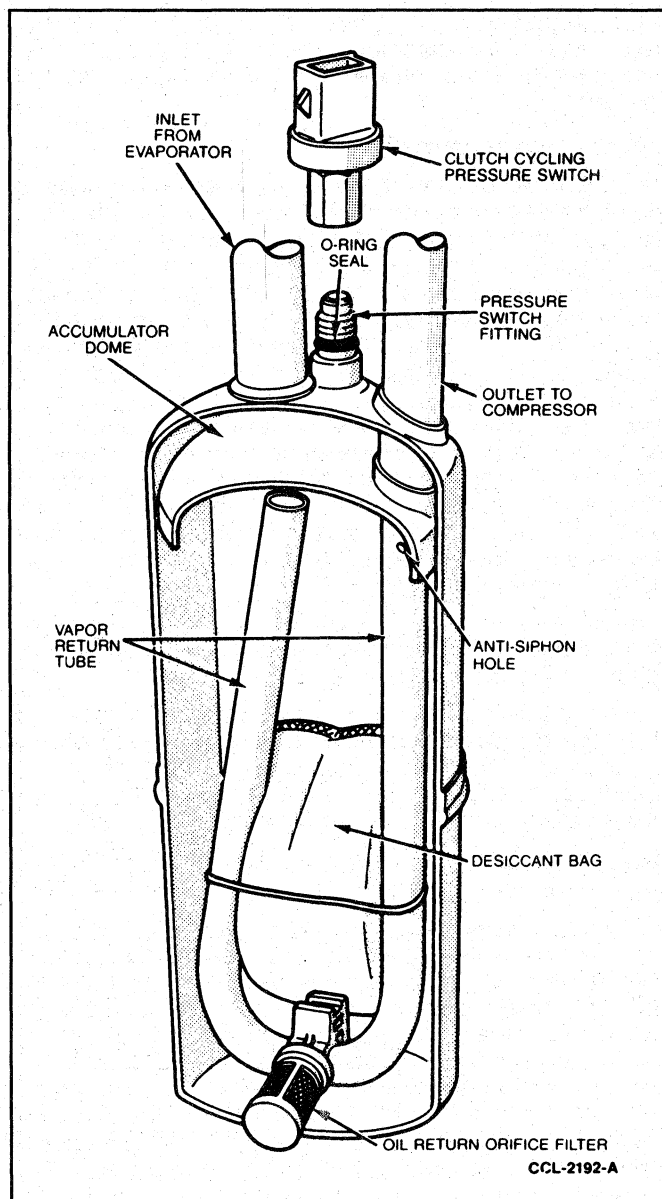
### Clutch Cycling Pressure Switch and Schrader-Type Valve

The clutch cycling pressure switch is mounted on a Schrader-type valve fitting on the top of the suction accumulator/drier assembly. A valve depressor, located inside the threaded end of the pressure switch, presses in on the Schrader valve stem as the switch is mounted and allows the suction pressure inside the accumulator/drier canister to control switch operation. The electrical switch contacts are normally open when the suction pressure is approximately 169 kPa (24.5 psi). They will close when the suction pressure rises to approximately 324 kPa (47 psi) or above. Lower ambient temperatures, below approximately 10°C (50°F) during winter cold weather seasons, will also open the clutch cycling pressure switch contacts due to the pressure/temperature relationship of the refrigerant in the system. The electrical switch contact controls the electrical circuit to the compressor magnetic clutch coil. When the switch contacts are closed, the clutch coil is energized and the A/C clutch is engaged to drive the compressor. When the switch contacts are open, the compressor magnetic clutch coil is de-energized, the A/C clutch is disengaged and the compressor does not operate. The clutch cycling pressure switch, when functioning properly, will control the evaporator core pressure at a point where the plate/fin surface temperature will be maintained slightly above freezing. This prevents evaporator icing and airflow blockage.

### Condenser Assembly

The A/C condenser is an aluminum fin and tube design heat exchanger located in front of the vehicle radiator. It cools compressed refrigerant gas by allowing air to pass over the fins and tubes to extract the heat, and condenses the gas to liquid refrigerant as it is cooled.

The condenser inlet and outlet connections are the male part of a spring lock coupling (Fig. 10) and require a



**FIG. 9 Suction Accumulator/Drier—Dome Type**

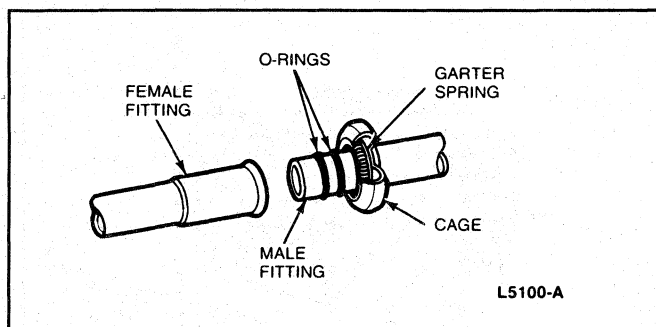
special service tool to disconnect the refrigerant lines from the condenser. The procedure to disconnect and reconnect the spring lock coupling is shown in Fig. 45.

### Spring Lock Coupling

The spring lock coupling (Fig. 10) is a refrigerant line coupling held together by a garter spring inside a circular cage. When the coupling is connected together, the flared end of the female fitting slips behind the garter spring inside the cage of the male fitting. The garter spring and cage then prevents the flared end of the female fitting from pulling out of the cage.

Two O-rings are used to seal between the two halves of the coupling. These O-rings are made of special material and **must** be replaced with an O-ring made of the same material. Use only the O-rings listed in the Ford Master Parts catalog for the spring lock coupling.

A plastic indicator ring is used on spring lock couplings to indicate, during vehicle assembly, that the couplings are connected. Once the coupling is connected, the indicator ring is no longer necessary but will remain captive by the coupling near the cage opening.



**FIG. 10 Spring Lock Coupling**

The indicator ring may also be used during service operations to indicate connection of the coupling. When the coupling is connected, the indicator ring will snap out of the cage opening but will remain captured on the coupling by the refrigerant line.

### Cooling Fan Controller

A cooling fan controller is used on 3.0L engines with air conditioning. The cooling fan controller cycles the engine cooling fan on whenever the A/C compressor is operating. The controller also allows for engine cooling fan operation whenever the engine coolant temperature reaches 105°C (221°F).

The cooling fan controller is located under the instrument panel to the left of the steering column. A schematic of the electrical components and circuits involved is shown in Fig. 11.

### A/C Compressor and Clutch

The FS-6 A/C compressor is used in all Taurus and Sable vehicles equipped with air conditioning. It is a 6-cylinder, swash-plate design which is belt-driven by the engine crankshaft pulley. This compressor has a displacement of 171cc (10.4 cubic inches). Lubrication is provided by a charge of 500 viscosity refrigerant oil in the refrigerant system.

The suction and discharge manifolds are attached to the top of the compressors with two screws and the pressure relief valve is threaded into the discharge manifold. The FS-6 uses extruded aluminum manifolds.

The clutch consists of three basic components; the pulley, the hub and the field coil. The pulley and field coil are attached to the front lead of the compressor with tapered snap rings. The hub is keyed to the compressor shaft and is fastened to the shaft with a self-locking nut.

Refer to Section 36-37 for compressor and clutch service procedures.

### Pressure Relief Valve

A pressure relief valve is installed on the compressor to relieve excessive high-pressure buildups of 312 kPa (450 psi) and above, and prevents damage to the compressor and other A/C components. The pressure relief valve is located on the side of the compressor discharge (high-pressure) manifold.

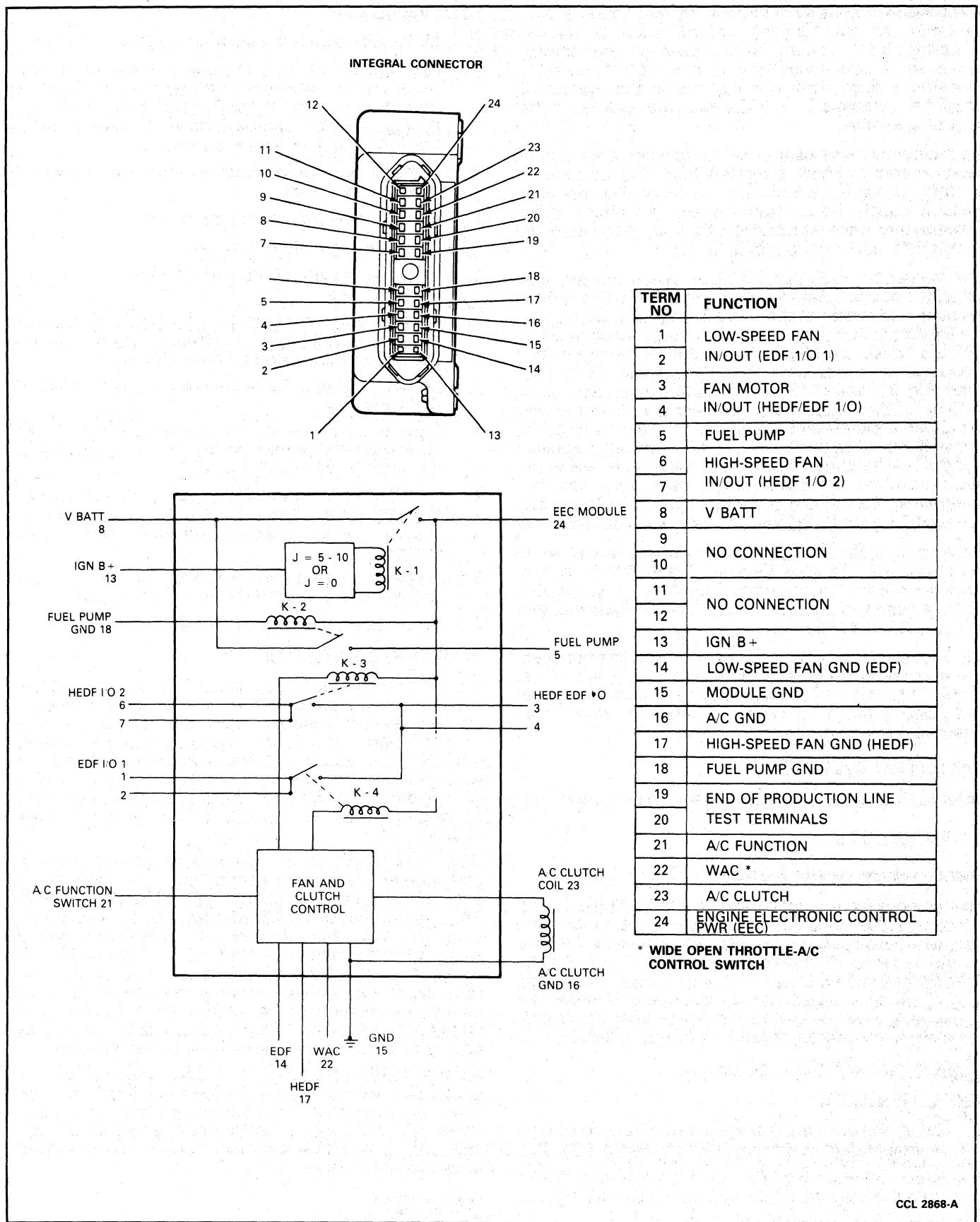
## DIAGNOSIS AND TESTING

### Electrical

Refer to Fig. 6.

### Vacuum System Tests

To test the A/C-heater control system, start the engine and rotate the function selector control knob slowly from



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FIG. 11 Cooling Fan Controller Electrical Schematic



one position to another. A momentary hiss sound should be heard as the function control knob is rotated indicating that vacuum is available at the control assembly. A continuous hiss at the control assembly indicates a major leak **somewhere** in the system. It **does not** necessarily indicate that the leak is at the control assembly.

If a momentary hiss **cannot** be heard when the function selector control knob is rotated from one position to another, check for a kinked, pinched or disconnected vacuum supply hose. Also inspect the check valve between the intake manifold and the vacuum reservoir to ensure it is working properly (Fig. 12).

If a momentary hiss can be heard when the function selector knob is rotated from one position to another, vacuum is available at the control assembly, then cycle the function selector control knob through each position with the blower on HI and check the location(s) of the discharge air. The airflow schematic and vacuum control chart (Fig. 3) shows the vacuum motors applied for each position of the function and temperature control knobs along with a system airflow diagram. The airflow diagram shows the position of each door when vacuum is applied and the no-vacuum position. Using this chart, airflow for each position of the control assembly can be determined. If a vacuum motor fails to operate, the motor can readily be found because the airflow will be incorrect.

If a vacuum motor is inoperative, check the operation of the motor with Rotunda Vacuum Tester 021-00014 or equivalent. If the vacuum motor operates properly, the vacuum hose is probably pinched, kinked, disconnected or has a hole in it (Fig. 12).

If the vacuum system functions normally at idle but goes to defrost during acceleration, a small leak exists in the system. The leak can be located by turning off the engine and using a gauge to check for vacuum delay while selectively blocking off vacuum hoses.

## Refrigerant System

Refer to Section 36-32 for refrigerant system diagnosis.

## ADJUSTMENTS

### Temperature Control Cable

The temperature control cable is self-adjusting with the rotation of the temperature selector knob to its fully clockwise (red) position as marked on the face of the control assembly. To prevent kinking of the control wire, a preset adjustment should be made before attempting to perform the self-adjustment operation. The preset adjustment may be performed either with the cable installed in the vehicle or before cable installation.

#### Cable Preset and Self-Adjustment

##### Before Installation

1. Insert end of a small pocket screwdriver in end loop of temperature control cable, at crank arm (Fig. 13).
2. Slide self-adjusting clip down control wire (away from loop) approximately 25.4mm (1-inch).
3. Install cable assembly.
4. Rotate temperature selector knob to clockwise (red) position marked on control assembly face to position self-adjusting clip.
5. Check for proper control operation.

## After Installation

1. Move selector knob clockwise to COOL position.
2. Hold crank arm firmly in position, insert blade of a small pocket screwdriver into wire loop (Fig. 13). Pull cable wire through self-adjusting clip until there is a space of approximately 25.4mm (1-inch) between clip and wire end loop.
3. Rotate selector knob clockwise to allow positioning of self-adjusting clip.
4. Check for proper control operation.

## Mini-Tube Vacuum Hose Service

1. Measure length of damaged area of mini-tube vacuum hose.
2. Cut a piece of standard 3mm (1/8-inch) ID vacuum hose approximately 25mm (1-inch) longer than the damaged area of mini-tube vacuum hose.
3. Cut off mini-tube vacuum hose on each side of damaged area.
4. Dip mini-tube hose ends in Tetra Hydro Furan (THF) or Methyl Ethyl Ketone (MEK). This solvent will seal mini-tube to vacuum hose.
5. Insert ends of mini-tube vacuum hose (Fig. 14) approximately 9mm (3/8-inch) into ends of standard 3mm (1/8-inch) service vacuum hose section.
6. Shake repair joint after assembly to ensure solvent is dispersed and vacuum line is not plugged.
7. Test system for a vacuum leak in service area.

## Adding Refrigerant Oil

It is imperative that the specified type and quantity of refrigerant oil be maintained in the refrigerant system for proper operation. A surplus of oil, the wrong oil viscosity or insufficient oil will all cause refrigerant system problems. Insufficient oil or the wrong oil results in poor lubrication and possible compressor damage. A surplus of oil allows too much oil to circulate with the refrigerant causing the cooling capacity of the system to be reduced.

When it is necessary to replace a refrigeration system component, certain procedures must be followed to ensure that the total oil charge on the system is correct after the new component is installed. During normal A/C operation, some refrigerant oil is circulated through the system with the refrigerant and some is retained in the compressor. If certain components of the system are removed for replacement, some of the refrigerant oil will go with the component. To maintain the original total oil charge, it is necessary to compensate for the oil loss by adding oil to the system with the replacement part.

As mentioned previously, two Schrader-type service gauge port valves, located in the refrigerant lines are used to service the refrigerant system. The high-pressure service gauge port valve requires an adapter for attaching a service hose. Fig. 8 shows an assortment of available adapters.

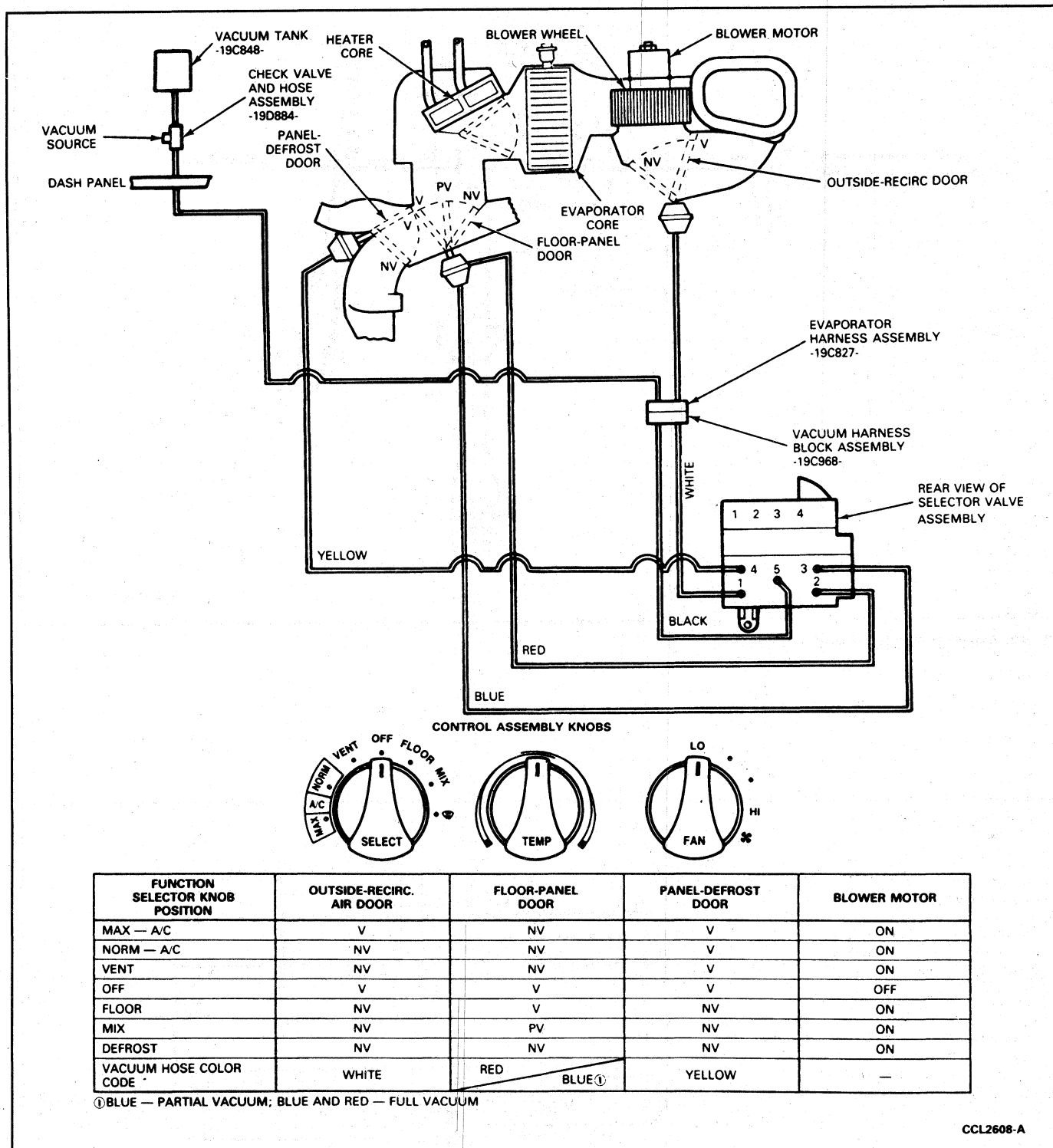
## Compressor

Refer to Section 36-37 for compressor refrigerant oil information and replacement.

## Accumulator/Drier

Drain the oil from the removed accumulator/drier through the Schrader valve fitting of the pressure switch





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FIG. 12 A/C System Schematic and Vacuum Control Chart

with the valve stem removed into a calibrated measuring container. Add the same amount of clean refrigerant oil to the new accumulator/drier after installation (Fig. 9).

**NOTE:** If more than 147.85ml (5 fl oz) of refrigerant oil is removed from an accumulator/drier, it is an indication that the oil drain hole in the accumulator/drier is plugged. Always check the accumulator/drier for excessive oil if the compressor has been replaced for lack of performance.

### Evaporator Core

Add 88.71ml (3 fl oz) of clean refrigerant oil to the accumulator/drier inlet tube whenever the evaporator core is replaced. This will compensate for the refrigerant oil lost in the replaced evaporator core.

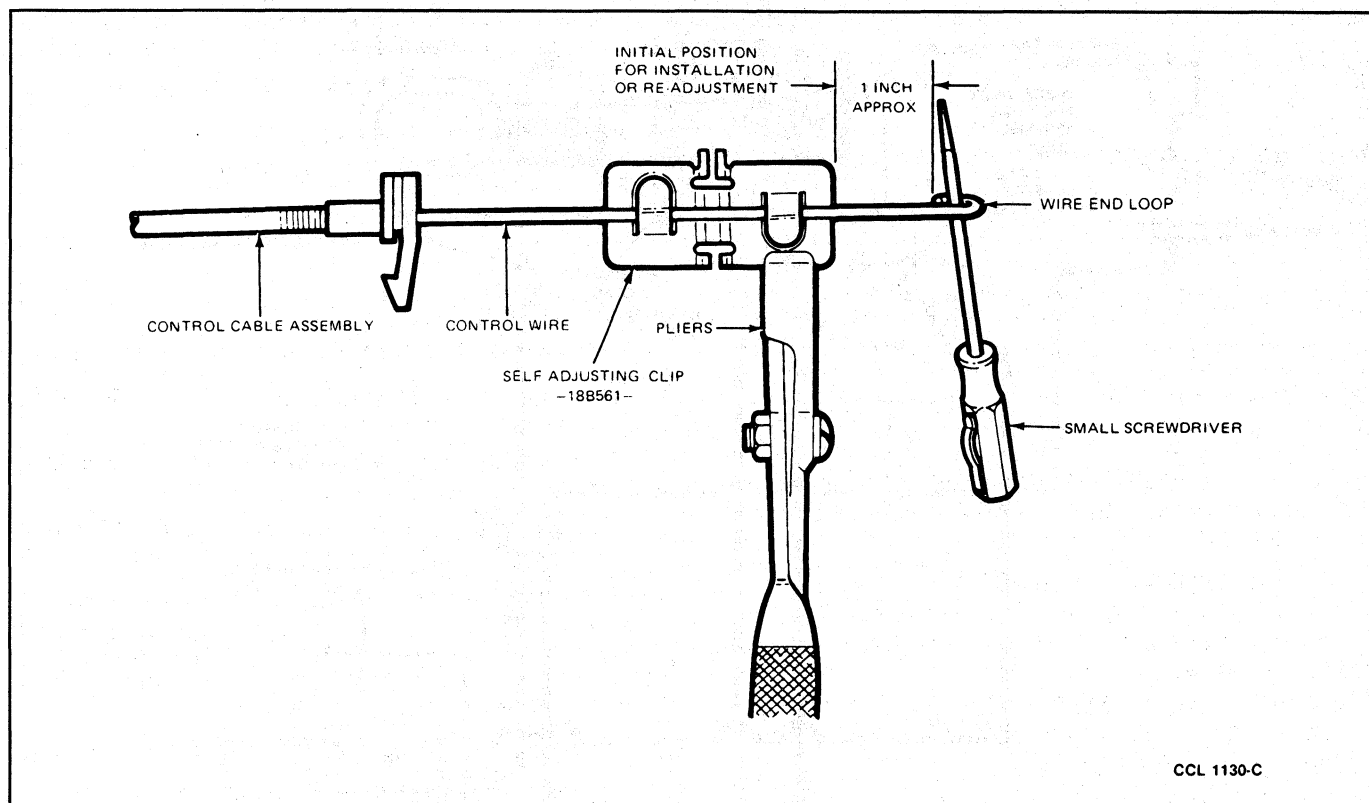


FIG. 13 Control Cable Preset Adjustment

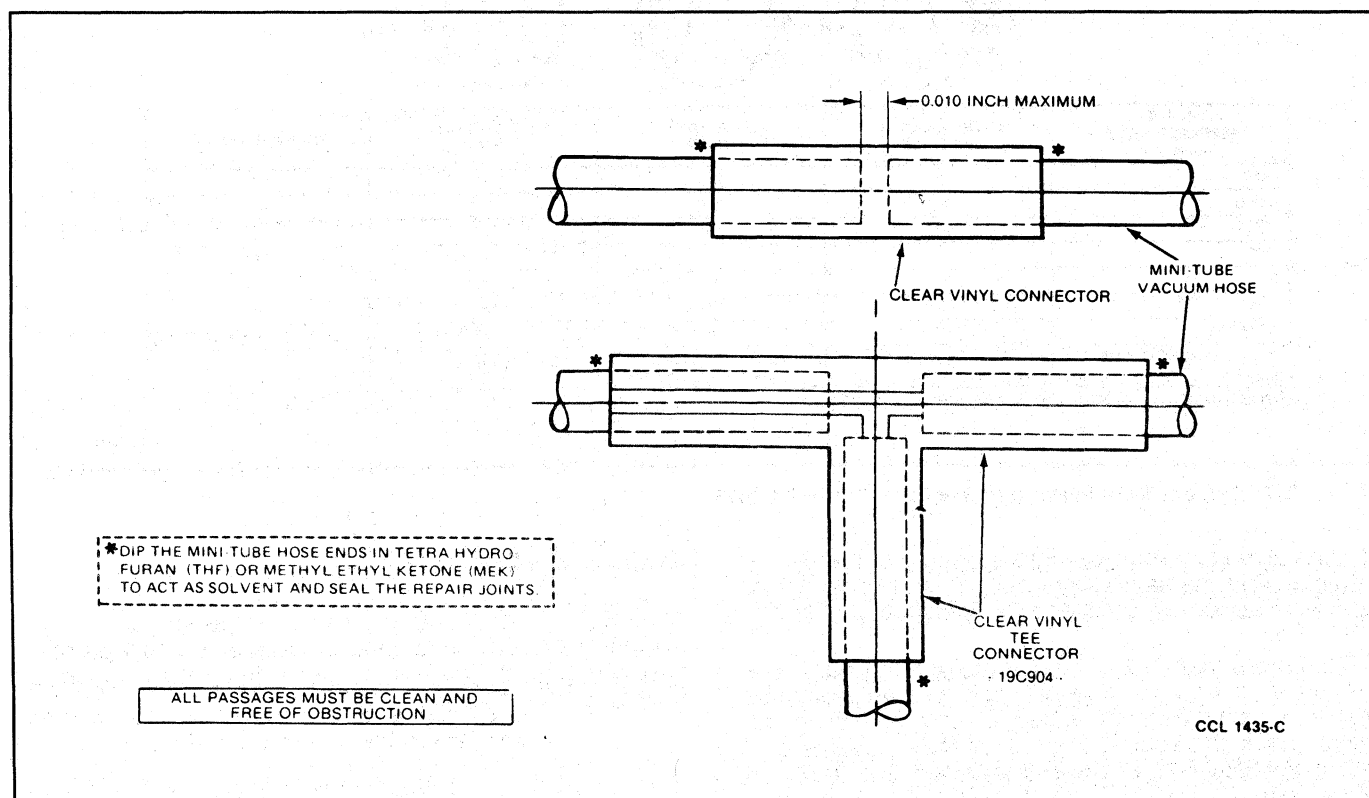


FIG. 14 Mini-Tube Vacuum Hose Service

## Condenser

Add 29.57ml (1 fl oz) of clean refrigerant oil to the condenser or the accumulator/drier if the condenser is replaced.

## Other Refrigerant System Components

Replacement of other refrigerant system components such as hoses, compressor valves, pressure switch, etc. do not require the addition of refrigerant oil.

## REMOVAL AND INSTALLATION

### Accumulator/Drier

#### Replacement Guidelines

Refer to Fig. 9.

Replace the suction accumulator/drier when:

1. Suction accumulator/drier restricted, plugged or perforated.
2. System left open more than 24 hours.
3. There is evidence of moisture in system (i.e., internal corrosion of metal lines or dark thick refrigerant oil).
4. When system is contaminated (such as seized compressor). If compressor has seized, also replace fixed orifice tube.

The accumulator/drier should **not** be replaced for the following conditions:

1. Loss of refrigerant charge.
2. Component such as condenser, evaporator or compressor (except as described above) is replaced.
3. Dent is found in outer shell of suction accumulator/drier.

### Fixed Orifice Tube

#### Replacement Guidelines

The fixed orifice tube should be replaced whenever the compressor is replaced for lack of performance (internal damage).

### Control Assembly

#### Removal

1. Disconnect battery ground cable.
2. Remove the instrument panel finish applique.
3. Remove four screws attaching control assembly to instrument panel (Fig. 15).
4. Pull control assembly from instrument panel opening and disconnect wire connectors from control assembly.
5. Disconnect vacuum harness and temperature control cable from control assembly. Discard used pushnut from vacuum harness.

#### Installation

1. Connect temperature cable to control assembly.
2. Connect wire connectors and vacuum harness to control assembly using new pushnuts.

**CAUTION: Push on the vacuum harness retaining nuts. Do not attempt to screw them onto the post.**

3. Position control assembly to instrument panel opening and install four attaching screws (Fig. 15).
4. Install the instrument panel finish applique.
5. Connect battery ground cable.
6. Check system for proper operation.

### Blower Switch

#### Removal

1. Disconnect battery ground cable.
2. Remove control assembly from instrument panel.
3. Remove fan switch knob (Fig. 12) from switch shaft by pulling it off shaft.
4. Remove four screws attaching control assembly to instrument panel.
5. Remove one screw (from back side of control assembly) attaching switch to control assembly.
6. Disconnect wire connector from switch and remove switch.

#### Installation

1. Position switch to control assembly.
2. Install screw to attach switch to control assembly.
3. Connect wire harness connector to switch.
4. Position control assembly in instrument panel opening. Install four attaching screws.
5. Place switch knob on switch shaft, push it all the way on.
6. Connect battery ground cable.
7. Check system for proper operation.

### Vacuum Selector Switch

#### Removal

1. Remove control assembly.
2. Pull function selector knob off of shaft.
3. Remove one screw attaching vacuum switch to control assembly. Remove vacuum selector switch (Fig. 15).

#### Installation

1. Position vacuum selector switch on control assembly bracket.
2. Install one screw to attach vacuum switch to control assembly.
3. Install function selector knob by pushing it on shaft.
4. Install control assembly.

### Temperature Control Cable

#### Removal

1. Remove control assembly from instrument panel.
2. Remove pushnut retaining cable end loop on temperature lever arm. Disconnect cable housing from control assembly. Discard used pushnut.
3. Disconnect temperature cable from plenum temperature blend door crank arm and cable mounting bracket.

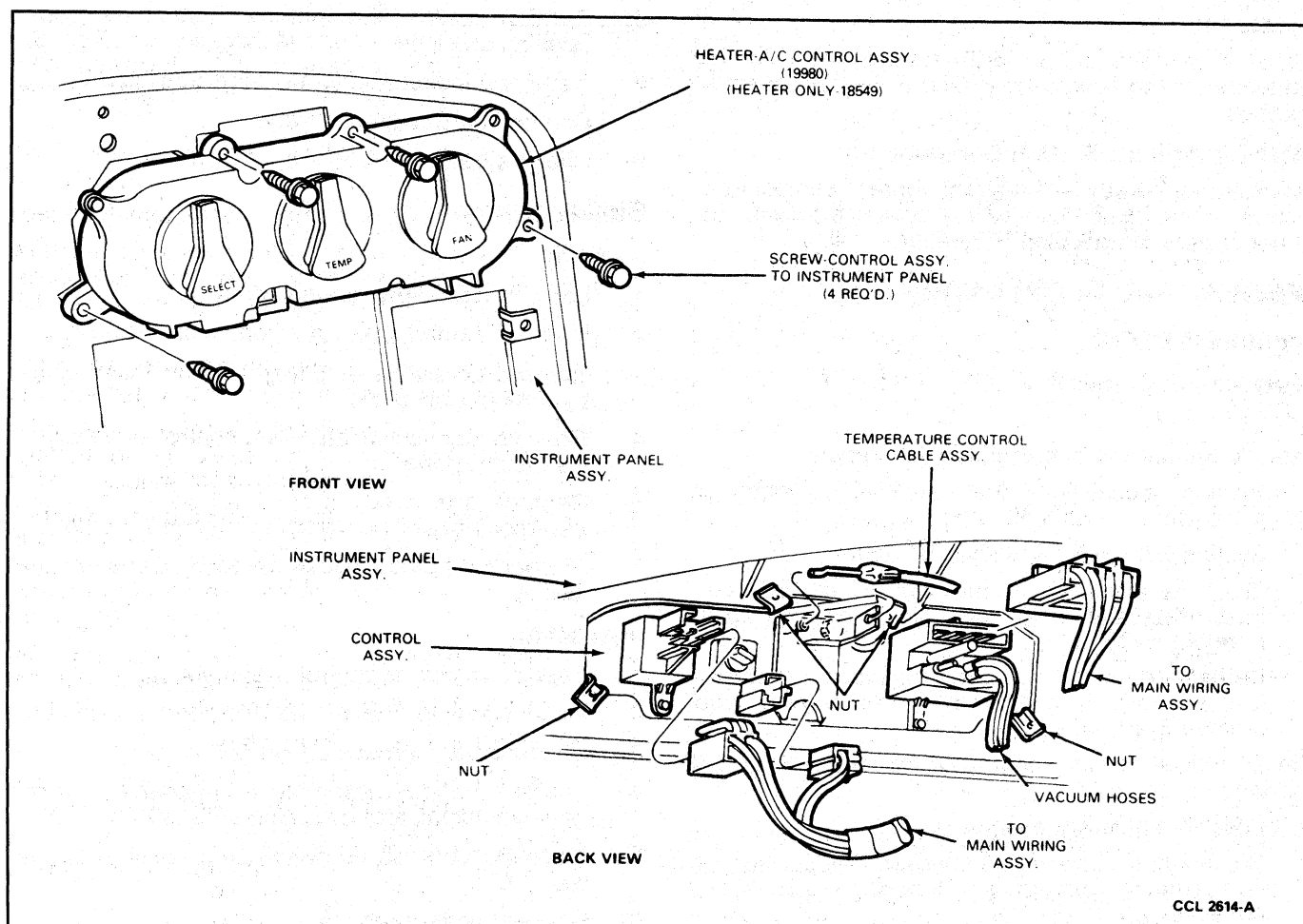


FIG. 15 Control Assembly Removal

**Installation**

1. Check to ensure self-adjusting clip is at least 25.4mm (1-inch) from end loop of control cable. Refer to Adjustments.
2. Route cable behind instrument panel and connect control cable to mounting bracket on plenum.
3. Install self-adjusting clip on temperature blend door crank arm.
4. Snap cable housing into place at control assembly. Connect loop end of control cable to temperature lever arm on control assembly.
5. Install new pushnut to retain cable end loop on temperature level arm.
6. Slide cable housing end retainer into heater case cable bracket. Push on it enough to secure cable housing to bracket (Fig. 16).
7. Connect self-adjusting clip at temperature cable door crank arm.
8. Install control assembly into instrument panel as outlined.

**Instrument Panel****Taurus**

Fig. 17 shows the instrument panel assembly and identifies the components which are visible when viewing the panel from the front.

**Removal**

1. Disconnect battery ground cable.
2. Remove two upper and two lower screws attaching steering column opening cover to instrument panel (Fig. 18). Remove cover.
3. Remove sound insulator in cowl area.
4. Remove steering column trim shrouds. Disconnect all electrical connections from steering column switches.
5. Remove four screws at steering column bracket. Lower steering column.
6. Remove lower LH radio finish panels by removing one screw from each panel, then snap each out of position in instrument panel (Fig. 19).
7. Remove seven cluster opening finish panel retaining screws, one jam nut behind headlamp switch knob, and one screw behind clock (or clock cover). Release finish panel by rocking its upper edge toward driver's position (Figs. 18 and 19).
8. Swing fuse panel downward to provide access to speedometer cable. Press on flat surface of cable's plastic connector to disconnect cable.
9. Panel can now be removed with cluster attached.
10. Using steering column, cluster and glove compartment openings for access, reach under instrument panel and disconnect all electrical connections, vacuum hoses, A/C-heater control cables and radio antenna cable.

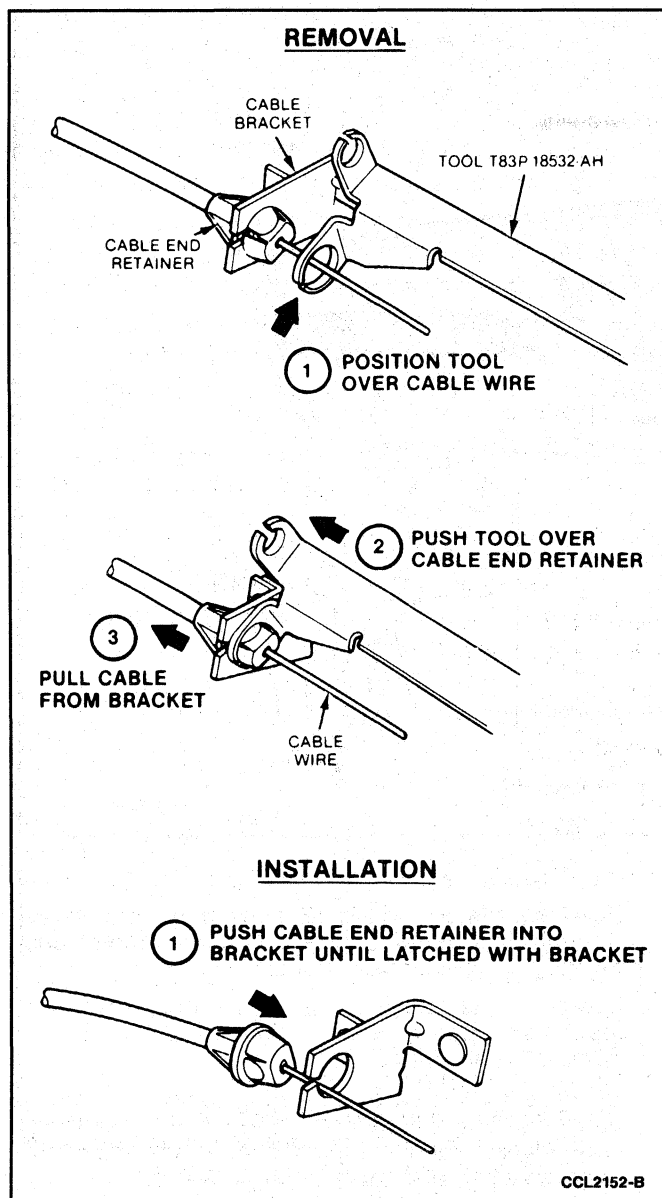


FIG. 16 Control Cable End Retainer Attachment

11. Disconnect all underhood connectors from main wiring harness. Disengage main harness rubber grommet from dash panel. Feed harness and connector halves from engine compartment through grommet hole into instrument panel area.
12. Remove two lower instrument panel-to-cowl side retaining screws from both RH and LH sides of panel.
13. Remove two instrument panel retaining screws located near the underside of radio.
14. Snap out RH and LH speaker opening covers.
15. Remove three instrument panel upper retaining screws. Remove instrument panel from vehicle.
16. Before installing replacement instrument panel, transfer all attaching components from old to new panel. Transfer parts include heater or air conditioning ducts, switches, main harness, glove compartment door, etc.

### Installation

1. Feed instrument panel wiring harness and connectors through dash panel and into engine compartment.
2. Install grommet for the harness into hole in dash panel.
3. Connect speedometer cable to speedometer head.
4. Position instrument panel with locating pin inserted into mating hole provided in cowl top. Install three upper panel retaining screws. Tighten to 1.4-2.3 N·m (12-20 lb-in).
5. Install two lower instrument panel-to-side cowl retaining screws. Tighten to 6.8-10.8 N·m (5-8 lb-ft).
7. From inside engine compartment, connect instrument panel wiring connectors to mating connectors in engine compartment wiring.
8. Working through openings for instrument cluster, steering column, and glove compartment, connect all electrical connections, vacuum, hoses, heater control cable, A/C control cable and radio antenna cable.
9. Position instrument cluster finish panel in its opening and install eight retaining screws. Tighten screws to 2.0-2.9 N·m (18-26 lb-in).
10. Install clock or clock cover plate.
11. Snap LH radio applique into position. Install retaining screw. Tighten to 2.0-2.9 N·m (18-26 lb-in).
12. Raise steering column and install four screws which secure column to support bracket.
13. Complete all electrical connections to steering column switches. Install steering column trim shrouds.
14. Position steering column cover against instrument panel. Install four retaining screws.
15. Position sound insulator in cowl area. Install two pushnuts onto studs provided in evaporator case.
16. Connect battery ground cable.

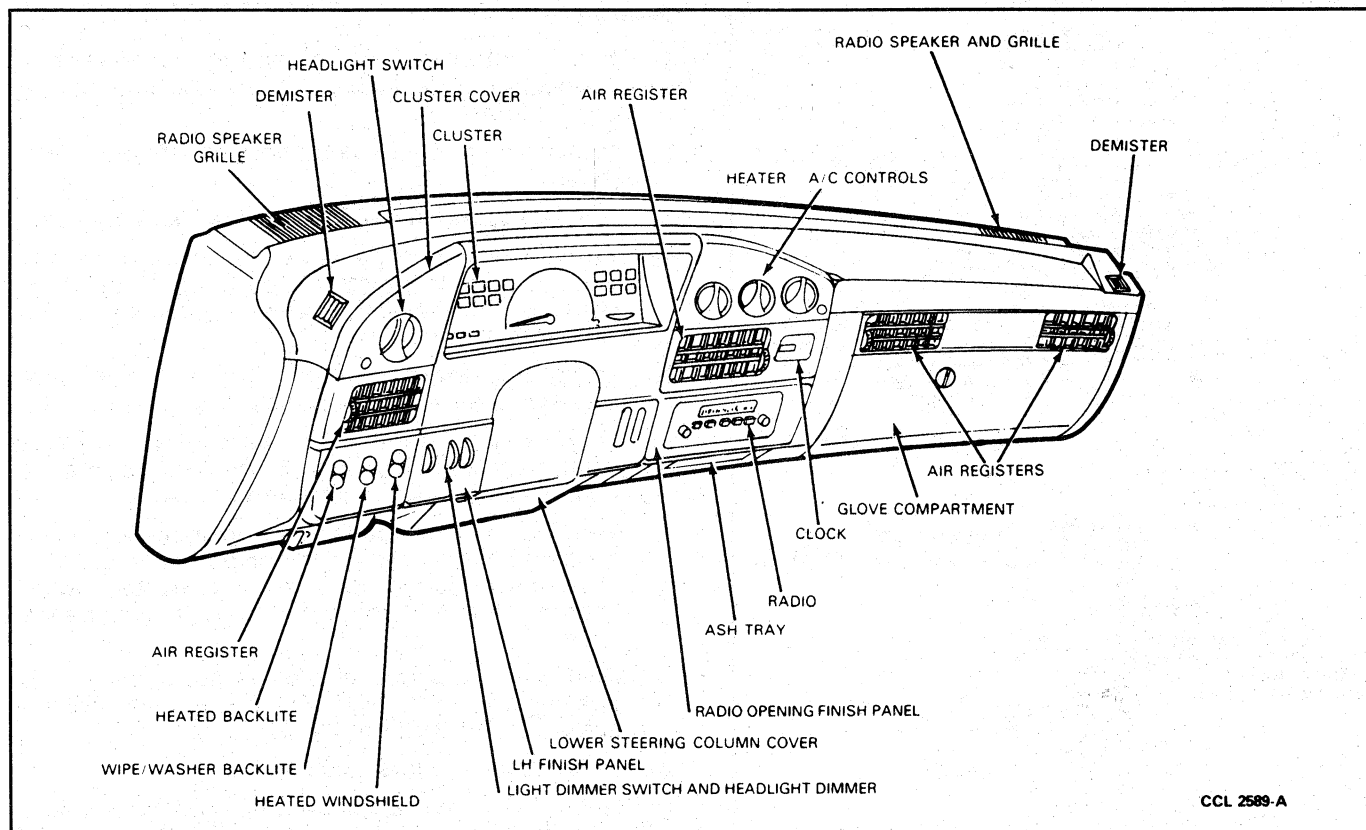
### Instrument Panel Assembly

#### Sable

Refer to Figs. 20 and 21.

#### Removal

1. Disconnect battery ground cable.
2. Remove four retaining screws at bottom of steering column opening.
3. Remove steering column trim shrouds.
4. Disconnect all electrical connections from steering column switches.
5. Remove one bolt and nut at lock pillar U-joint and four screws at steering column to release steering column.
6. Before removing cluster opening finish panel, remove lower finish panel.
7. Remove five cluster opening finish panel retaining screws. Remove panel by disengaging five hidden retainers located along upper edge. Free panel by rocking upper edge toward driver. Panel can be removed without cluster disassembly from panel.



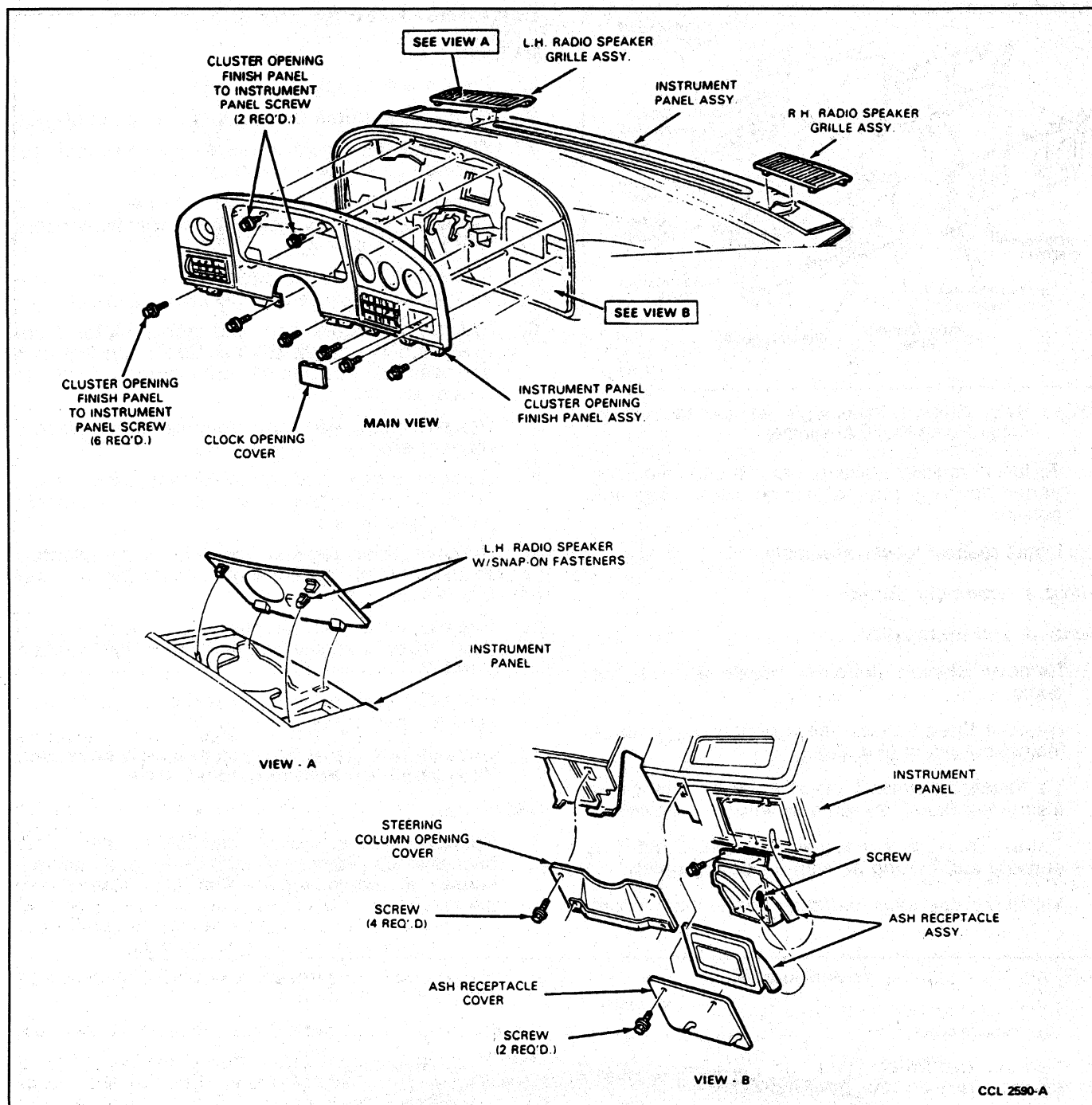
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**FIG. 17 Instrument Panel Assembly, Taurus**

8. Pivot glove compartment assembly by depressing side of glove compartment bin.
9. Using steering column, cluster, and glove compartment openings, reach under the instrument panel and disconnect all electrical connections, vacuum hoses, A/C-heater control cable and radio antenna cable.
10. Disconnect all under hood electrical connectors of main wire harness. Disengage rubber grommet from dash panel and feed wire and connectors into instrument panel area.
11. Remove one bolt attaching instrument panel-to-floor brace above LH side terminal.
12. Remove two lower instrument panel-to-cowl side retaining screws at both RH and LH sides.
13. Snap out RH and LH speaker opening covers. Snap out defroster guide.
14. Remove three instrument panel upper retaining screws. Remove instrument panel from vehicle, or place it on front seat if removal was performed to gain accessibility.
15. If instrument panel replacement is involved, transfer all attaching components to new instrument panel including heater or air conditioner ducts, switches, main harness, glove compartment bin, etc.
3. Feed instrument wiring harness and connectors through dash panel into engine compartment and install grommet in dash panel.
4. From inside engine compartment, connect instrument panel wiring connectors to engine compartment wiring.
5. Using instrument cluster, steering column and glove compartment openings, connect all electrical connections, vacuum hoses, heater, air conditioner control cables and radio antenna cable.
6. Install glove compartment assembly. Tighten to 2.0-2.6 N·m (18-23 lb-in).
7. Connect speedometer cable to speedometer head.
8. Install instrument cluster finish panel in position to install five retaining screws. Engage five upper retainers. Tighten screws to 6.8-10.8 N·m (5-8 lb-ft).
9. Install radio applique in position with two retainer clips and two retaining screws. Tighten screws to 2.0-2.7 N·m (18-23 lb-in).
10. Raise steering column into position. Install four retaining screws at support bracket and one nut and bolt at locking collar U-joint.
11. Connect all electrical connections to steering column switches. Install steering column trim shrouds.
12. Position sound insulator. Install two retaining screws at instrument panel. Push retaining pin into brake pedal support. Tighten screws to 2.0-2.6 N·m (18-23 lb-in).
13. Position steering column cover against instrument panel and install four retaining screws.

#### Installation

1. Install two lower instrument panel-to-side cowl retaining screws. Tighten to 6.8-10.8 N·m (5-8 lb-ft).
2. Install one bolt attaching instrument panel-to-floor brace located above LH side of tunnel.



**FIG. 18 Instrument Panel Assembly, Taurus—Disassembled View**

14. Snap in defroster grille.
15. Snap in RH and LH radio speaker grilles.
16. Connect battery ground cable.

### Louver Assemblies, Rectangular

#### Removal and Installation

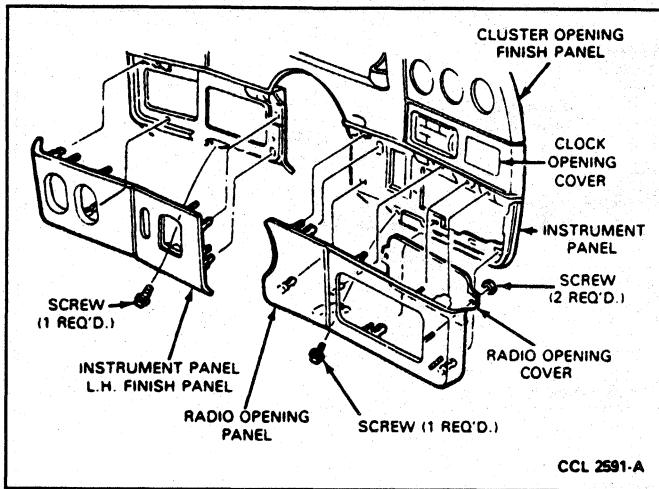
1. Insert a flat blade screwdriver under tab on the inner surface of RH end of louver assembly. Pry tab toward louvers until retaining tab pivot clears its attaching hole in housing (Fig. 22).
2. Pull louver assembly outward only far enough to prevent pivot from re-engaging in the hole.

3. Repeat Step 1 for retaining tab on the LH end of the louver assembly. Withdraw louver assembly from housing.
4. To install louver assembly, push it into opening in register housing until the pivots snap in place in their mating holes in the register housing.

### Register Housing Assembly—Rectangular

#### Removal and Installation

1. Remove register louver assembly as outlined.
2. Depress tabs located in upper surface of register housing. Pull housing out of its opening in instrument panel (Fig. 22).



**FIG. 19 Radio Opening Panel Assembly and Instrument Panel Finish Panel Assembly**

3. To install register housing, press it into instrument panel opening until attaching tabs snap into position.
4. Install register louver assembly.

#### Register Assembly, Round

##### Removal and Installation

1. Remove plenum defroster nozzle and register ducts.
2. Remove three screws which attach connector to instrument panel (Fig. 23).
3. To install connector, place it in its opening in instrument panel. Install three attaching screws.
4. Rotate knob on connector to ensure that it is opening and closing air shut-off door properly.
5. Install register ducts, defroster nozzle and plenum.

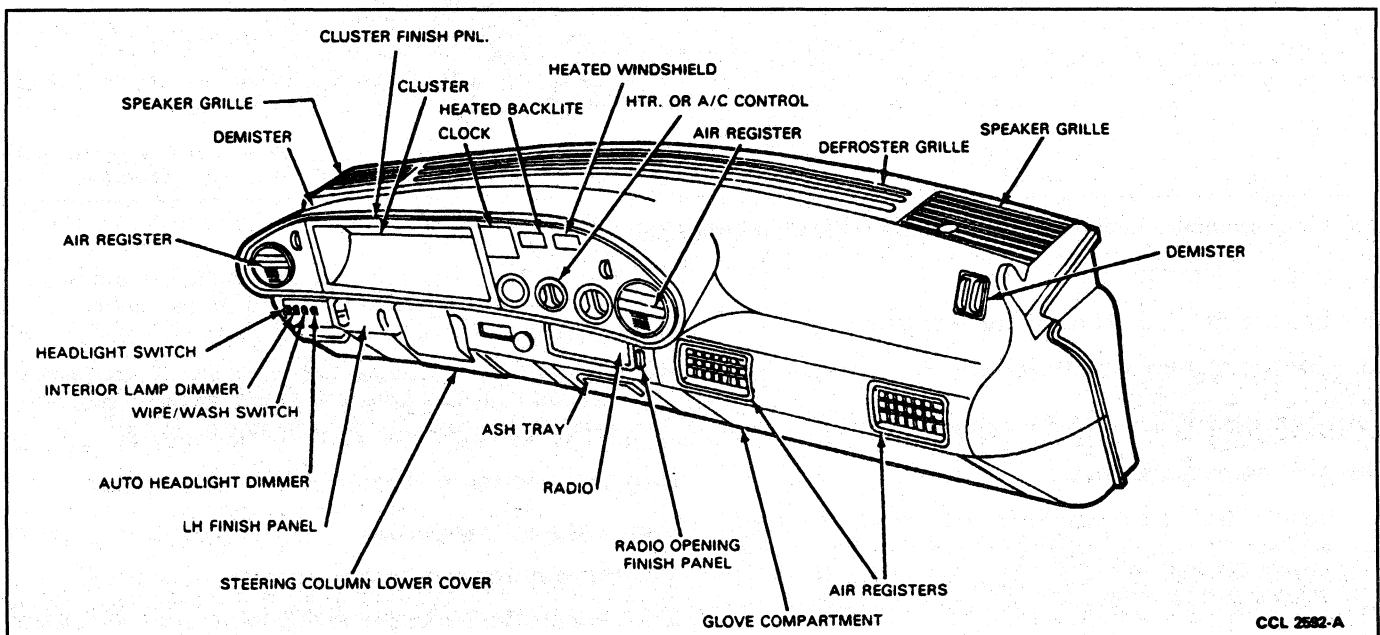
## Evaporator Case Assembly

### Removal

1. Disconnect battery ground cable.
2. Drain coolant from radiator into a clean container.
3. Discharge refrigerant from A/C system as outlined. Observe all safety precautions.
4. Disconnect heater hoses from heater core. Plug heater core tubes or blow coolant from heater core with low-pressure air.
5. Disconnect vacuum supply hose from in-line vacuum check valve in engine compartment.
6. Disconnect liquid line and accumulator from evaporator core at dash panel. Cap refrigerant lines and evaporator core to prevent entrance of dirt and excess moisture.
7. Remove instrument panel as outlined and place it on front seat.
8. Remove screw holding instrument panel shake brace to evaporator case. Remove instrument panel shake brace.
9. Remove floor register (or rear seat adapter) attached to bottom of evaporator case (two screws) (Fig. 24, View B).
10. Remove three nuts attaching evaporator case to dash panel in engine compartment (Fig. 24, Main View).
11. Remove two screws attaching support brackets to cowl top panel (Fig. 24, View A).
12. Carefully pull evaporator case assembly away from dash panel and remove it from vehicle.

### Installation

1. Position evaporator case assembly to dash panel and cowl top panel at air inlet opening. Install two screws to attach support brackets to cowl top panel.



**FIG. 20 Instrument Panel Assembly, Sable**



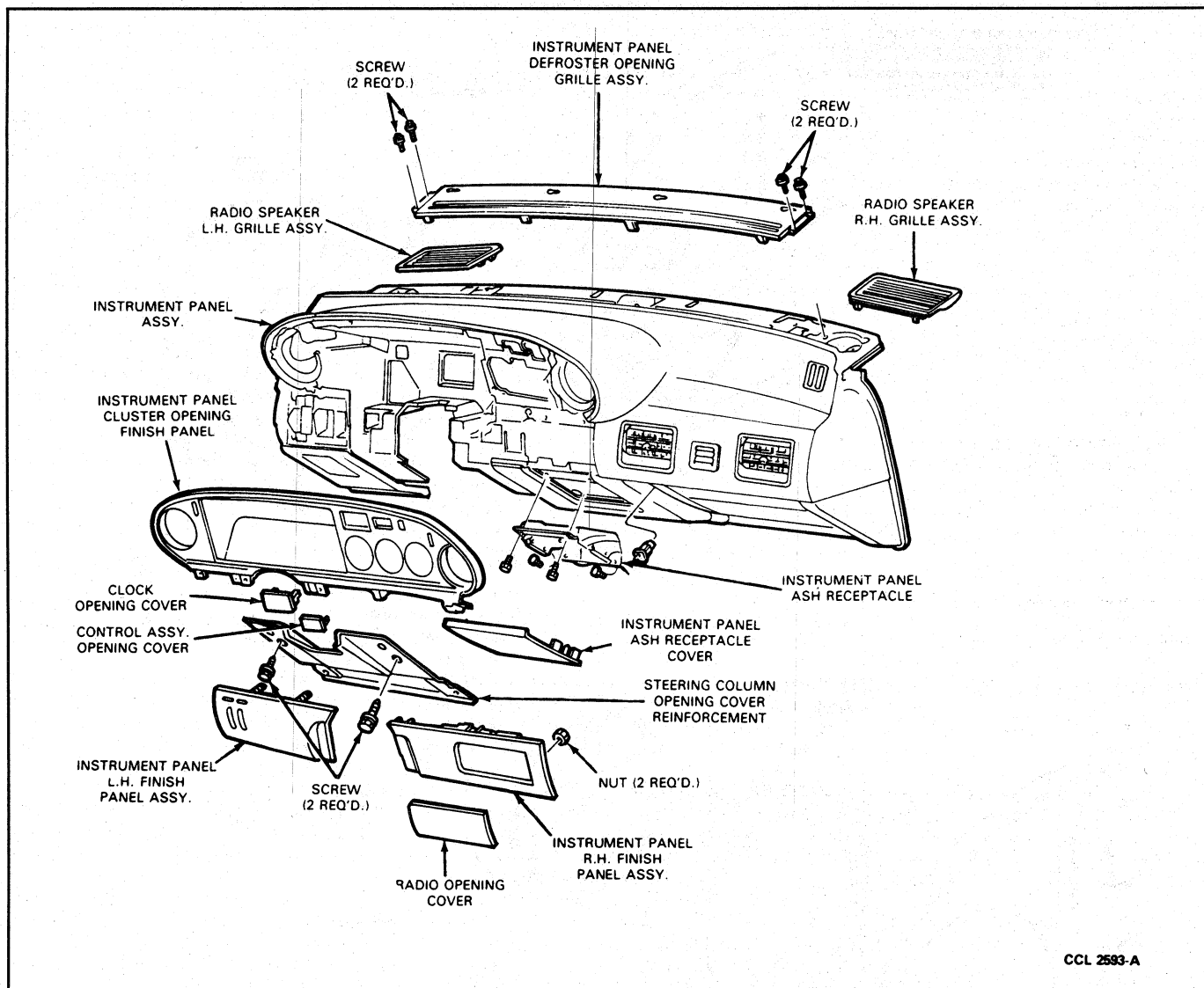


FIG. 21 Instrument Panel Assembly, Sable—Disassembled View

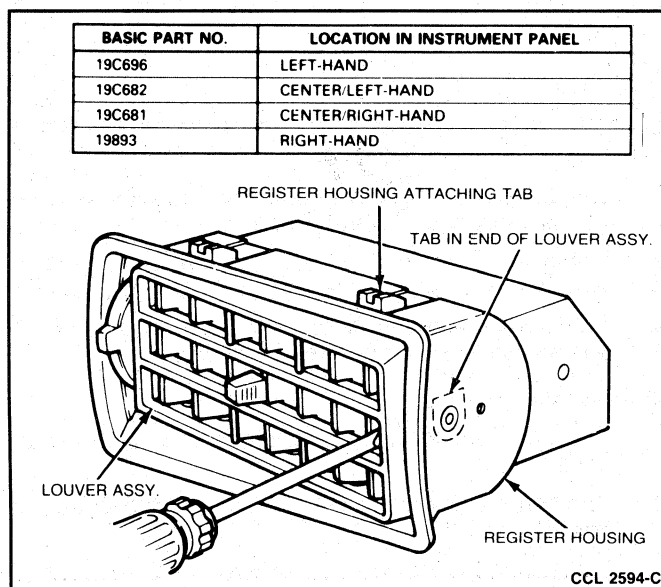


FIG. 22 Register Assembly, Rectangular—Removal

2. Install three nuts in engine compartment which attach evaporator case to dash panel.
3. Install floor register (or rear seat adapter) to evaporator case (two screws).
4. Install instrument panel shake brace and screw to evaporator case.
5. Install instrument panel as outlined.
6. Connect liquid line and suction accumulator to evaporator core.
7. Connect heater hoses to heater core.
8. Connect black vacuum supply hose to vacuum check valve in engine compartment.
9. Fill radiator to correct level with previously removed coolant or specified mixture of coolant and water.
10. Connect battery ground cable.
11. Leak test, evacuate and charge A/C refrigerant system.
12. Check system for proper operation.

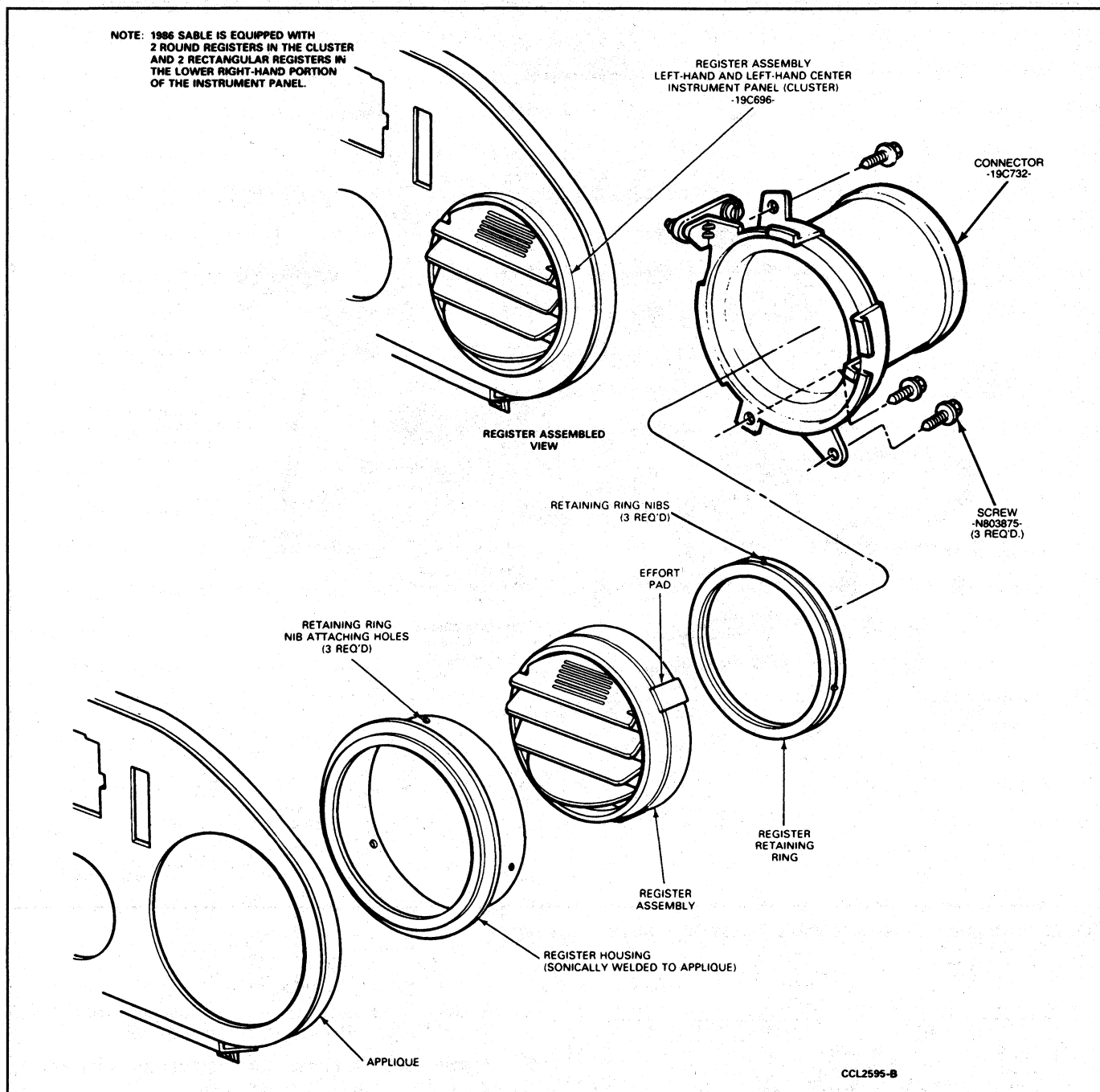


FIG. 23 Register Assembly, Round—Removal

## Evaporator Core

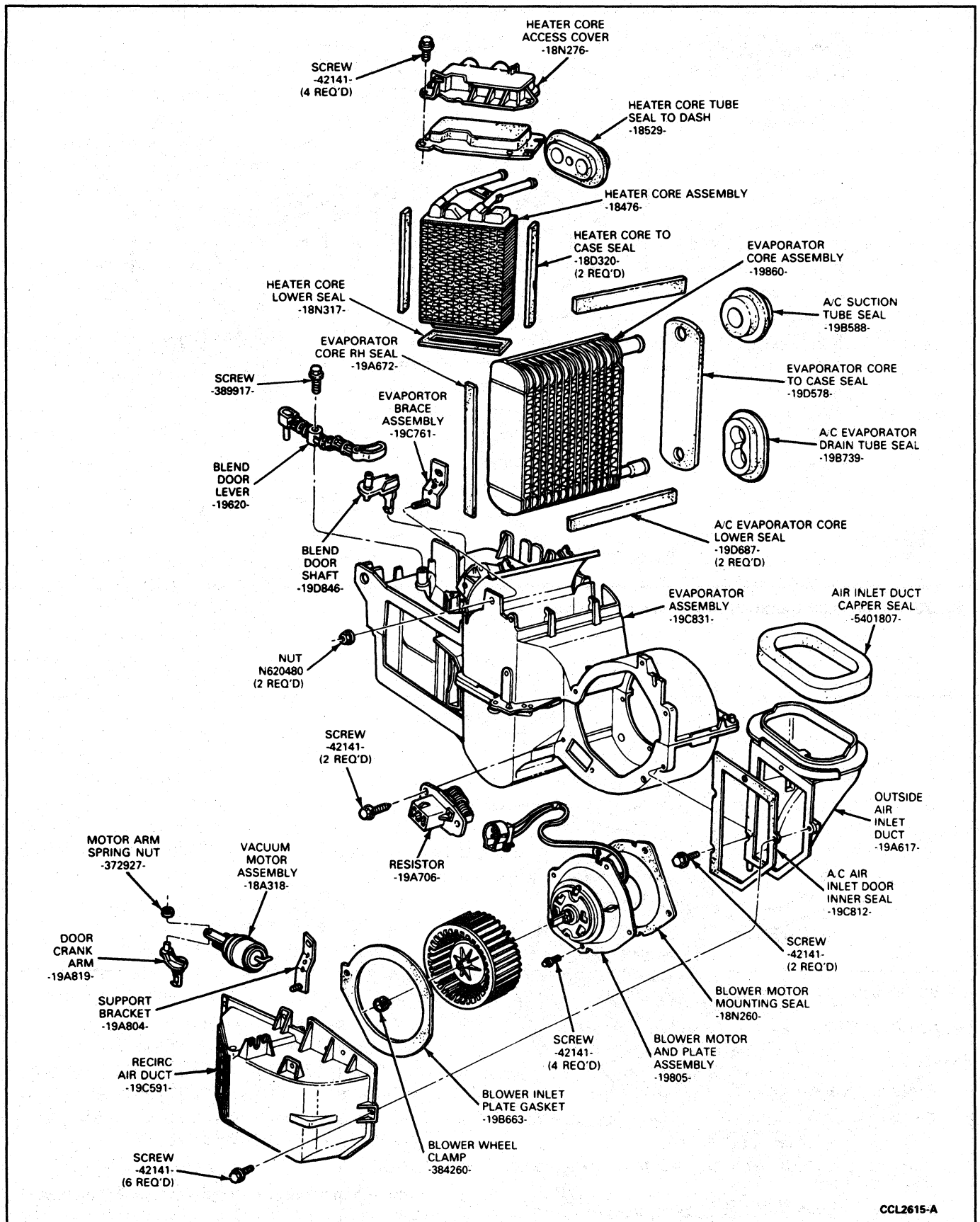
### Removal

1. Remove evaporator case as outlined.
2. Disconnect and remove vacuum harness from vacuum motor (Fig. 24, View A).
3. Remove six recirc duct screws from evaporator (Fig. 25). Remove duct.
4. Remove air inlet duct (two screws) from evaporator case (Fig. 26).
5. Remove support bracket from evaporator case (Fig. 24, View A).
6. Remove molded seals from evaporator core tubes (Fig. 24, Main View).

7. Drill 3/16-inch hole in each of two upright tabs on top of evaporator case (Fig. 27).
8. Using a hot knife or small saw blade, cut top of evaporator case between raised outlines (Fig. 28).
9. Fold cutout cover back from opening and lift evaporator core from case (Fig. 29).

### Installation

1. Transfer four foam core seals to new evaporator core.
2. Position evaporator core in case and close cutout cover.
3. Install spring nut on each of two upright tabs and adjacent holes drilled in front flange. Ensure hole in spring nut is aligned with 3/16-inch holes drilled in



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FIG. 24 Heater and Evaporator Installation

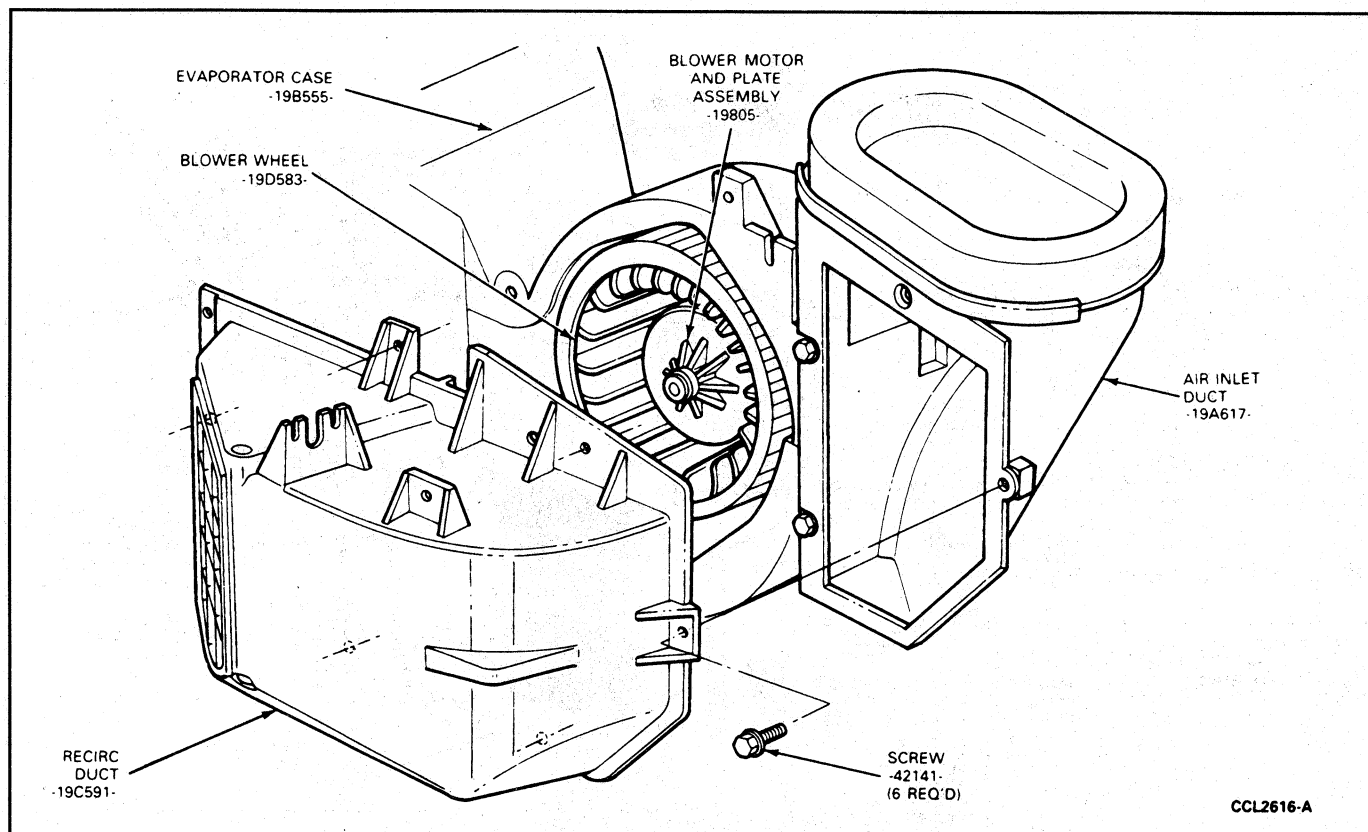


FIG. 25 Recirc Duct Removal from Evaporator Case

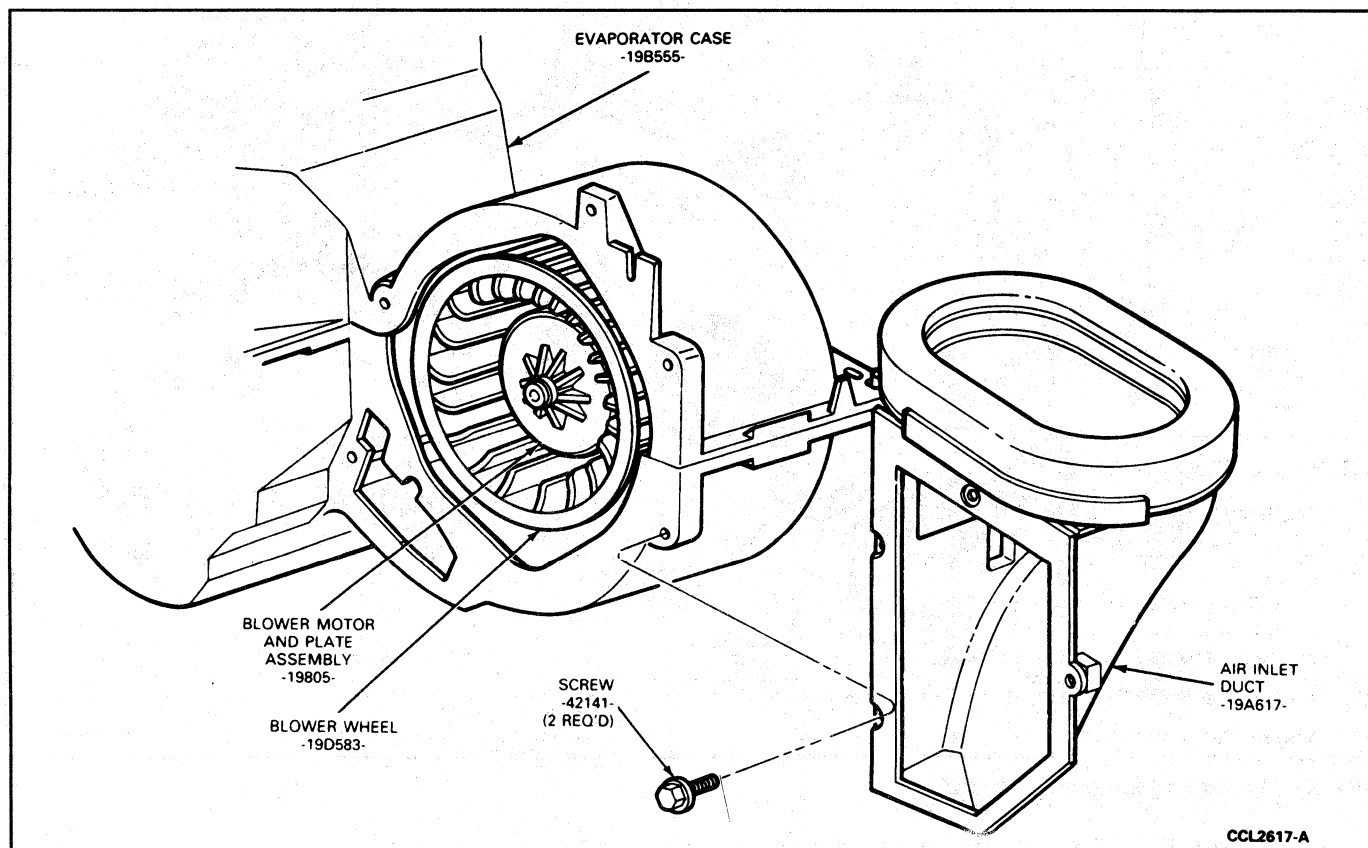


FIG. 26 Air Inlet Duct Removal from Evaporator Case

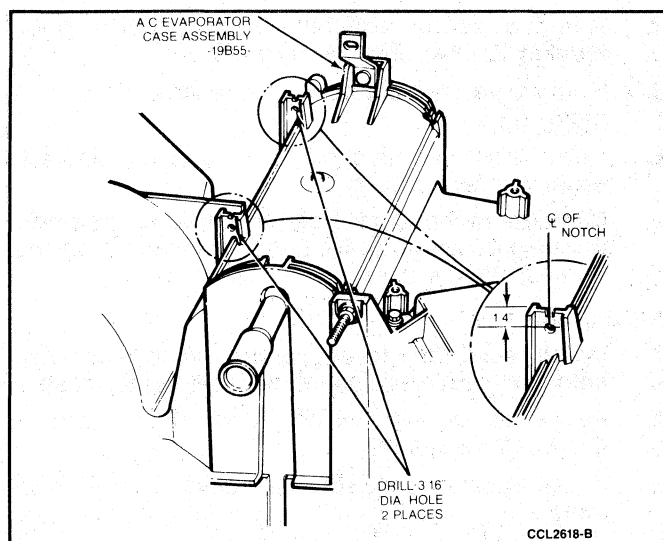


FIG. 27 Drilling Holes in Evaporator Case Tabs

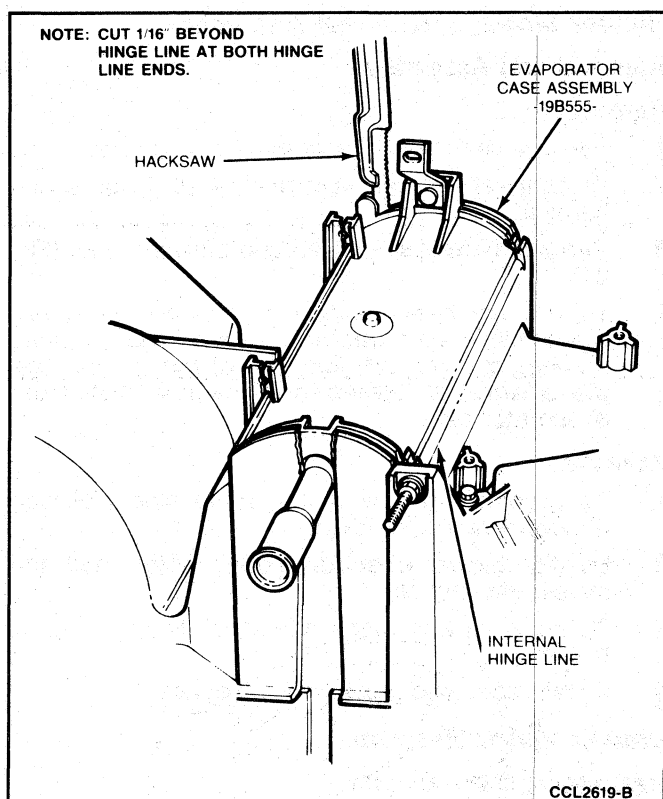


FIG. 28 Evaporator Case Cutting

tab and flange. Install and tighten screw in each spring nut (through hole in tab or flange) to secure cutout cover in closed position (Fig. 30).

4. Install caulking cord (rope sealer) D9AZ-19560-A, or equivalent, to seal evaporator case against leakage along cut line (Fig. 31).
5. Assemble support bracket to evaporator case.
6. Install air inlet duct on evaporator case (two screws).
7. Install recirc duct on evaporator case (six screws).
8. Install vacuum harness on evaporator case.
9. Install foam seals over evaporator tubes.

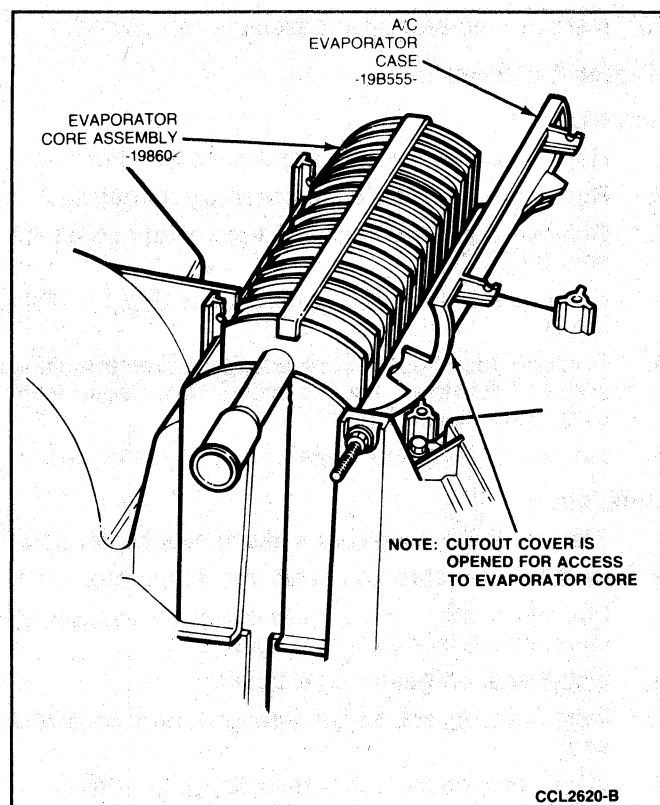


FIG. 29 Evaporator Core Removal from Case

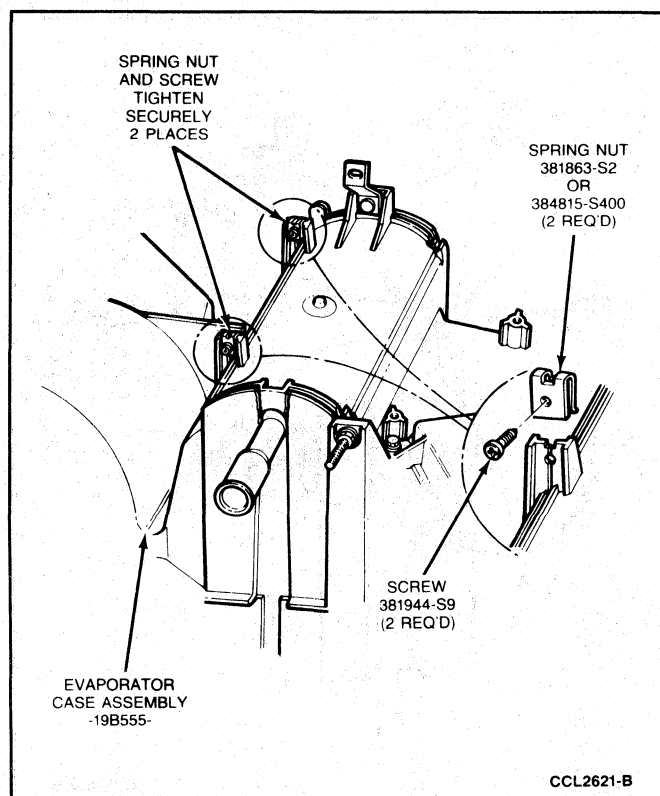


FIG. 30 Cutout Cover Securing in Closed Position

10. Install evaporator case assembly as outlined.

## Heater Core

### Removal

1. Remove instrument panel and place it on front seat.
2. Remove evaporator case assembly as outlined.
3. Remove vacuum source line from heater core tube seal (Fig. 32).
4. Remove seal from heater core tubes (Fig. 24, Main View).
5. Remove four heater core access cover attaching screws. Remove access cover and seal from evaporator case (Fig. 33).
6. Lift heater core and seals from evaporator case.

### Installation

1. Transfer three foam core seals to new heater core.
2. Install heater core and seals into evaporator case.
3. Position heater core access cover on evaporator case. Install four attaching screws.
4. Install seal on heater core tubes.
5. Install vacuum source line through heater core tube seal.
6. Install evaporator case assembly into vehicle as outlined.
7. Install instrument panel as outlined.

## Recirc Duct Assembly

### Removal

1. Open glove compartment door and release retainers, lowering door.

2. Remove screw attaching recirc duct support bracket to cowl (Fig. 24, View A).
3. Remove vacuum connection to recirc door vacuum motor (Fig. 25).
4. Remove screws attaching recirc duct to evaporator assembly (six screws).
5. Remove recirc duct from evaporator assembly, lowering it through space between instrument panel and evaporator case.

### Installation

1. Install recirc duct to evaporator, lifting recirc duct between instrument panel and evaporator case.
2. Install six screws which retain recirc duct to evaporator assembly.
3. Install vacuum connector to recirc door vacuum motor.
4. Install screw attaching support bracket to cowl.
5. Close glove compartment door.

## Blower Motor and Wheel Assembly

### Removal and Assembly

#### Removal

1. Remove recirc duct assembly from vehicle.
2. Disconnect blower electrical lead from wiring harness.
3. Remove blower wheel clip and blower wheel (Fig. 34).
4. To remove blower motor and wheel assembly, disconnect blower motor electrical lead to wiring harness and remove four blower motor mounting plate screws. Remove blower motor from evaporator case.

#### Assembly

1. To assemble blower motor, route electrical lead through evaporator case.
2. Position blower wheel on blower motor shaft and install retaining clip.
3. Connect blower motor electrical lead to wiring harness.
4. Install recirc duct assembly in vehicle.

## Blower Motor Resistor

### Removal and Installation

The blower motor resistor and thermal limiter assembly is installed on the passenger side of the evaporator case behind the glove compartment (Fig. 35). Use only the specified resistor assembly for service replacement. Do not apply sealer to the resistor board mounting surface.

1. Open glove compartment door and release glove compartment retainers so that glove compartment hangs down.
2. Disconnect wire harness connector from resistor assembly.
3. Remove two resistor attaching screws and remove resistor from evaporator case.
4. To install, position resistor assembly in evaporator case opening and install two attaching screws. Do not apply sealer to resistor assembly mounting surface.

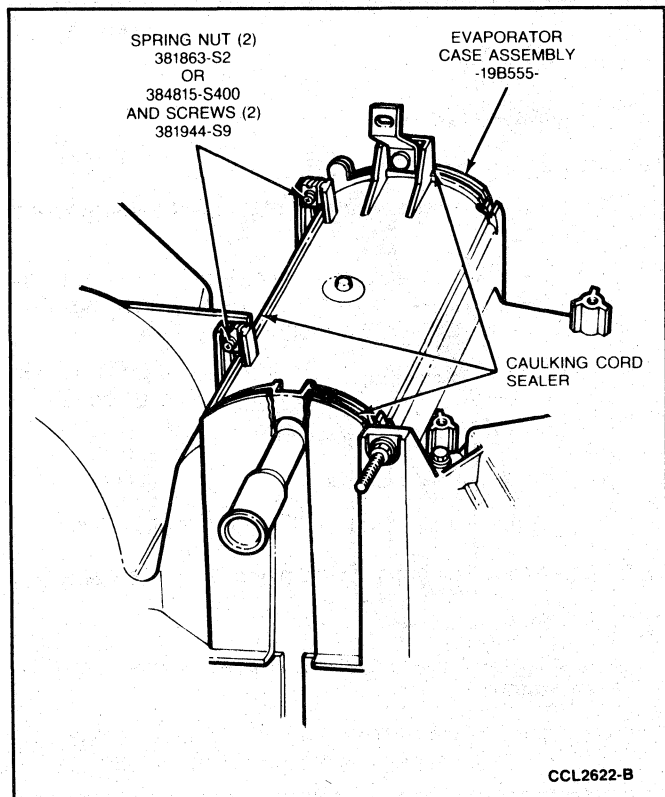
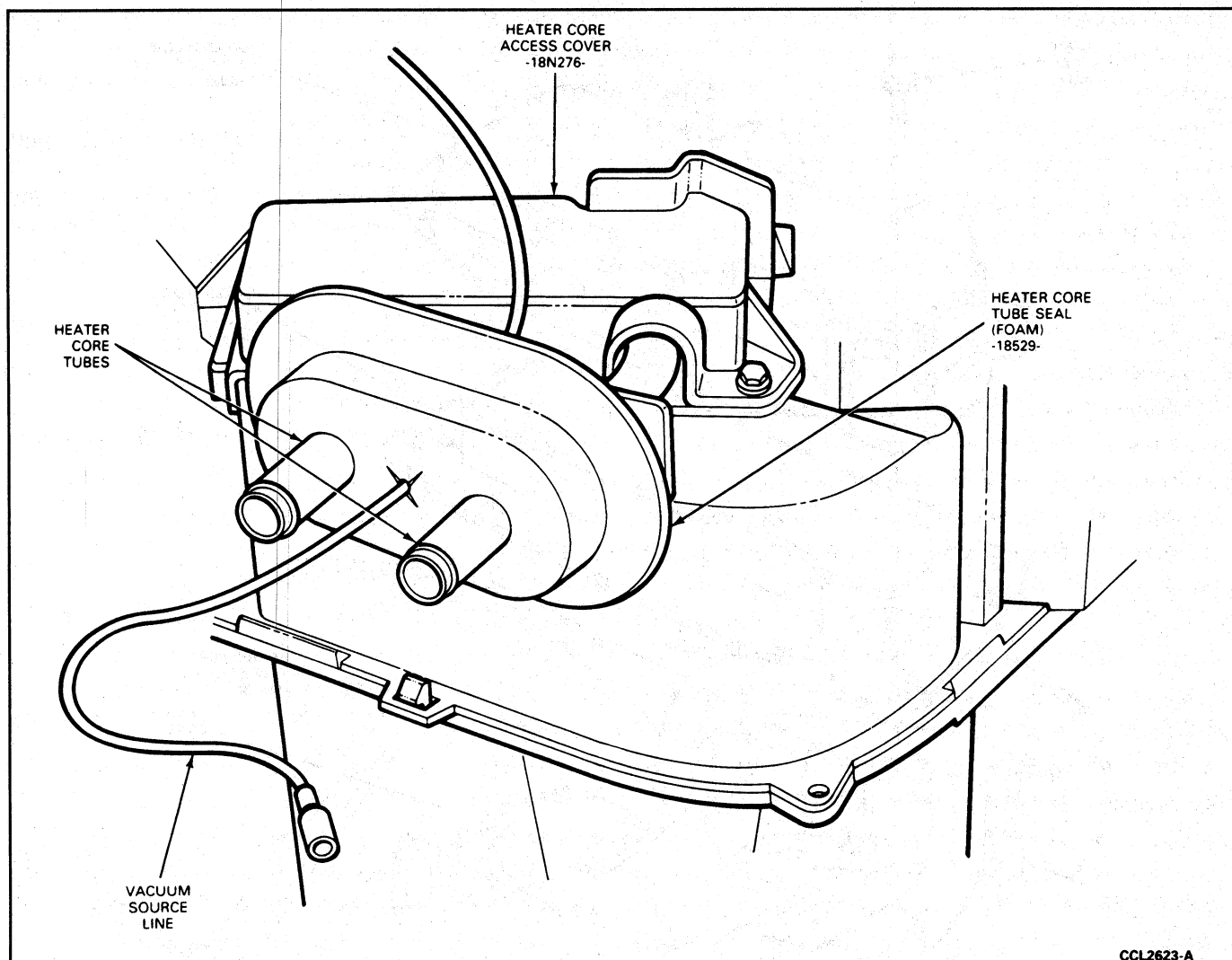


FIG. 31 Caulking Cord Installation



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FIG. 32 Vacuum Line Removal from Heater Core Tube Seal

5. Connect wire harness connector to resistor.
6. Check operation of blower motor.
7. Close glove compartment door.

### Outside-Recirc Door Vacuum Motor

#### Removal

1. Lower glove compartment door to provide access to recirc duct assembly.
2. Disconnect white vacuum hose from end of vacuum motor.
3. Remove motor arm retainer from door crank arm (Fig. 36).
4. Remove two nuts retaining vacuum motor to recirc duct, and remove motor.

#### Installation

1. Position vacuum motor to outside-recirc door crank arm, then position motor to recirc duct. Install two retaining nuts.
2. Install retainer on door crank arm.
3. Connect white vacuum hose to vacuum motor and check operation of vacuum motor.
4. Lift glove compartment into position.

### A/C Plenum Chamber

#### Removal and Installation

1. Remove instrument panel and place it back against front seat.
2. Remove two screws attaching center plenum to instrument panel and one screw attaching the defroster nozzle to the plenum (Fig. 37).
3. Disconnect vacuum hose connector from vacuum harness where it is strapped to defroster nozzle.
4. Disconnect demister hoses.
5. Remove plenum chamber.
6. To install plenum, reverse Steps 1 through 5.

### Defroster Nozzle and Demister Duct/Hoses

#### Removal and Installation

1. Remove instrument panel and place it back against front seat.
2. Lower A/C plenum chamber by loosening two screws attaching it to instrument panel (Fig. 37).
3. Remove three screws attaching defroster nozzle to instrument panel.

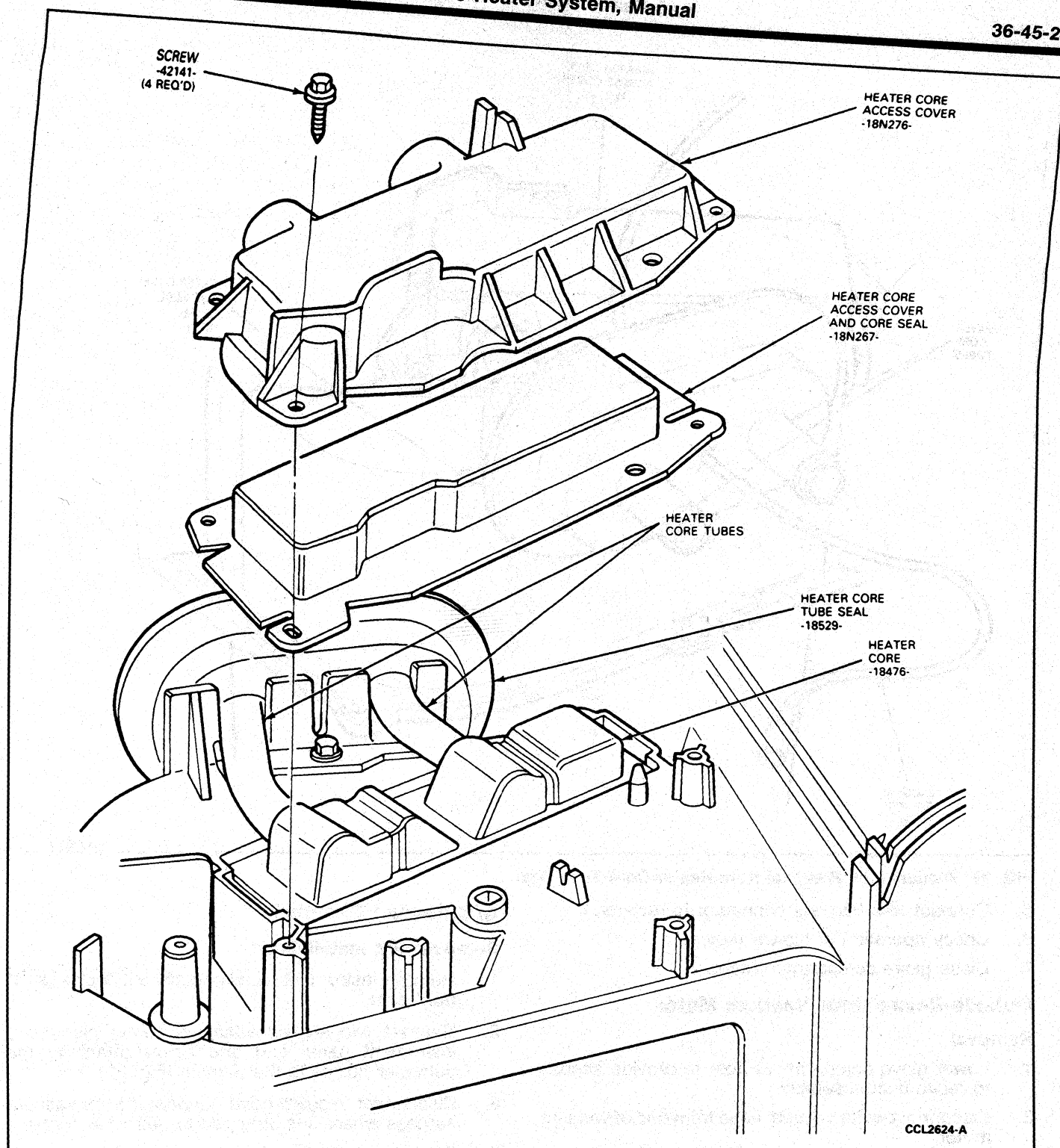


FIG. 33 Heater Core Access Cover Removal

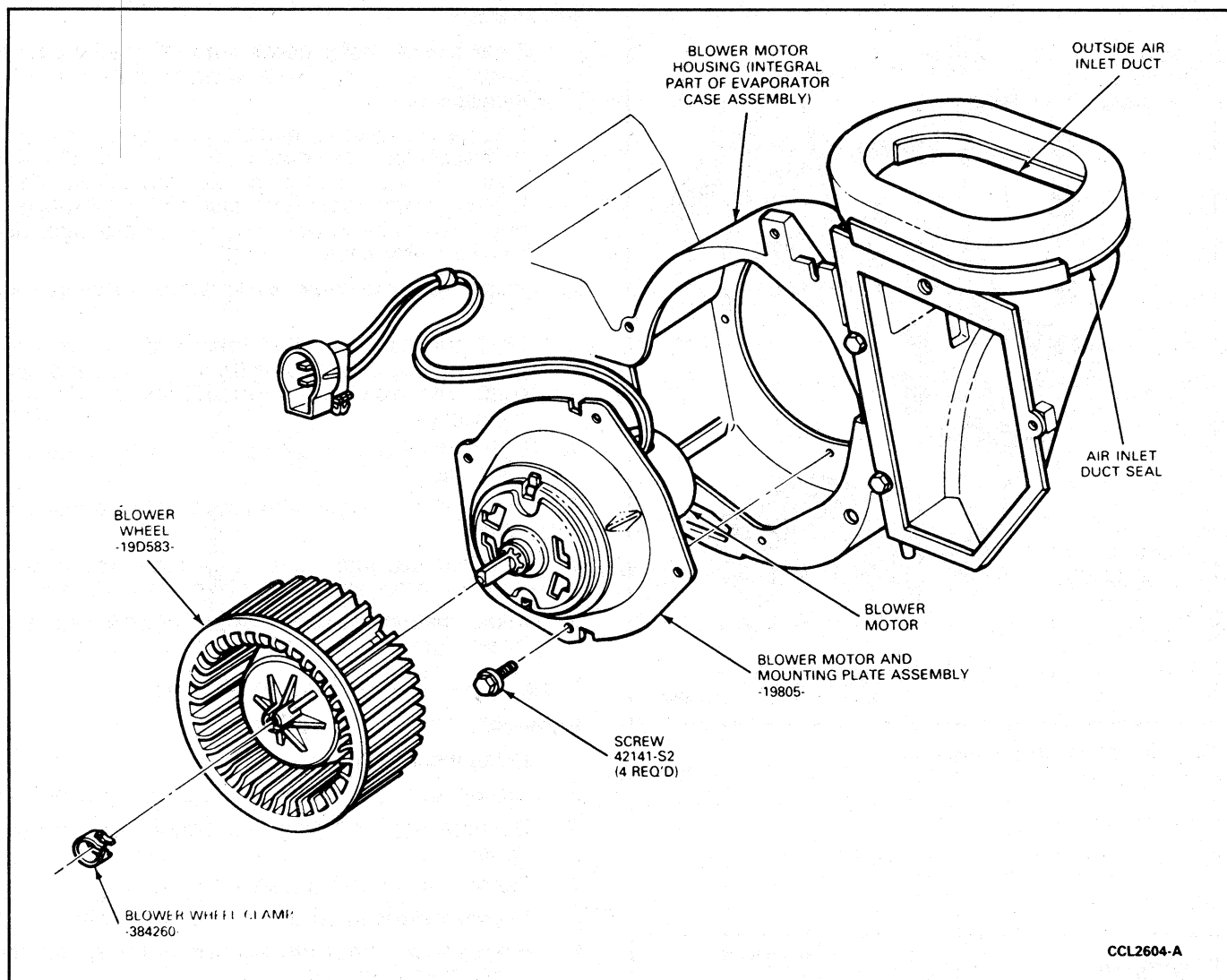
4. Disconnect demister hoses from both ends of demister unit, where it is attached to defroster nozzle (Figs. 38 and 39).
5. Remove two screws holding demisters and hose assembly to instrument panel.
6. Reverse Steps 1 through 5 to install defroster nozzle and demister duct/hose assemblies.

### Register Ducts

#### Removal

1. Remove instrument panel and place it back against front seat.
2. Lower A/C plenum chamber.
3. Remove defroster nozzle.





**FIG. 34 Blower Wheel Clip and Motor Removal**

4. Remove four screws. Center and/or LH and RH ducts, as required (Fig. 40).

#### Installation

1. Assemble the LH, RH and center ducts together.
2. Position the ducts to the instrument panel and install the four attaching screws.
3. Install defroster nozzle.
4. Position center plenum chamber and install it in instrument panel.
5. Install instrument panel as outlined.

#### Floor Air Distribution Duct

##### Front and Rear Heater Systems

#### Removal and Installation

1. Remove two screws attaching duct to evaporator case assembly just below A/C heat distribution duct.
2. Pull floor air distribution duct away from evaporator case.
3. To install duct, position it on evaporator case. Ensure retainer at forward edge of duct is inserted over edge of opening in evaporator case.

4. Install two attaching screws.

#### Air Inlet Duct and Blower Housing Assembly

#### Removal

1. Remove glove compartment and disconnect hose from outside recirc door vacuum motor (Fig. 41).
2. Remove instrument panel lower right-to-side cowl attaching bolt.
3. Remove screw attaching support brace to top of air inlet duct.
4. Disconnect blower motor power lead at wire connector.
5. Remove nut retaining blower housing lower support bracket to evaporator case (Fig. 41).
6. Remove side cowl trim panel.
7. Remove one screw attaching top of air inlet duct to evaporator case (Fig. 41).
8. Move air inlet duct and blower housing assembly down and away from evaporator case.

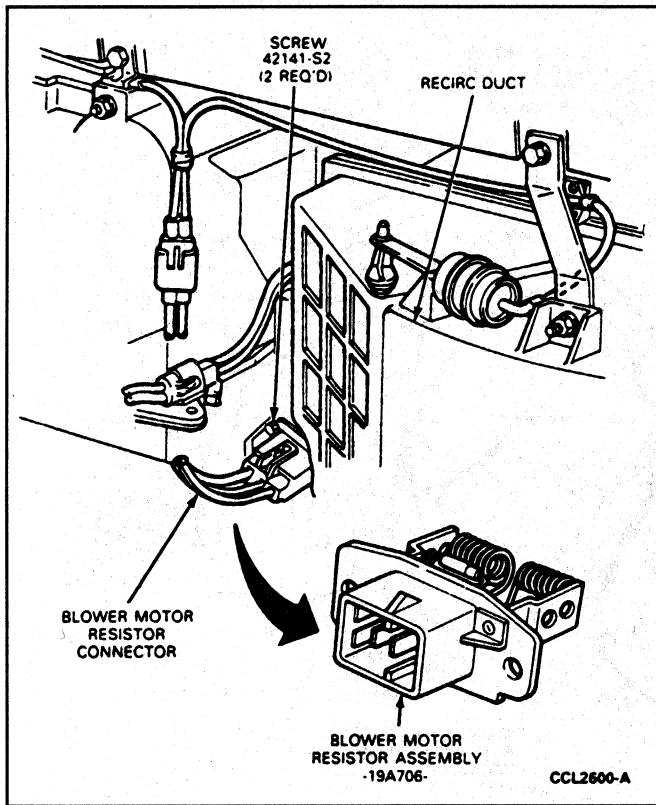


FIG. 35 Blower Motor Resistor

### Installation

1. Tape blower motor power lead to air inlet duct to keep wire away from blower outlet during installation.
2. Position air inlet duct and blower housing assembly to evaporator case, inserting flange at top of blower outlet into opening in evaporator case. Slide blower housing lower bracket over stud and install retaining nut. Ensure blower wire is routed to passenger side of evaporator case.
3. Install screw to retain air inlet duct to evaporator case.
4. Hold outside recirc door open and rotate blower wheel to ensure it rotates freely. If an interference exists, remove blower motor and wheel and correct condition.
5. Connect blower motor power lead to harness at connector.
6. Install air inlet duct-to-cowl support brace attaching screw.
7. Connect vacuum hose to outside recirc door vacuum motor and install glove compartment.
8. Install instrument panel lower RH attaching bolt. Install right cowl side trim panel.

### Floor—Panel Door Vacuum Motor

#### Removal

1. Disconnect battery ground cable.
2. Disconnect both heater hoses at dash panel.
3. Remove nuts retaining evaporator case to dash panel.
4. Remove instrument panel as outlined.
5. Remove steering column bottom trim panel.
6. Remove RH mirror remote control bezel unit and bezel, if so equipped.
7. Remove steering column opening cover panel.
8. Remove steering column shroud.
9. Disconnect PRNDL from steering column.
10. Remove steering column retaining nuts and lower to seat.
11. Remove instrument panel to brake support screw.
12. Remove glove compartment door.
13. Disconnect temperature control cable at A/C-heater assembly.
14. Disconnect vacuum multiple plug from back of A/C-heater control.
15. Disconnect blower motor and resistor (Fig. 35).
16. Remove ash receptacle and disconnect electrical connector.
17. Remove instrument panel-to-floor retaining screws.
18. Remove LH and RH cowl side panels.
19. Pull carpet back and remove screw at lower flange of heater housing.
20. Disconnect wire harness retainer.
21. Hoist vehicle. Refer to Pre-Delivery manual, Section 50-04.
22. Disconnect wire harness and push grommet through floor.

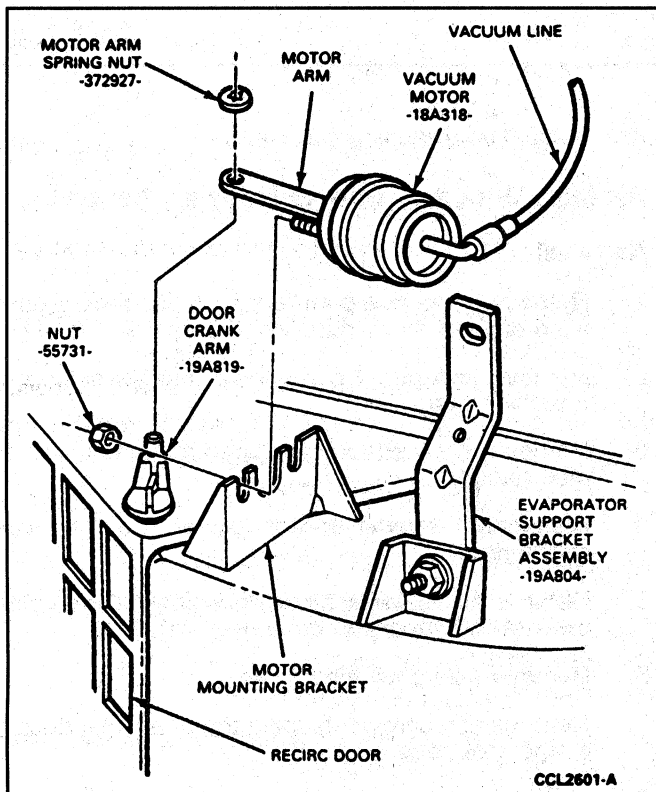
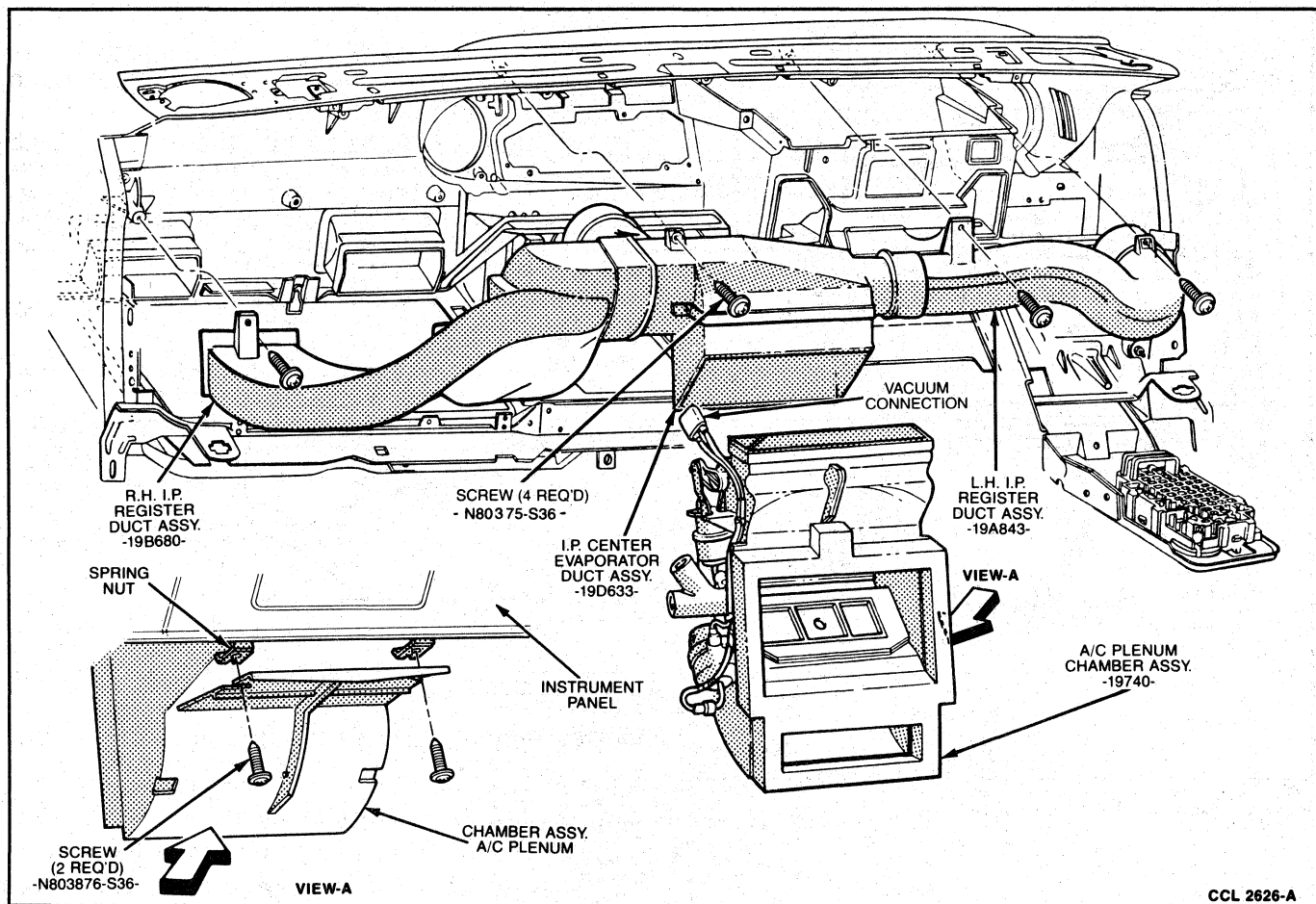


FIG. 36 Motor Arm Removal from Door Crank Arm



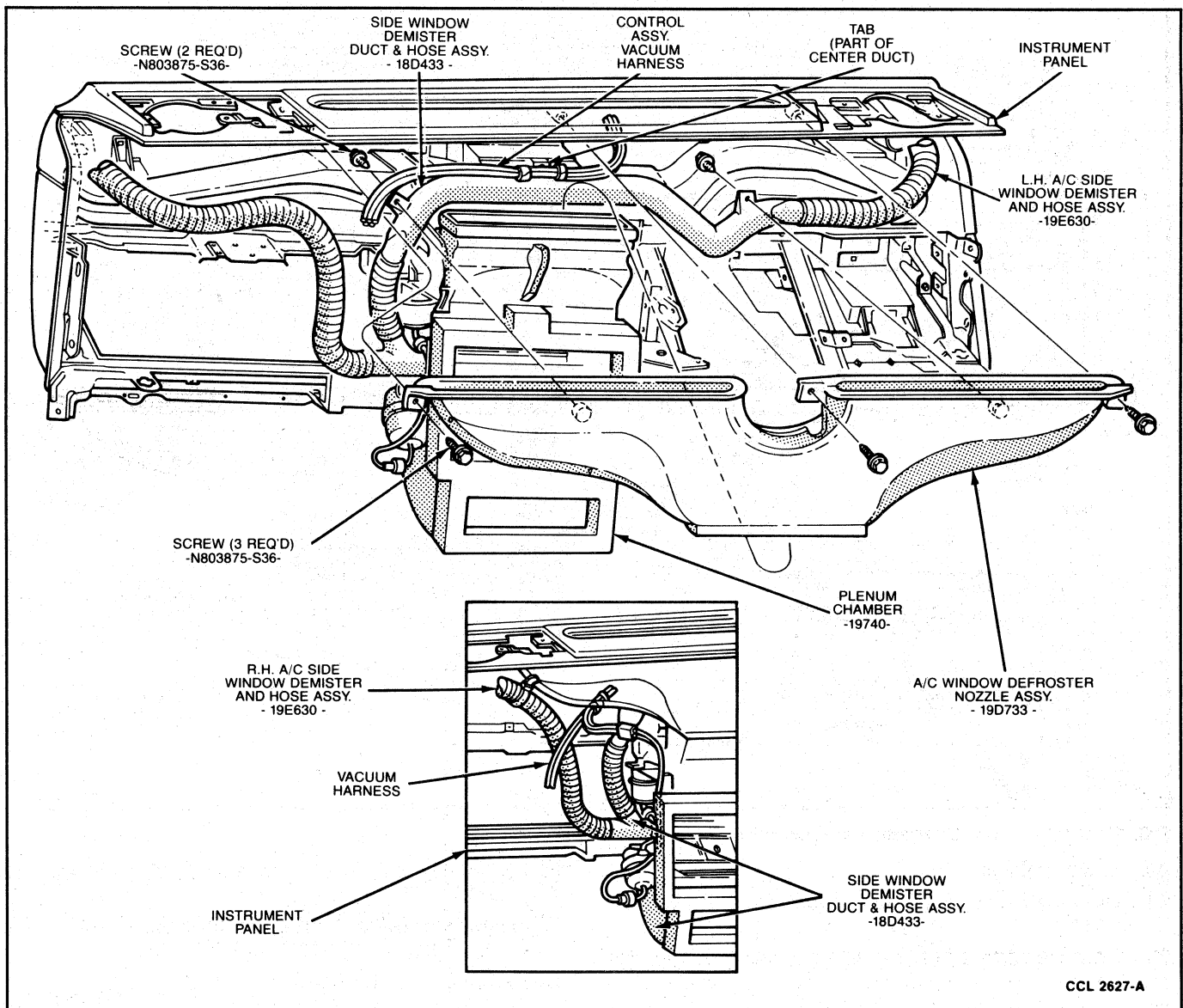
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**FIG. 37 A/C Plenum Chamber Attachments**

23. Lower vehicle.
24. Disconnect speedometer cable from instrument cluster.
25. Remove screws from LH side and upper evaporator case.
26. Disconnect wiring harness at evaporator case.
27. Remove top instrument panel screws.
28. Remove instrument panel-to-pillar bolts.
29. Pull instrument panel rearward and lay on steering column.
30. Remove two case support-to-cowl bracket attaching screws.
31. Carefully pull case from dash panel until core cover screws can be removed.
32. Disconnect arm and pivot shaft assembly from motor clip.
33. Remove two nuts retaining motor to bracket on LH side of plenum and disconnect vacuum hose.
34. Remove motor.

**Installation**

1. Position motor to bracket and secure with two nuts.
2. Connect vacuum hose to motor.
3. Install motor arm clip.
4. Position evaporator case to dash panel and install one screw to dash bracket.
5. Install case-to-dash bracket screws.
6. Install screws on LH side and under evaporator case.
7. Install evaporator case to dash panel retaining nuts inside engine compartment.
8. Connect heater hoses.
9. Install instrument panel to dash panel and install center screw.
10. Install instrument panel top screws.
11. Install instrument panel-to-brake support bolt over steering column.
12. Install two lower instrument panel support screws.
13. Connect wiring under instrument panel.
14. Install instrument panel-to-floor retaining screws.
15. Connect ash receptacle and install in instrument panel.
16. Connect speedometer cable.
17. Connect control cables to heater.
18. Connect blower motor and resistor.
19. Raise steering column to instrument panel and install retaining bolts.
20. Install PRNDL and adjust.
21. Install hood release handle.
22. Position remote mirror control in instrument panel and install bezel and bezel nut.
23. Connect multiple vacuum plug to back of A/C heater control.



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**FIG. 38 Defroster Nozzle and Demister Hose Assemblies**

24. Install glove compartment door.
25. Install LH and RH cowl panels.
26. Feed wires through floor seat grommet. Install retainer.
27. Position carpet back in position.
28. Install steering column shroud.
29. Install steering column lower trim panel.
30. Raise vehicle on hoist. Refer to Pre-Delivery manual, Section 50-04.
31. Connect backup lamp switch wire.
32. Lower vehicle.
33. Connect battery ground cable.
34. Refill cooling system.
35. Check operation of all instrument panel items.

### Floor-Defrost Door

#### Removal and Installation

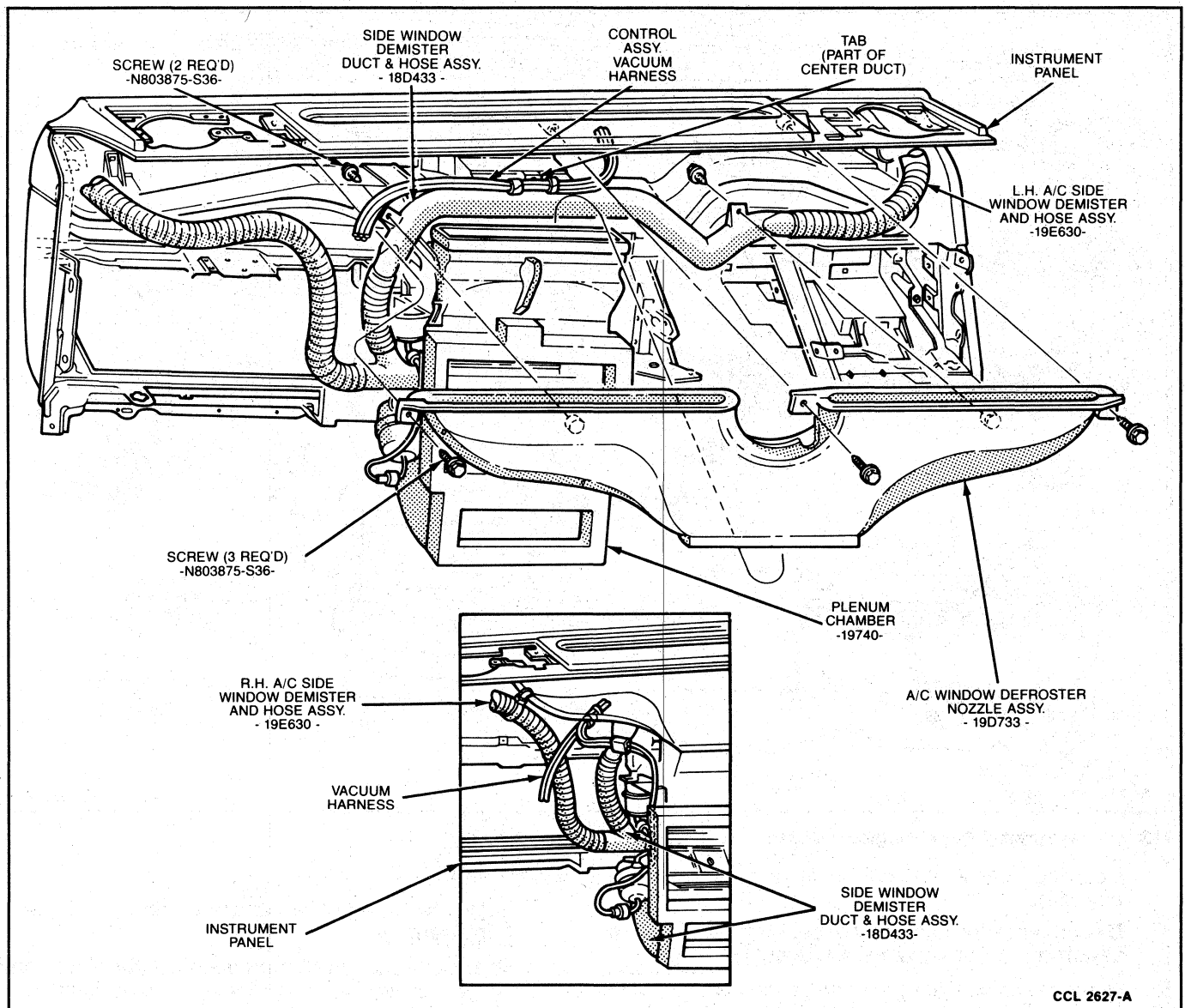
1. Remove instrument panel.

2. Remove screw retaining floor-defrost door to door shaft.
3. Slide door off shaft and remove door from evaporator case.
4. To install floor-defrost door, position it in evaporator case and slide it on shaft. Ensure it is firmly seated on shaft.
5. Install floor-defrost door retaining screw.
6. Install instrument panel.

### Panel-Defrost Door Vacuum Motor

#### Removal

1. Disconnect battery ground cable.
2. Remove instrument panel.
3. Remove spring nut retaining panel-defrost door vacuum motor arm to door shaft.
4. Remove two nuts retaining vacuum motor to mounting bracket.
5. Remove vacuum motor from mounting bracket and disconnect vacuum hose.



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**FIG. 39 Demister Nozzles****Installation**

1. Position vacuum motor to mounting bracket and door shaft.
2. Install two nuts to attach panel-defrost vacuum motor to mounting bracket.
3. Connect vacuum hose to panel-defrost vacuum motor.
4. Install instrument panel.
5. Connect battery ground cable.

**Panel-Defrost Door****Removal**

1. Remove panel-defrost distribution duct.
2. Remove one screw retaining panel-defrost door to door crank and pull door from door crank.
3. To replace door crank, remove spring nut retaining crank to vacuum motor arm. Disengage vacuum motor arm from door crank and remove crank from panel-defrost distribution duct.

**Installation**

1. Place door crank in panel-defrost distribution duct. Place flatwasher on crank end of shaft, then vacuum motor arm and install a new spring nut to retain vacuum motor arm on door crank.
2. Position panel-defrost door on crank so door is on same side of crank as vacuum motor. Install retaining screw.
3. Install panel-defrost distribution duct.

**Suction Accumulator/Drier****Removal**

1. Discharge refrigerant from A/C system following recommended service procedures. Observe all safety precautions.
2. Disconnect suction hose at compressor. Cap suction hose and compressor to prevent entrance of dirt and moisture.
3. Disconnect accumulator/drier inlet tube (Fig. 42) from evaporator core outlet. Use Spring Lock

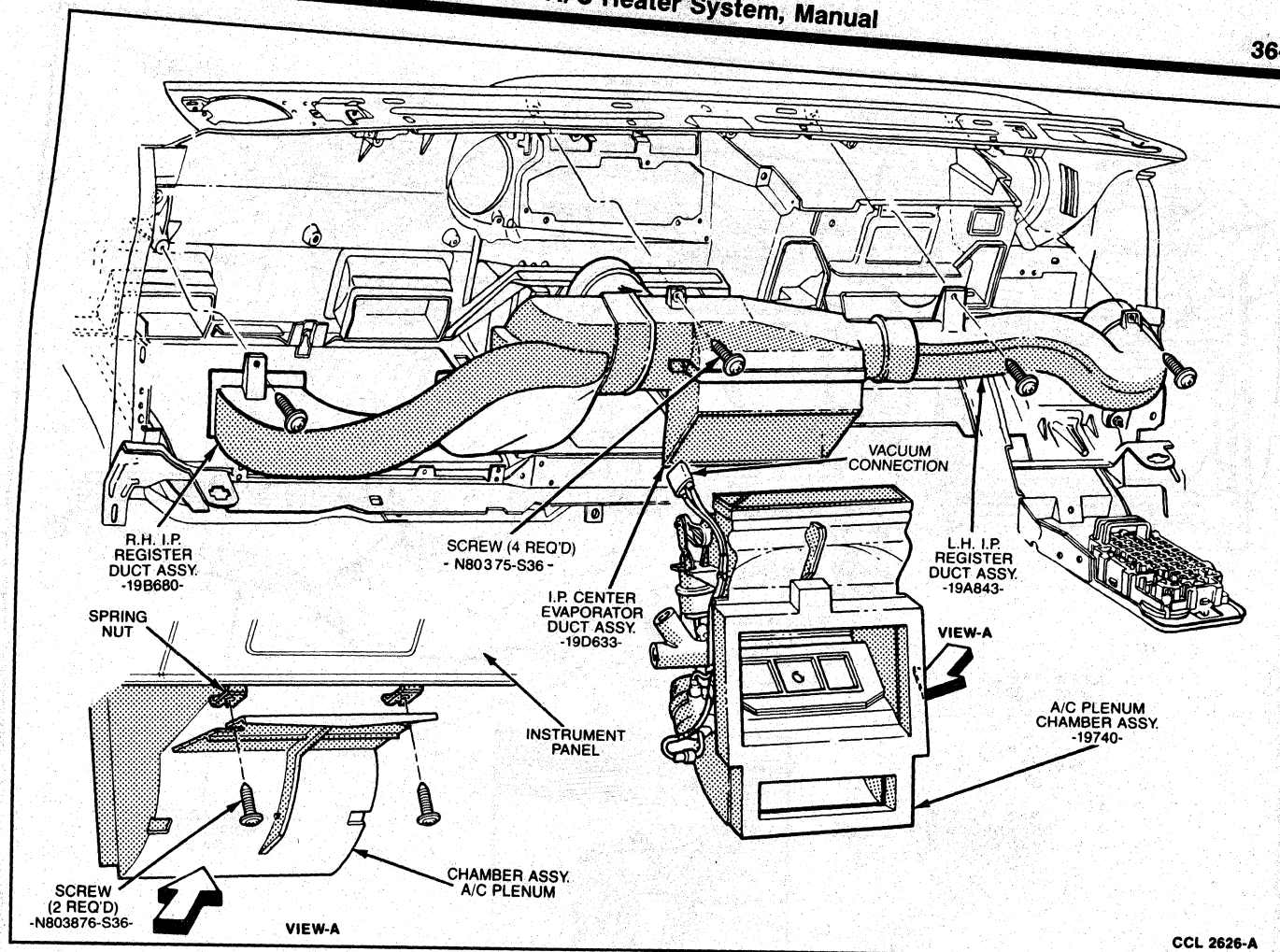


FIG. 40 Instrument Panel Register Ducts

Coupling Tool T85L-19623-A to remove inlet tube (Fig. 44).

4. Disconnect wire harness connector from pressure switch on top of accumulator/drier.
5. Remove screw holding suction accumulator/drier in accumulator bracket and remove suction accumulator/drier.

#### Installation

1. Position suction accumulator/drier to vehicle and route suction hose to compressor.
2. Using new O-ring lubricated with clean refrigerant oil, connect accumulator/drier inlet tube to evaporator core outlet.
3. Install screw in suction accumulator/drier bracket.
4. Using new O-ring lubricated with clean refrigerant oil, connect suction hose to compressor.
5. Leak test, evacuate and charge system following recommended service procedures. Observe all safety precautions.
6. Check system for proper operation.

#### Clutch Cycling Pressure Switch

##### Removal

1. Disconnect wire harness connector from pressure switch (Fig. 43).
2. Unscrew pressure switch from top of suction accumulator/drier.

#### Installation

1. Lubricate O-ring on accumulator nipple with clean refrigerant oil.
2. Screw pressure switch on accumulator nipple and tighten switch to specification. Hand tighten if plastic nipple.
3. Connect wire connector to pressure switch.
4. Check pressure switch installation for refrigerant leaks.
5. Check system for proper operation.

#### Fixed Orifice Tube

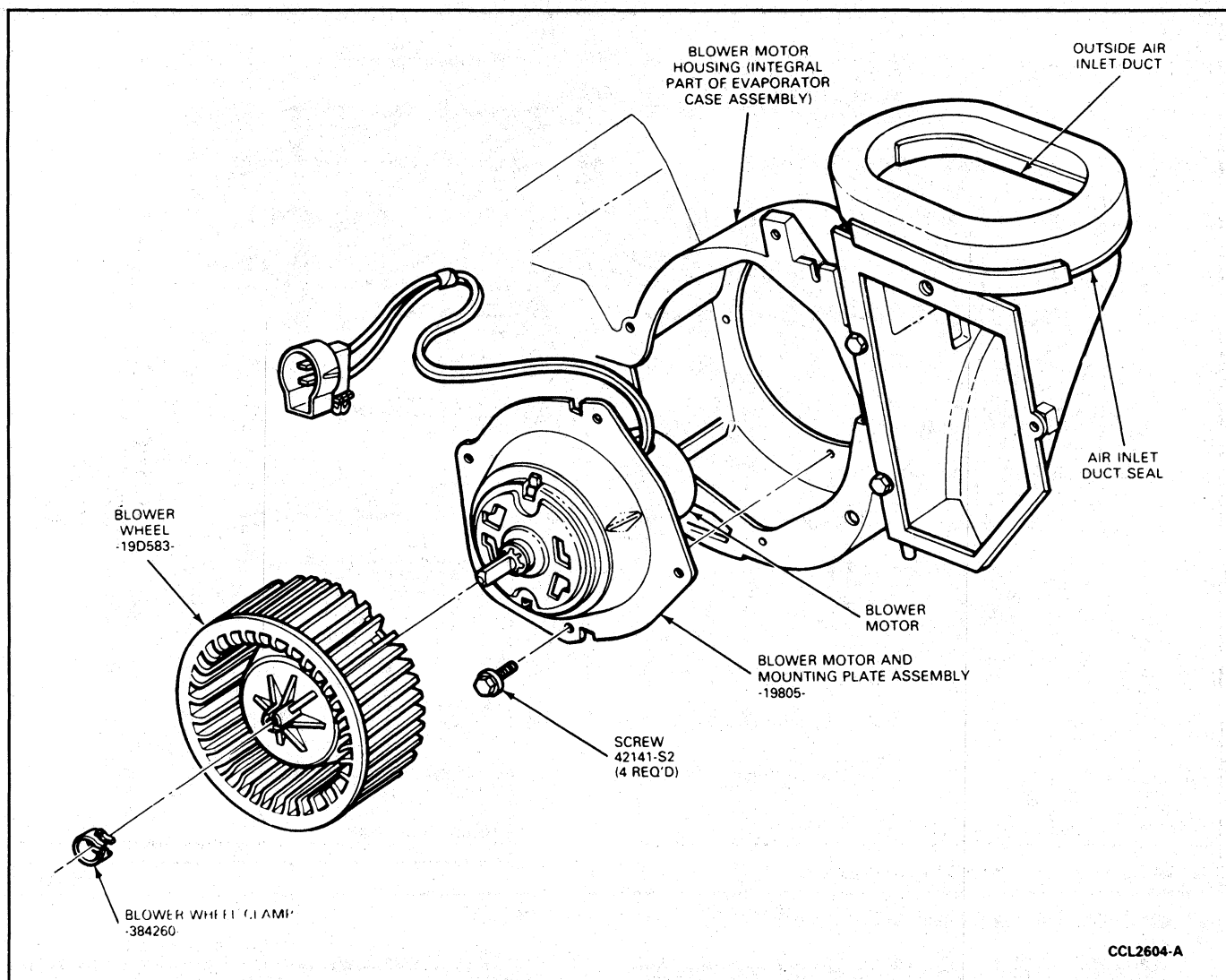
**Do not** attempt to remove fixed orifice tube. The fixed orifice tube is an integral part of liquid line. When a new fixed orifice tube is required, new liquid line (with integral fixed orifice tube) must be installed.

#### Removal and Installation

1. Discharge refrigerant from A/C system following recommended service procedures. Observe all safety precautions.
2. Disconnect refrigerant line at condenser outlet and evaporator inlet connections using the procedure and one of spring lock coupling tools shown in Fig. 44.
3. Remove line from vehicle.
4. Route new refrigerant line (and integral fixed orifice tube) with protective caps installed.

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CCL2604-A

**FIG. 41 Air Inlet Duct and Blower Housing Assembly**

5. Remove protective caps and connect new refrigerant line into system using new O-rings, lubricated with clean refrigerant oil. Connect spring lock couplings Fig. 44.
6. Leak test, evacuate and charge refrigerant system following recommended service procedures. Observe all safety precautions.

### Spring Lock Coupling

The spring lock coupling is a unique two-piece refrigerant line coupling held together by a garter spring (Fig. 44). When connected together, two O-rings seal between the two fittings of the connector. A garter spring within the cage of the male fitting expands over the flared lip of the female fitting and prevents connector separation.

Refer to Fig. 44 and relate the numbered illustrations to the following Steps.

### To Disconnect Coupling

1. Discharge refrigerant from system following approved procedures. Then, fit Spring Lock Coupling Disconnect Tool T81P-19623-G for 3/8-inch and 1/2-inch couplings or T83P-19623-C for 5/8-inch couplings or equivalent to coupling as shown. Larger opening end of Spring Lock Coupling Disconnect Tool T81P-19623-G is for 1/2-inch

compressor discharge lines and smaller end is for 3/8-inch liquid lines. The 3/4-inch Spring Lock Coupling Disconnect Tool T85L-19623-A is required for servicing the accumulator suction connection to evaporator outlet.

2. Close tool and push tool into open side of cage to expand garter spring and release female fitting.

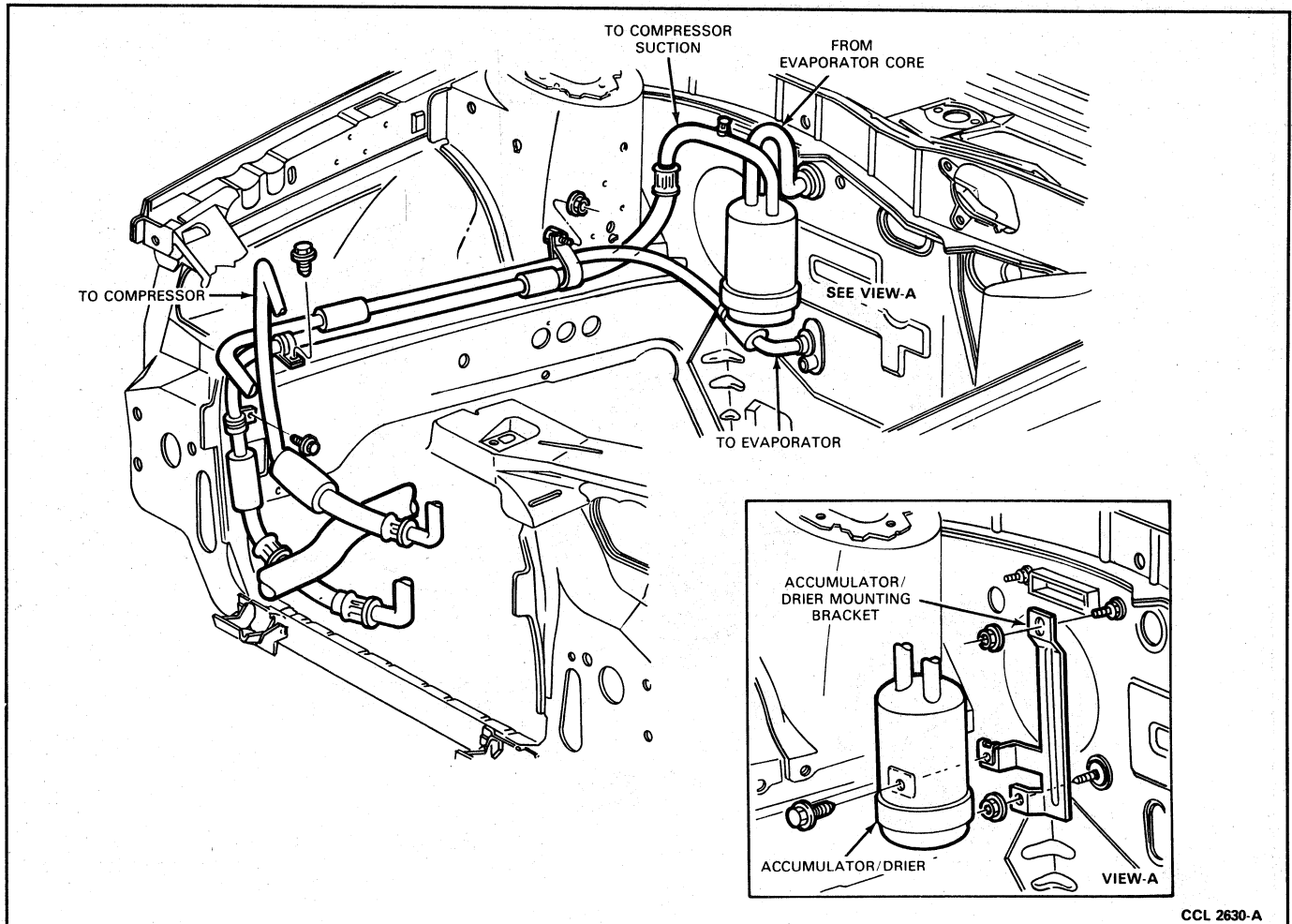
NOTE: The garter spring may not release if the tool is cocked while pushing it into the cage opening.

3. After garter spring is expanded, pull fittings apart.
4. Remove tool from the disconnected coupling.

### To Connect Coupling

1. Check to ensure that garter spring is in cage of male fitting. If garter spring is missing, install new spring by pushing it into cage opening. If garter spring is damaged, remove it from cage with small wire hook (**do not use a screwdriver**) and install new spring.
2. Clean all dirt or foreign material from both pieces of coupling.
3. Install new O-rings on male fitting.

NOTE: Use only specified O-rings as they are made of a special material. Use of any O-ring other than



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**FIG. 42 Suction Accumulator/Drier**

- specified O-ring may allow connection to leak intermittently during vehicle operation.
- Lubricate male fitting, O-rings and inside of female fitting with clean refrigerant oil.
  - Then, fit female fitting to male fitting and push until garter spring snaps over flared end of female fitting.
  - To ensure coupling engagement, pull female fitting and visually check to ensure garter spring is over flared end of female fitting.

**Condenser****Removal**

- Discharge refrigerant from A/C system at service access gauge port valve located on suction line. Observe all safety precautions.
- Disconnect two refrigerant lines at fittings on RH side of radiator (Fig. 45). Perform spring-lock coupling disconnect procedure.
- Remove four bolts attaching condenser to radiator support. Remove condenser from vehicle.

**Installation**

- Position condenser assembly to radiator support brackets and install attaching bolts.
- Connect refrigerant lines to condenser assembly. Perform spring lock coupling connection procedure.

- Leak test, evacuate and charge refrigerant system following recommended service procedures. Observe safety precautions.

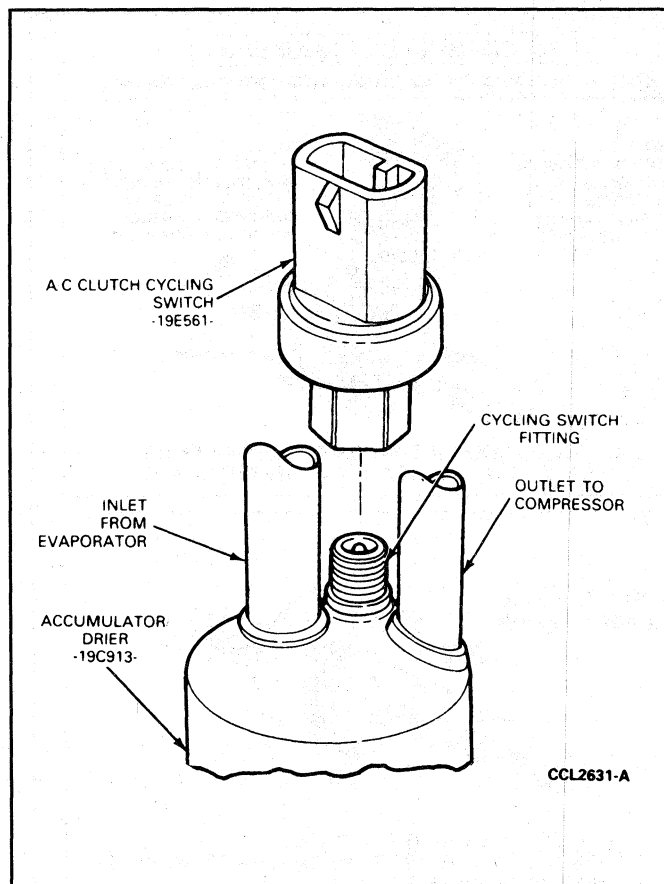
**Refrigerant Lines****Removal and Installation**

- Discharge refrigerant from A/C system at low-pressure access gauge port valve located on suction line near compressor following recommended service procedures (Section 36-32). Observe all safety precautions.
- Disconnect and remove refrigerant line. At condenser, perform spring lock coupling disconnect procedure.
- Route new refrigerant line with protective caps installed (Fig. 46).
- Connect refrigerant line into system using new O-rings lubricated with clean specified refrigerant oil. At condenser, perform spring lock coupling connection procedure.
- Leak Test, evacuate and charge refrigerant system following recommended service procedures. Observe all safety precautions.

**Heater Hoses**

The heater hose routing and removal and installation procedures are the same as those which apply to the





**FIG. 43 Clutch Cycling Pressure Switch Harness Connector**

manual A/C system. Figs. 47 and 48 repeats the illustration shown in Section 36-12 for reference.

## Compressor (FS-6 Six Cylinder)

### 3.0L V-6 Engine

#### Removal

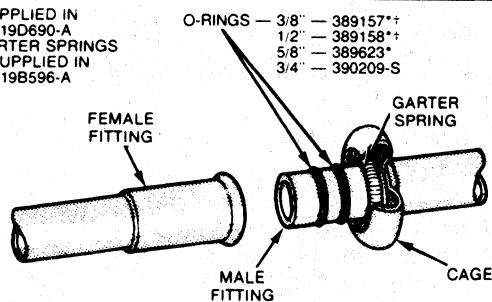
1. Discharge system following recommended service procedures. Observe all safety precautions.

2. Disconnect compressor clutch wires at field coil connector on compressor.
3. Loosen drive belt.
4. Disconnect hose assemblies from condenser and suction line.
5. Remove four bolts.
6. Remove compressor and manifold and tube assembly from vehicle as a unit. Assembly will not clear sub-frame and radio support if attempt is made to remove unit from bottom. It must be removed from top (Fig. 49).
7. Remove manifold and tube assembly as an on-bench operation.
8. If compressor is to be replaced, remove clutch and field coil assembly.

#### Installation

1. New service replacement FS-6 compressor contains 300ml (10 fluid ounces) of specified refrigerant oil. Before replacement compressor installation drain 120ml (4 fluid ounces) of refrigerant oil from compressor. This will maintain total system oil charge within specified limits.
2. Install manifold and tube assembly on A/C compressor (two bolts).
3. Install compressor and manifold and tube assembly on A/C mounting bracket (four bolts).
4. Using new O-rings lubricated with clean refrigerant oil, connect suction line to compressor manifold and tube assembly. Attach discharge line to A/C condenser.
5. Connect clutch wires to field coil connector.
6. Install drive belt. Adjust drive belt tension to 190-217 N·m (140-160 lb-ft).
7. Leak test, evacuate and charge system following recommended service procedures. Observe all safety precautions.
8. Check system for proper operation.

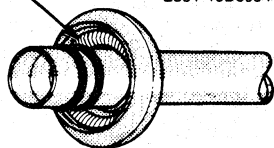
\*ALSO SUPPLIED IN  
KIT E35Y-19D690-A  
WITH GARTER SPRINGS  
\* ALSO SUPPLIED IN  
KIT E1ZZ-19B596-A



SPRING LOCK COUPLING DISCONNECTED

### TO CONNECT COUPLING

GARTER  
SPRING

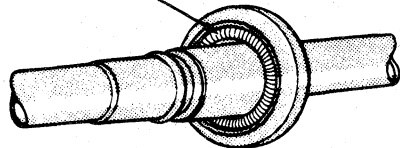


CHECK FOR MISSING OR DAMAGED GARTER SPRING — REMOVE DAMAGED SPRING WITH SMALL HOOKED WIRE — INSTALL NEW SPRING IF DAMAGED OR MISSING.

REPLACEMENT GARTER SPRINGS  
3/8 INCH — E1ZZ-19E576-A\*  
1/2 INCH — E1ZZ-19E576-B\*  
5/8 INCH — E35Y-19E576-A\*  
3/4 INCH — E69Z-19E576-A  
\*ALSO AVAILABLE IN  
E35Y-19D690-A KIT WITH O-RINGS

A — CLEAN FITTINGS  
B — INSTALL NEW O-RINGS — USE ONLY SPECIFIED O-RINGS  
C — LUBRICATE WITH CLEAN REFRIGERANT OIL  
D — ASSEMBLE FITTING TOGETHER BY PUSHING WITH A SLIGHT TWISTING MOTION

GARTER SPRING

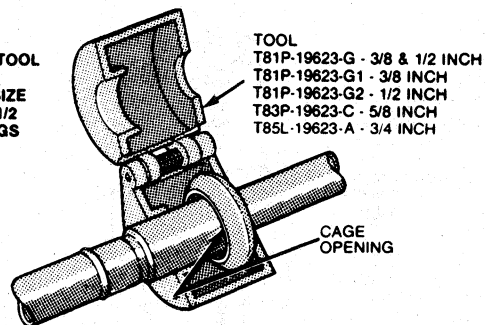


TO ENSURE COUPLING ENGAGEMENT, VISUALLY CHECK TO BE SURE GARTER SPRING IS OVER FLARED END OF FEMALE FITTING.

### TO DISCONNECT COUPLING

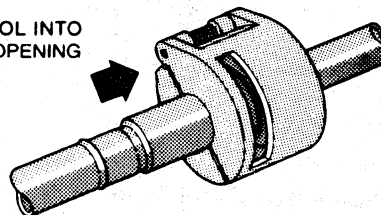
CAUTION — DISCHARGE SYSTEM BEFORE DISCONNECTING COUPLING

NOTE:  
EACH END OF TOOL  
T81P-19623-G IS  
A DIFFERENT SIZE  
TO FIT 3/8 and 1/2  
INCH COUPLINGS

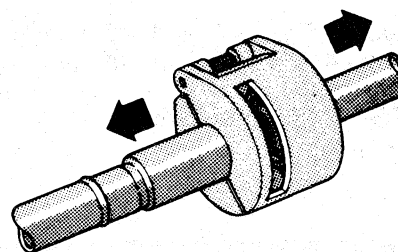


① FIT TOOL TO COUPLING SO THAT TOOL CAN ENTER CAGE OPENING TO RELEASE THE GARTER SPRING.

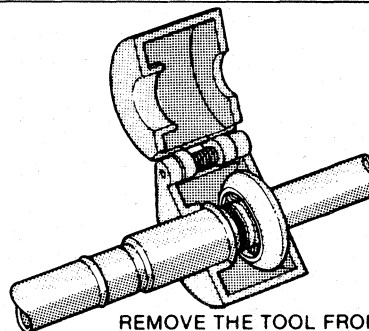
PUSH TOOL INTO  
CAGE OPENING



② PUSH THE TOOL INTO THE CAGE OPENING TO RELEASE THE FEMALE FITTING FROM THE GARTER SPRING.



③ PULL THE COUPLING MALE AND FEMALE FITTINGS APART.



④ REMOVE THE TOOL FROM THE DISCONNECTED SPRING LOCK COUPLING.

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FIG. 44 Spring Lock Coupling

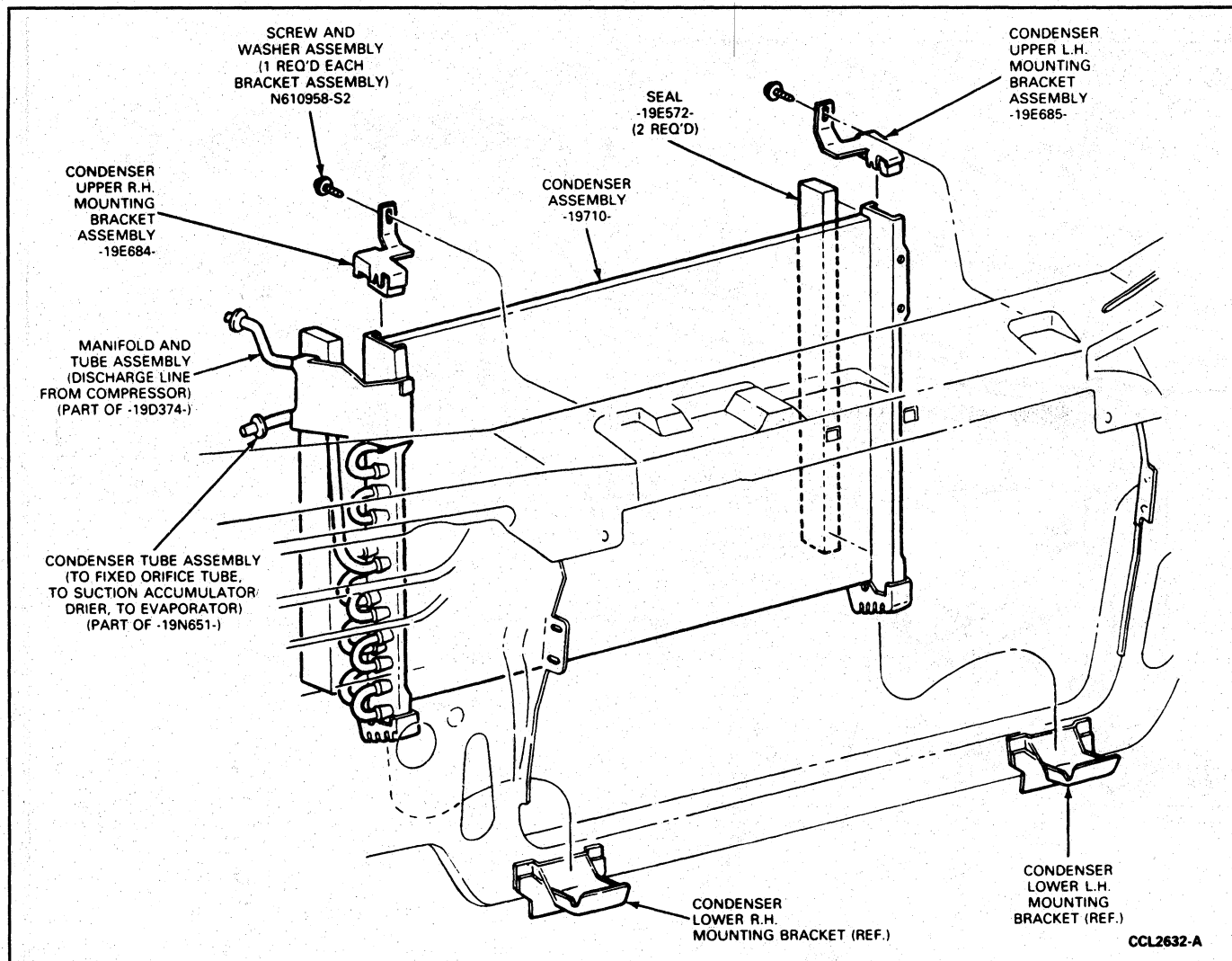


FIG. 45 Condenser Assembly

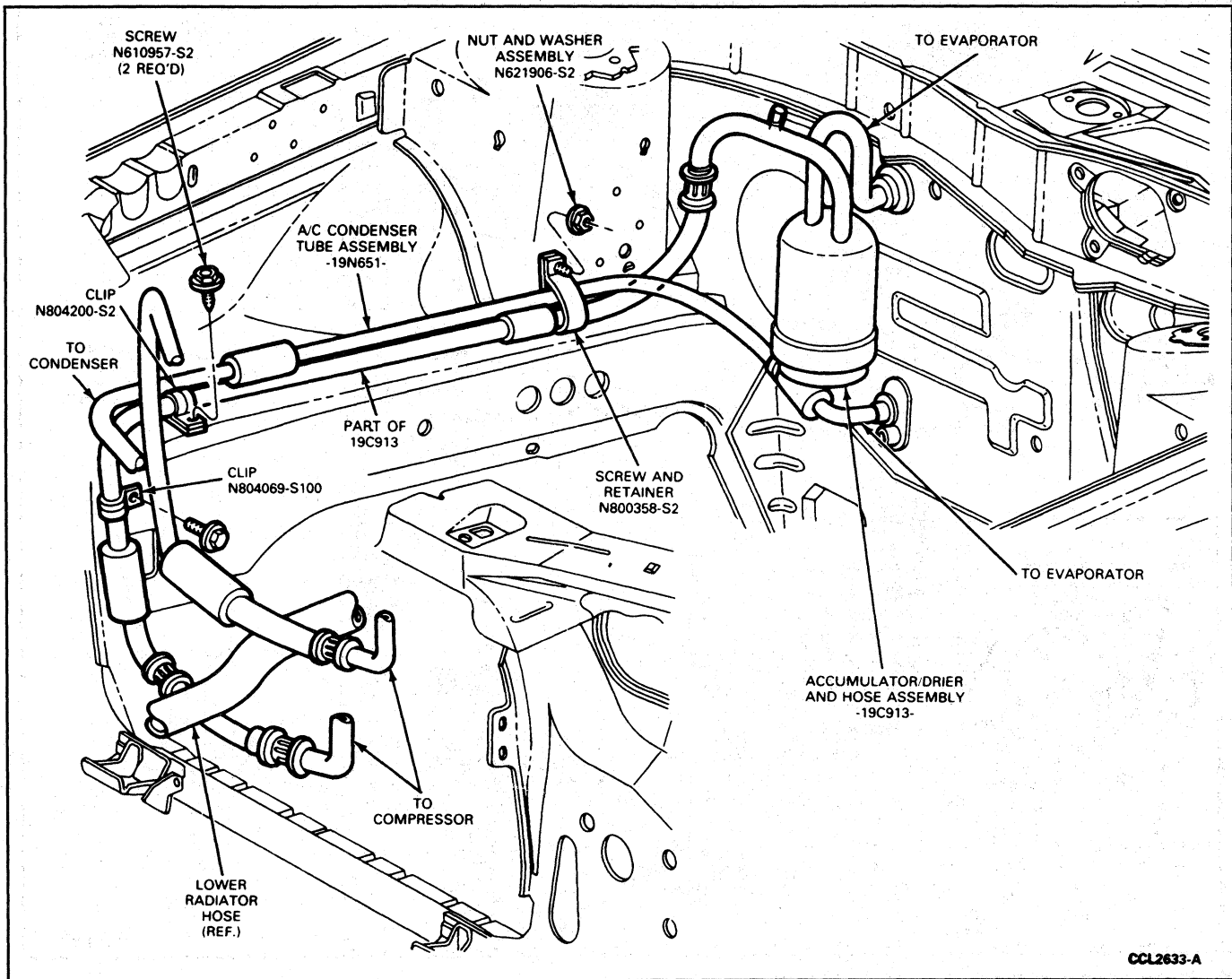
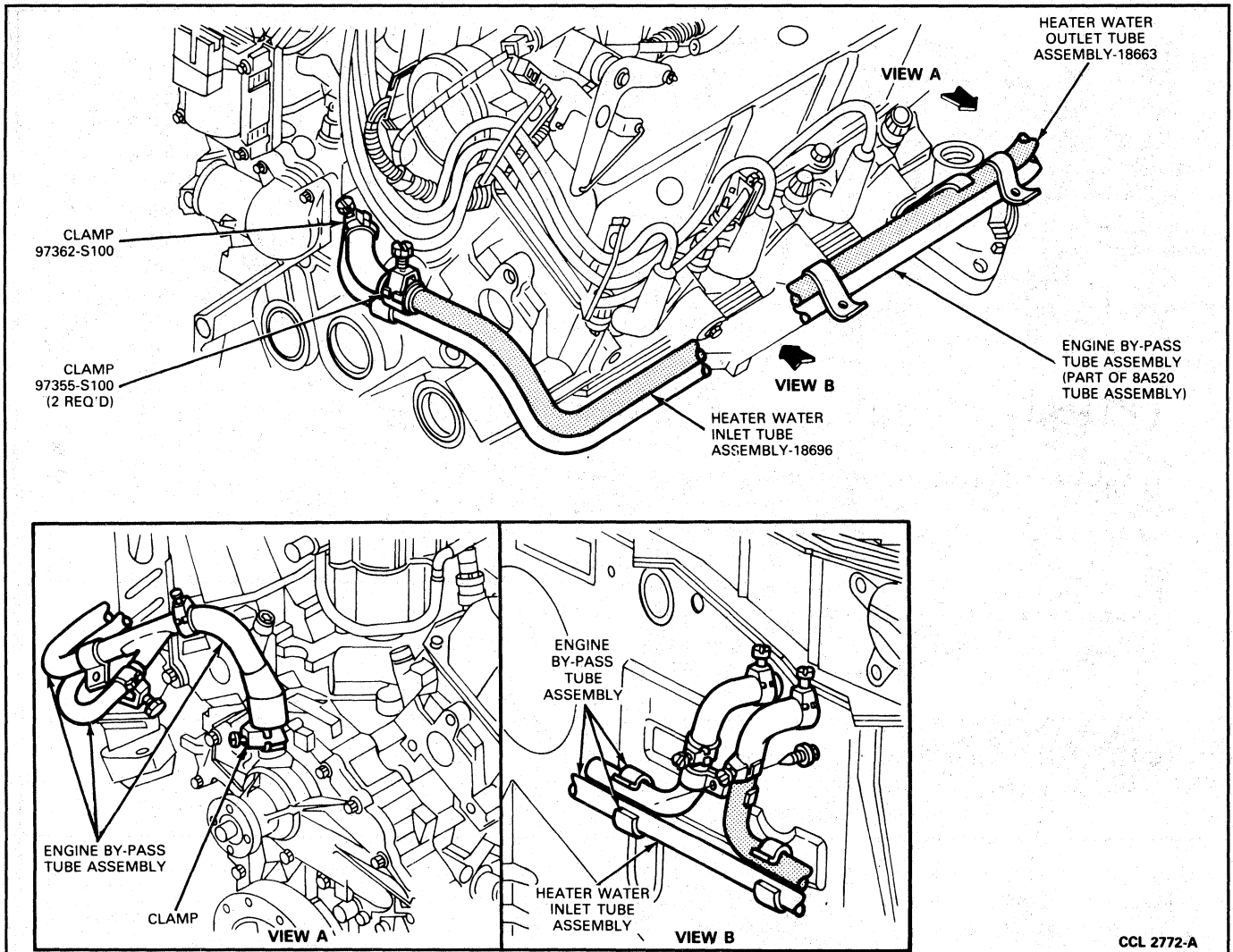


FIG. 46 Refrigerant Lines—2.5L and 3.0L Engines

**FIG. 47 Heater Hose Installation—3.0L Engine**

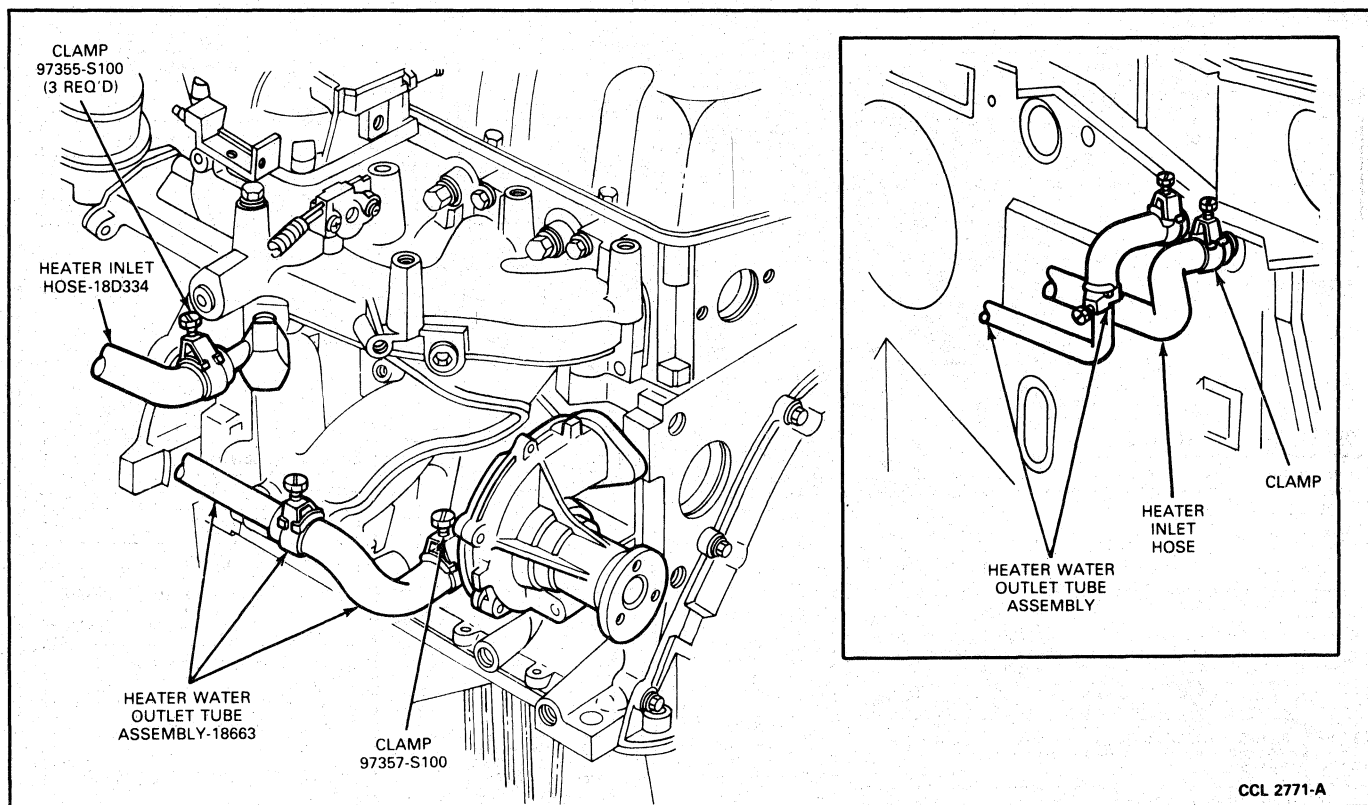


FIG. 48 Heater Hose Installation—2.5L Engine

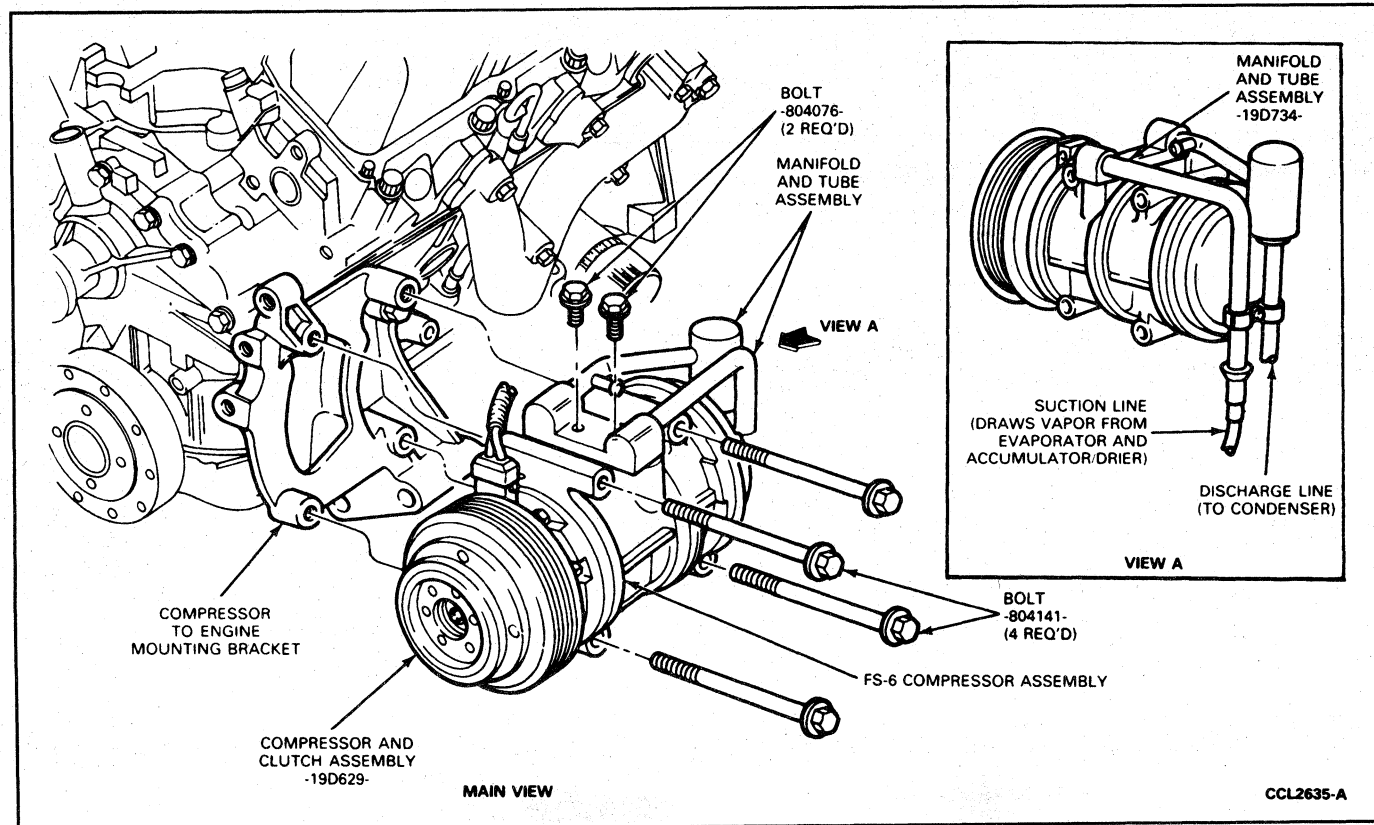


FIG. 49 FS-6 Compressor Installation—3.0L Engine

## SPECIFICATIONS

## REFRIGERANT SYSTEM COMPONENTS AND CAPACITIES

Vehicle ②	Compressor	Clutch Cycling Pressure Switch ①	Fixed Orifice Tube	Refrigerant Capacity*	
	FS-6			(oz.)	(kg.)
Taurus/Sable	X	X	X	40	1.134

\*Plus (2 oz.) (.056 kg.) minus (2 oz.) (.056 kg.)

① Pressure switch opens at 169 kPa (24.5 psi)

② All models equipped with Suction Accumulator Drier

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## TORQUE SPECIFICATIONS

Description	N·m	Lb·Ft
Pressure Switch to Accumulator Nipple (Plastic Base)	Finger Tight Only	
Liquid Line to Evaporator Core	Spring Lock Coupling	
Accumulator to Evaporator Core	Spring Lock Coupling	
Liquid Line to Condenser	Spring Lock Coupling	
Discharge Line to Condenser	Spring Lock Coupling	
Suction Hose to Accumulator	Spring Lock Coupling	
Hose Manifold to Compressor	18-23	13-17
Clutch Hub Nut	13-20	10-14
Compressor Attaching Bolts	34-47	25-35
Compressor Bracket to Engine	42-58	31-43

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## SPRING LOCK COUPLING COMPONENTS

O-Ring	3/8 Inch — 389157
	1/2 Inch — 389158
	5/8 Inch — 389623
	3/4 Inch — 390209-S
Garter Springs	3/8 Inch — E1ZZ-19E576-A (YF-990)
	1/2 Inch — E1ZZ-19E576-A (YF-991)
	5/8 Inch — E35Y-19E576-A (YF-1134)
	3/4 Inch — E69Z-19E576-A
<b>Service Kits</b>	
E1ZZ-19B596-A (YF-982)	Contains 6 ea. 389157 & 389158 O-Rings
E35Y-19D690-A (YF-1158)	Contains 389157, 389158 & 389623 O-Rings. E1ZZ-19E576-A & B and E35Y-19E576-A Springs

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## REFRIGERANT SYSTEM

<b>System Protection</b> Clutch Cycling Pressure Switch	Close Maximum 47 psi Open Minimum 23 psi
High Pressure Relief Valve*	3103 kPa (450 psi)
<b>Capacity</b>	44 Oz. $\pm$ 2 Oz.
<b>Type</b> Refrigerant 12 (R-12) ESA-M17B2A	Dichlorodifluoromethane CCL 2F <sub>2</sub> D4AZ-19B519-A, Ford YN1-A, 14 Oz. Can, Motorcraft YN-7, 30 Lb. Container

\*Located in high pressure hose near compressor.

## ELECTRICAL SYSTEM

<b>System Protection</b> Blower Circuit	30 Amp. Fuse
Clutch Circuit	15 Amp. Fuse
<b>Blower Resistor Circuit</b>	Thermal Limiter (Integral w/ Resistor)

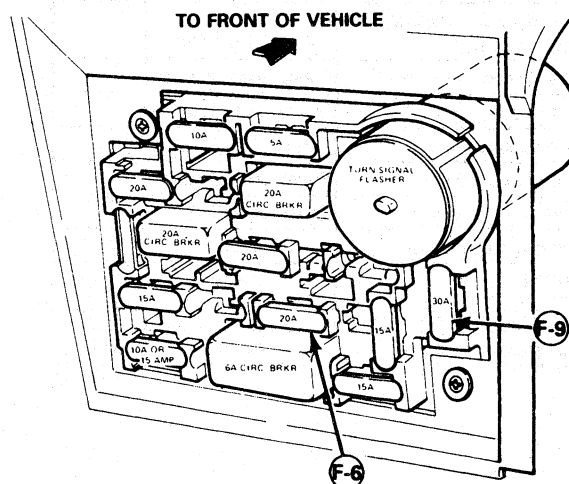
## DRIVE BELT TENSION — FS-6 COMPRESSOR

Belt Type	New	Used Minimum*	Used Reset Limits
6 Rib	120-160	90	75-120

\*Used is any belt in operation 10 minutes or more.

## COMPRESSOR, FS-6 SPECIFICATIONS

<b>Type</b>	Swash Plate, 3 Double Acting Pistons — Axial Type
<b>Displacement</b>	10.4 CID
<b>Cylinder Bore (Dia.)</b>	1.4 Inch
<b>Stroke</b>	1.2 Inch
<b>Rotation</b>	Clockwise
<b>Rotational Torque</b> (Maximum Manifold Removed)	10 N·m (7 Lb-Ft)
<b>Refrigerant Oil</b> Type	ESA-M2C31-A — 500 Viscosity
Capacity	10 Fluid Ounces
Part Number	C9AZ-19577-B Motorcraft YN-2
<b>Magnetic Clutch</b> Air Gap Between Pulley and Hub	0.021-0.036 Inch
Current Draw	4.67 Amps @ 12.8 Volts
Run-Out (Maximum)	0.02 Inch — Radial or Axial



The fuse panel is located in the lower left side of the instrument panel, behind a cover which must be removed for access.

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## SPECIAL SERVICE TOOLS

Part Number	Motorcraft Part Number	Description
T63L-8620-A	YT-371	Belt Tension Gauge
D81L-19703-A	YT-367	Service Access Adapter (High Pressure)
Rotunda 007-00001	—	Digital Volt-Ohm Meter
Rotunda 055-00014	YT-288	Electronic Leak Detector
Rotunda 023-00006	YT-202	Flame Type Leak Detector
Rotunda 023-00007	YT-227	Dial Thermometer
—	YT-204	Safety Shield Goggles
Rotunda 023-00009	YT-229	Small Can Adapter
Rotunda 063-00010	YT-201	Manifold Gauge Set
T81P-19623-G1	YF-1056	Spring-Lock Coupling Disconnect Tool — 3/8 inch
T81P-19623-G2	—	Spring-Lock Coupling Disconnect Tool — 1/2 inch
T83P-19623-C	—	Spring-Lock Coupling Disconnect Tool — 5/8 inch
T85L-19623-A	—	Spring-Lock Coupling Disconnect Tool — 3/4 inch
T57L-500-B	—	Bench Mounted Holding Fixture
T83P-18532-AH	—	Control Cable Removal Tool

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# SECTION 36-75 Automatic Temperature Control—Electronic

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## VEHICLE APPLICATION

Taurus/Sable.

## DESCRIPTION

The Electronic ATC system is available as an option on Taurus/Sable vehicles. This system is graphically represented in a block diagram (Fig. 1).

With the use of a microcomputer, the control assembly analyzes inputs from five major sources:

1. Temperature, mode, and blower selections (made by the driver or front seat passenger).
2. In-vehicle temperature.
3. Ambient temperature.
4. Engine temperature.
5. Sunload sensor.

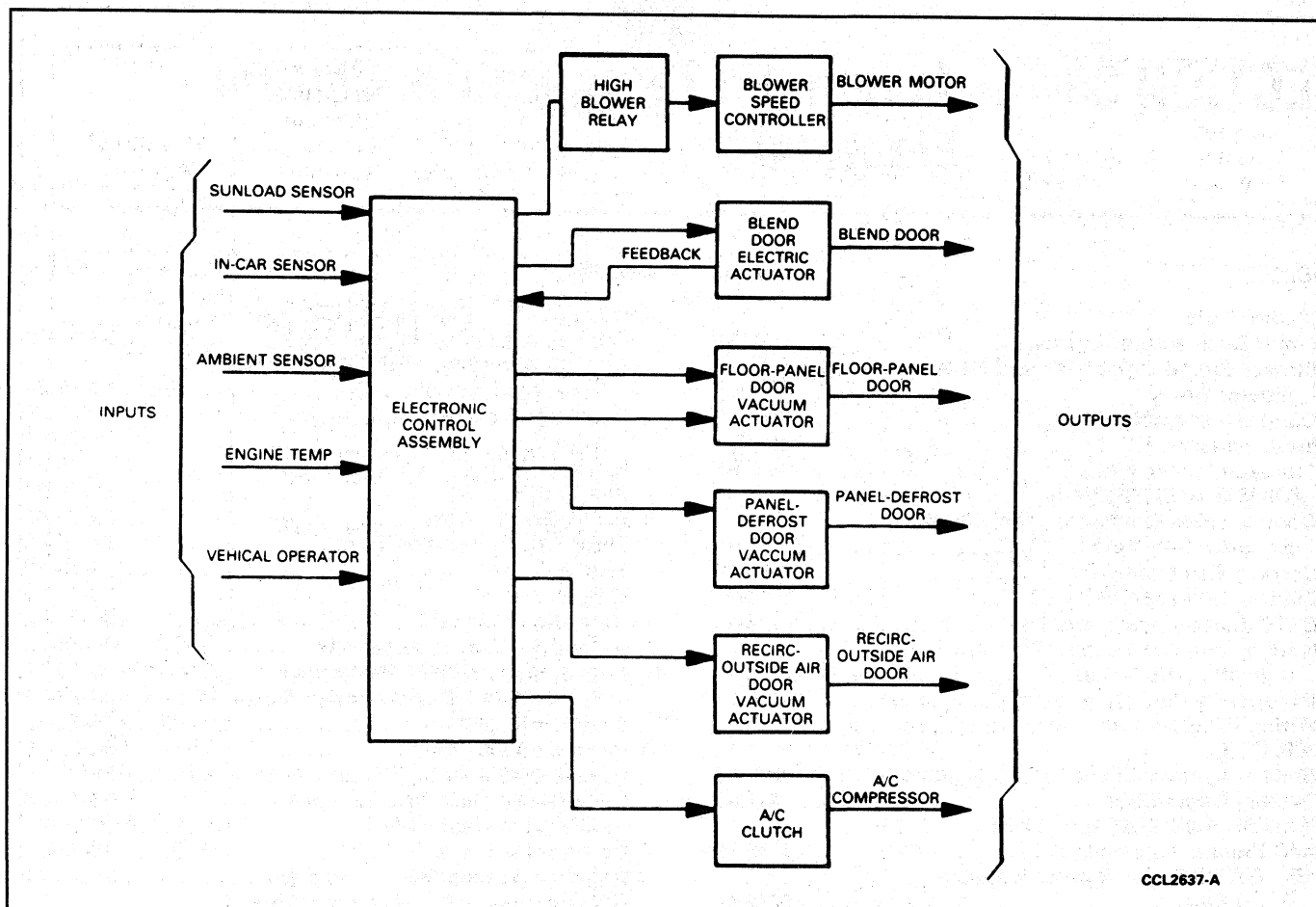
Using these inputs, the microcomputer determines the correct conditions for the following six outputs:

1. A/C compressor clutch engagement.

2. Blower speed.
3. Blend door position.
4. Floor-panel door position.
5. Panel-defrost door position.
6. Outside-recirc door position.

A small DC electric motor or actuator is used to operate the temperature blend door. Vacuum actuators are used to control each of the three remaining air distribution doors. A feedback circuit is used in the blend door actuator to supply the control head with blend door position information. The blower motor is controlled by the control assembly through the blower speed controller and the high-blower relay. The blower speed controller and the high-blower relay are required to convert a low power signal from the control head to the high power signal required to drive the blower. Fig. 2 shows the control assembly response to the function knob selections.

A Self-Test feature has been included in the control assembly to supply the technician with error codes.



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**FIG. 1 System Block Diagram**

These codes direct the technician to the damaged component. The Self Test is described later in this Section.

### Control Assembly

The electronic automatic temperature control assembly is located in the instrument panel and consists of ten push buttons, a variable blower speed knob for manual input, and a liquid crystal display (LCD) for displaying set temperature, ambient temperature, and diagnostic codes (Fig. 3).

There are five Light Emitting Diodes (LEDs) to display the manual mode overrides and two LED light bars to indicate automatic function and automatic fan control. The set temperature can be raised or lowered in one-degree increments between 18° and 29°C (65° and 85°F) through the use of a warmer or cooler (blue) button. There is also a 16°C (60°F) setting for maximum cool and a 32°C (90°F) setting for maximum heat. When the OUTSIDE button is pressed, the LCD will display the outside ambient temperature for four seconds and then return to the set temperature display. The remaining six buttons select a manual function override: OFF, A/C, DEFROST, FLOOR, PANEL, and RECIRC.

Whenever the blower knob is turned, the automatic blower control is overridden, and a manual blower speed is selected. When the parking lamps/headlamps are activated, the LCD will dim, the bezel backlighting will turn on, and the LEDs will dim. As the rheostat voltage is

varied, the LCD and backlighting intensity will vary. Whenever the MILES/KM button on the vehicle's cluster button assembly is pressed (vehicles equipped with an electronic cluster only), the temperature setting will be displayed in degrees Fahrenheit (°F). The display will change to a degrees Celsius (°C) indication when the cluster button assembly MILES/KM button is pressed again.

The control assembly performs the following functions:

- Processes data from the manual inputs to the control panel; from in-vehicle, ambient, engine temperature and sunload sensors, and from the blend door actuator position sensor.
- When the ignition switch is turned to the RUN position, the control will remember the last temperature, function and blower settings.
- Provides continuous position control of the blend door actuator.
- Provides discrete, two-position control of the panel-defrost and outside-recirc vacuum actuators.
- Provides three-position control of the function actuator.
- Provides a continuously variable blower signal which is amplified by the solid-state blower speed control (BSC) module and the high blower relay (HBR) to control the blower voltage.
- Provides an A/C power feed which is delivered to the pressure switch by a relay built into the control.

Control Assembly Selection	Blend Door Response	Floor-Panel Door Response	Panel-Defrost Door Response	Recirc. — Outside Air Door Response	Blower Response (Unless Manually Overridden)	A/C Clutch Response
Off	Remains fixed	Air to plenum	Fixed in defrost	Fixed in recirc.	Blower off	Clutch off
Auto	Varies according to sensor temperatures and customer temperature selection. Door is in heat position when sensors are cool — door is in A/C position when sensors are hot.	Air to floor during heating; air to plenum during cooling; air to both between heating & cooling.	Air to defrost nozzle during heating; air to panel during cooling.	Fixed in recirc. when engine temp. is below 120°F and heating req'd. Recirculates air when maximum air conditioning is required. Otherwise outside air.	Variable blower speeds when engine coolant temp. is above 120°F or A/C required. Blower is off when engine coolant is below 120°F and heating req'd.	Clutch on if outside temperature is above 50°F.
A/C		From "Off" or "Auto", air to plenum. Otherwise air is directed per function override. (i.e., floor, panel, defrost)	From "Off" or "Auto", fixed in panel. Otherwise, door position is per function override. (i.e., floor, panel, defrost)	Recirculates air when maximum air conditioning is required. Otherwise uses outside air.	Variable blower speeds.	Clutch on if outside temperature is above 50°F. Clutch will toggle on & off as A/C button is toggled on & off.
Panel		Air to plenum	Fixed in panel			
Panel & floor		Air to plenum and floor				
Floor		Air to floor	Fixed in defrost	Fixed in outside air.	Minimum automatic blower voltage is 6.2 volts.	Although clutch is always on if outside temperature is above 50°F, A/C indicator may be toggled on and off.
Floor & defrost		Air to plenum and floor				
Defrost		Air to plenum				

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FIG. 2 System Response

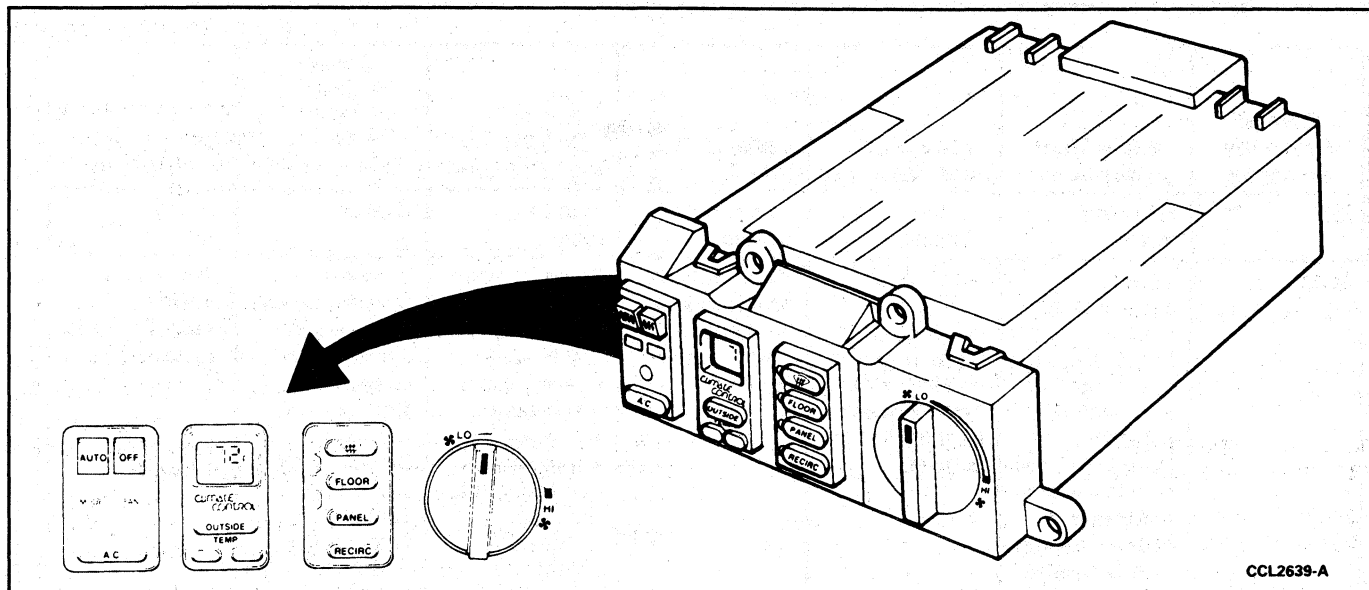


FIG. 3 EATC Control Assembly

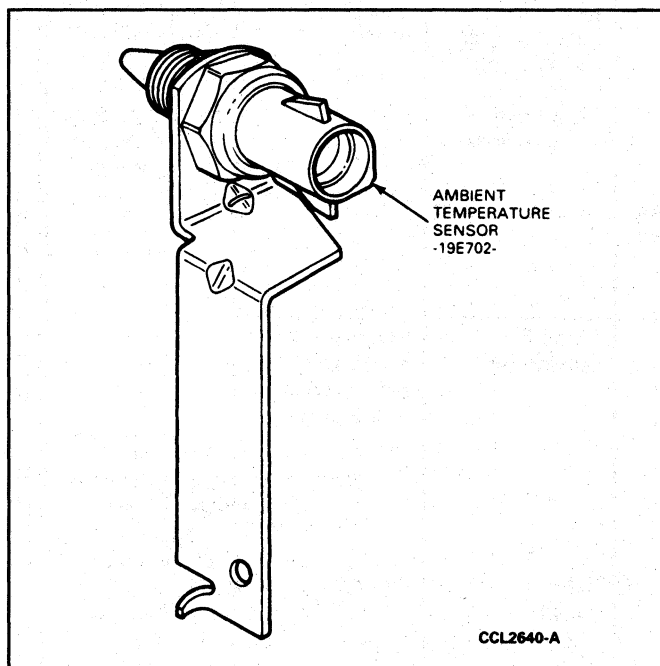


FIG. 4 Ambient Temperature Sensor

### Input Sensors

- **Ambient Temperature Sensor:** located in front of the condenser on the LH side of the vehicle, and contains a thermistor which measures the temperature of the outside air (Fig. 4).
- **In-Vehicle Temperature Sensor:** located behind the instrument panel above the glove compartment, contains a thermistor which measures the temperature of the air inside the passenger compartment (Figs. 5 and 6).
- **Sunload Sensor:** located in the LH radio speaker grille assembly. The sunload sensor contains a photovoltaic (sensitive to sunlight) diode (Fig. 7).

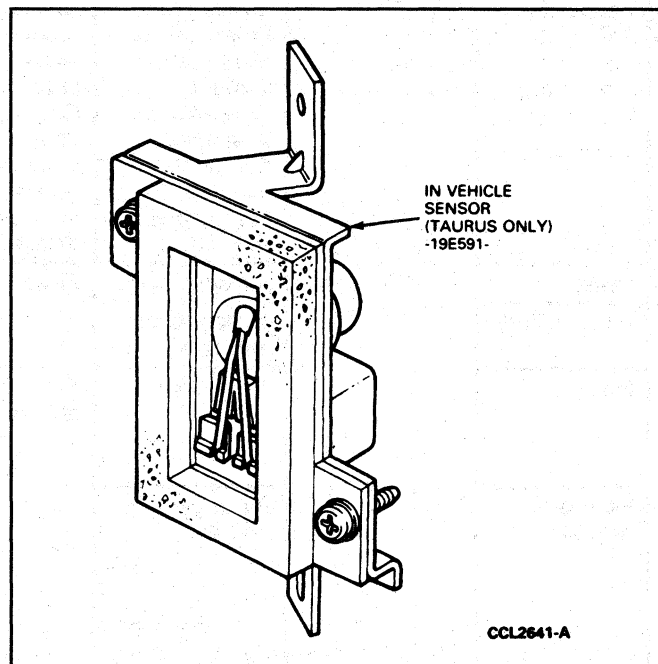


FIG. 5 In-Vehicle Sensor—Taurus

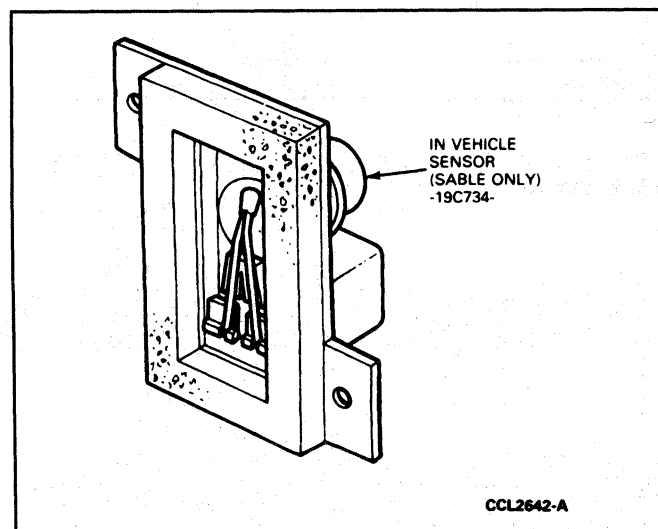


FIG. 6 In-Vehicle Sensor—Sable

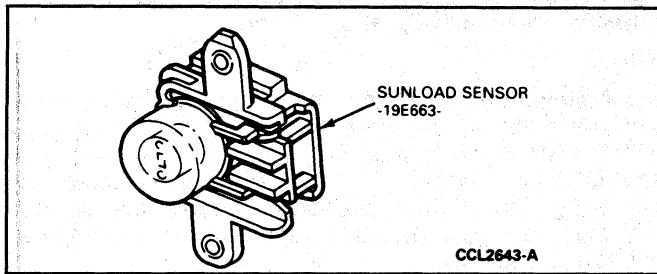


FIG. 7 Sunload Sensor

### Blower Speed Controller and High-Blower Relay

The blower speed controller (Fig. 8) is located in the evaporator case, upstream of the evaporator core.

The high-blower relay (Fig. 9) is located on the upper half of the evaporator case.

The function of the high-blower relay is to convert low current signals from the electronic control assembly to a high current, variable ground feed to the blower motor. Blower motor speed is infinitely variable and is controlled by the electronic control assembly software and blend door actuator position. A delay function provides a

gradual increase or decrease in blower motor speed under all conditions.

**CAUTION:** The system should not be operated with the blower motor disconnected. Damage may occur to the electronic blower speed controller if cooling air is not provided by the blower motor.

### Blend Door Actuator, Electric

The blend door actuator is located on top of the evaporator assembly and controls blend door movement on command from the control assembly (Fig. 10). Internally, an electronic circuit accepts commands from the control head and positions the blend door by electric motor. A separate potentiometer feeds blend door position information back to the control head.

### Pressure Relief Valve

A pressure relief valve is installed in the system to relieve pressure buildups above 3100 kPa (450 psi) and to prevent damage to the compressor and other A/C system components. The pressure relief valve is located in side of the discharge (high-pressure) line near the compressor manifold.

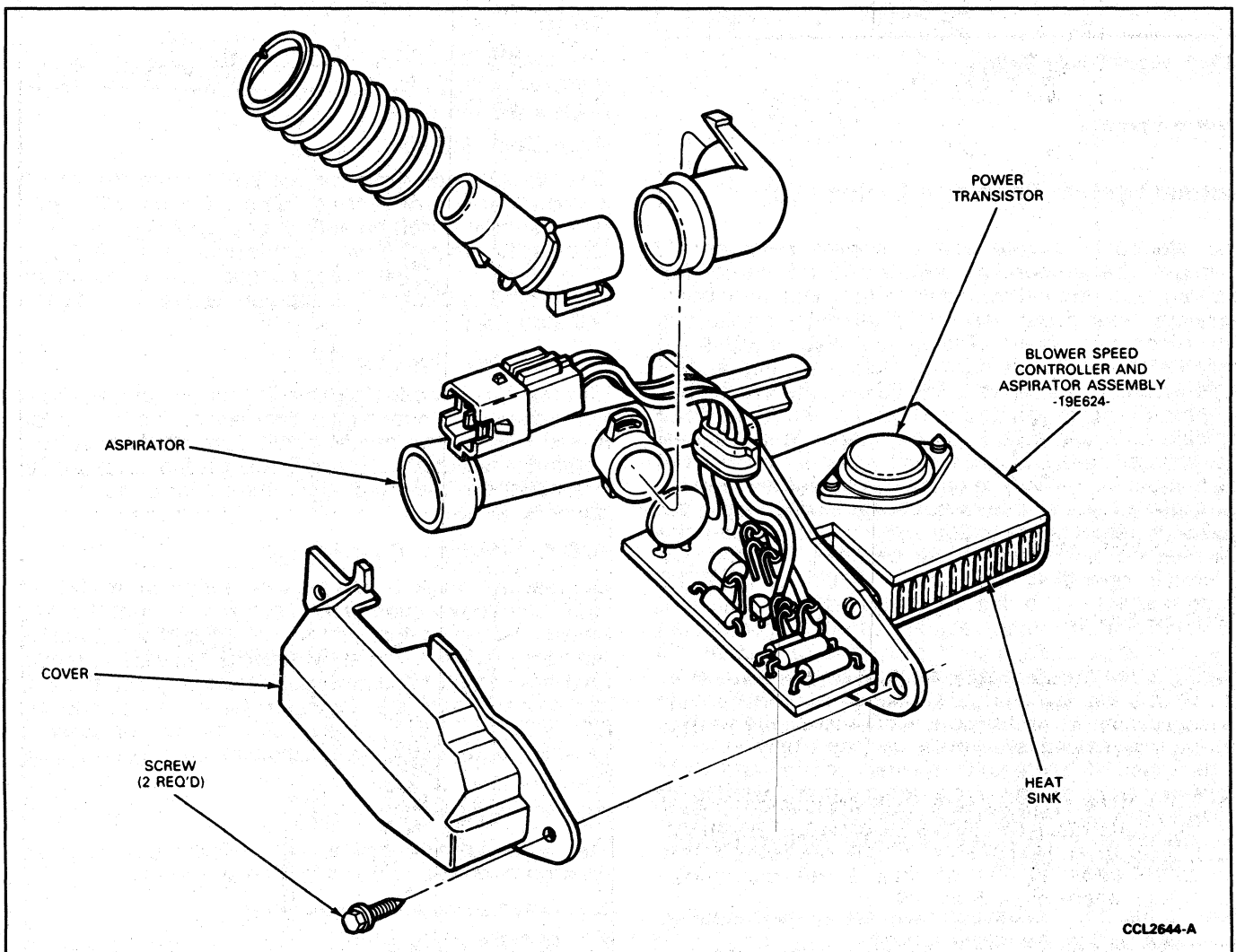


FIG. 8 Blower Speed Control and Aspirator Assembly

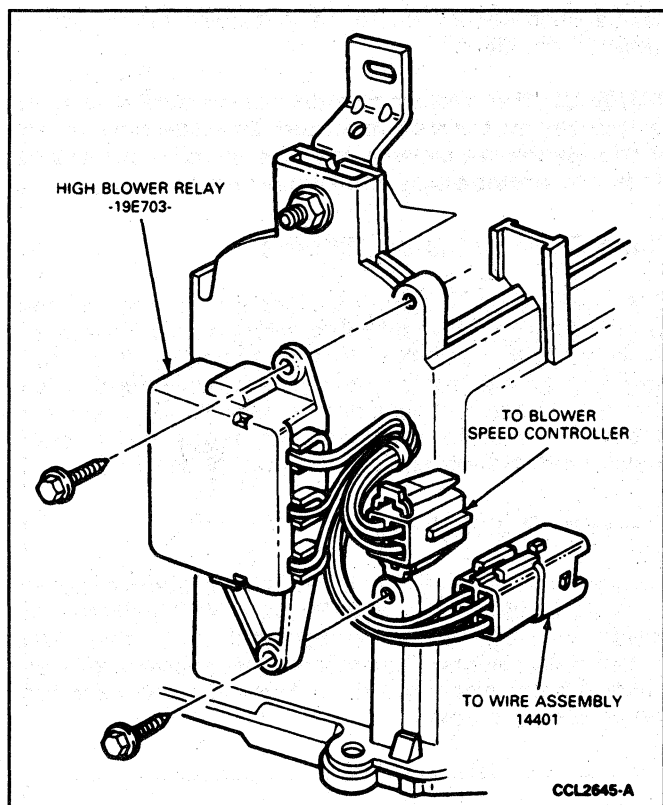


FIG. 9 High-Blower Relay

## OPERATION

### Normal System Operation (Automatic)

The electronic climate control system automatically maintains the temperature selected for driving comfort and regulates the airflow between the instrument panel registers, floor ducts, windshield defroster nozzle and side window demisters. The system also provides the option of manually overriding the blower speed and/or airflow direction as desired. Additionally, the system has automatic solar compensation for high sunload conditions. This results in cooler interior temperatures. The sunload sensor is located in the upper LH corner of the instrument panel. The outside temperature can also be displayed at any time by momentarily depressing the OUTSIDE temperature button. The outside temperature will then be displayed for four seconds. For optimum automatic operation, the system should be in AUTO mode and set to the desired comfort degree setting. If the vehicle interior temperature is warmer or cooler than the set temperature, the climate control system will automatically provide heat (when the engine is warm) or air conditioning, as required, to reach the comfort setting as fast as possible. If it is necessary to adjust the comfort setting, the setting should be changed only in small increments (1-2 degrees) to maintain comfort and avoid large variations of in-vehicle temperature. Raising or lowering the set temperature in large increments from the comfort setting **will not** reduce the time required to reach stabilized comfort.

Refer to Fig. 11. The balloon numbers in the illustration are referenced in the following text.

## System Description

### Auto ①

Depressing the AUTO button turns the system on in the fully automatic mode. Both the AUTO MODE ③ and AUTO FAN ④ indicator will light. The system will automatically maintain the temperature selected by controlling the airflow direction (mode), the airflow quantity (fan speed), and discharge temperature required for comfort.

When heating is required, the airflow will automatically be directed through the floor ducts and demisters with a small amount of air through the defroster. During cool weather, the fan operation will be delayed until the engine has heated sufficiently to provide warm discharge temperatures.

When cooling is required, the airflow will be directed through the instrument panel registers. The registers can be adjusted for optimum comfort. When maximum cooling is required, the system will automatically operate in a recirculating mode for rapid cool down and automatically change to outside air as the vehicle interior approaches the selected temperature.

In moderate conditions, the system will automatically operate in a split mode, with airflow directed through the floor ducts and through the windshield defroster ducts at a moderate temperature and fan speed.

### Off ②

Depressing the OFF button will turn the system off completely and display the word OFF in the digital display window ⑥.

### Auto Mode Indicator ③

The AUTO mode indicator will be lit when the AUTO button ① is depressed. The system will then automatically direct the airflow as previously described. Depressing any of the five override buttons, ⑤, ⑩, ⑪, ⑫, ⑬, will lock the system in a fixed function and turn off the AUTO mode indicator. The appropriate override indicator will then be lit.

### Auto Blower Indicator ④

Like the AUTO mode indicator ③, this indicator will be lit when the AUTO button ① is depressed. The blower fan speed will then be automatically controlled for system comfort requirements. The indicator will turn off when the blower fan override knob ⑭ is turned for a manual fan speed selection.

### A/C Compressor Override ⑤

Depressing the A/C compressor button from OFF or AUTO mode will engage the compressor, light the A/C compressor indicator, light the PANEL mode override indicator and lock the air distribution in PANEL mode. Depressing the button a second time will turn off the A/C compressor and the indicator lamp to provide an ECONOMY or VENT mode. A/C compressor override capability is available in all manual modes: ⑤, ⑩, ⑪, ⑫, ⑬.

### Digital Display Window ⑥

The digital display window will indicate one of three displays depending upon the manual selection:

1. Selected comfort temperature.
2. Outside temperature.

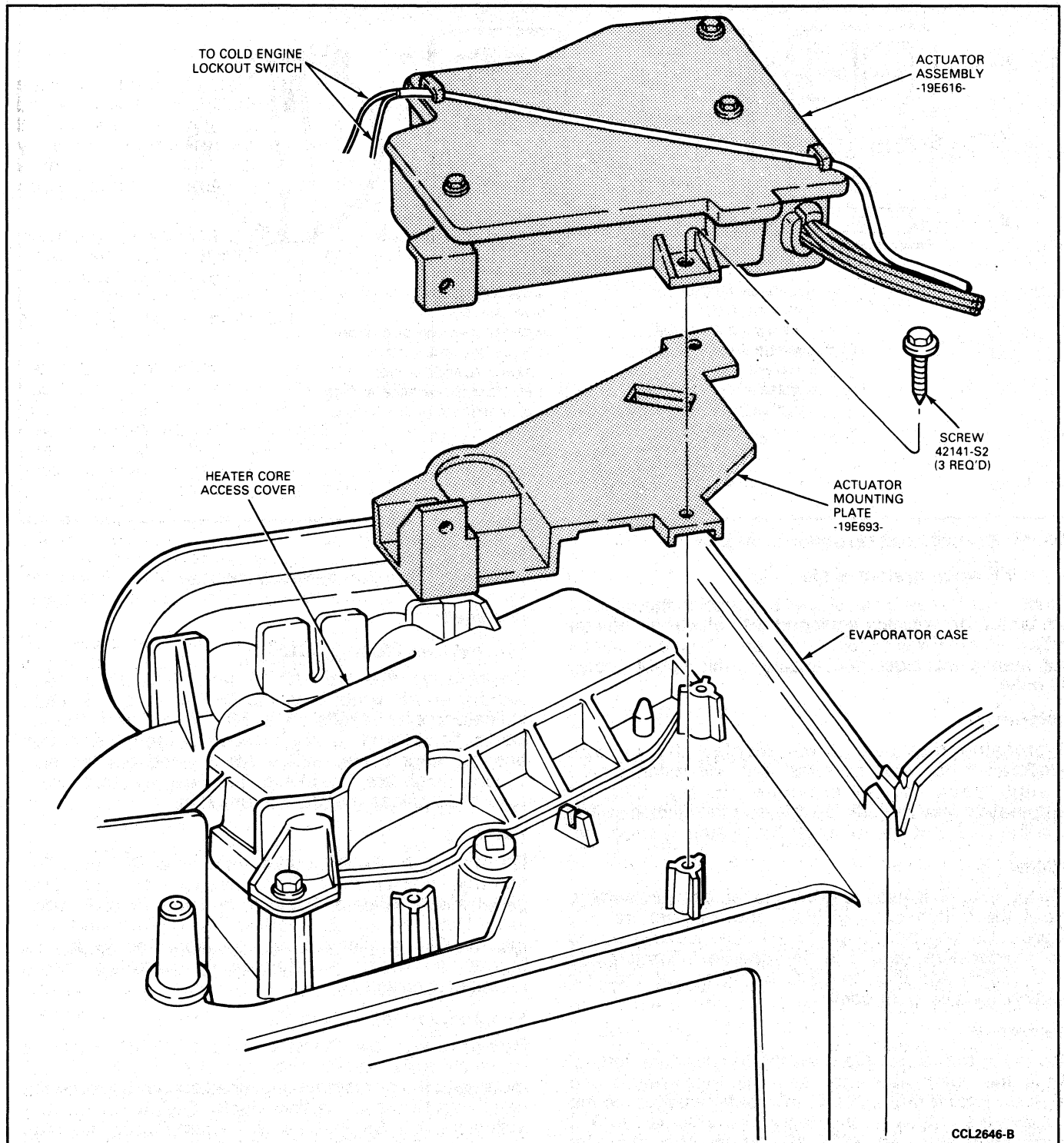
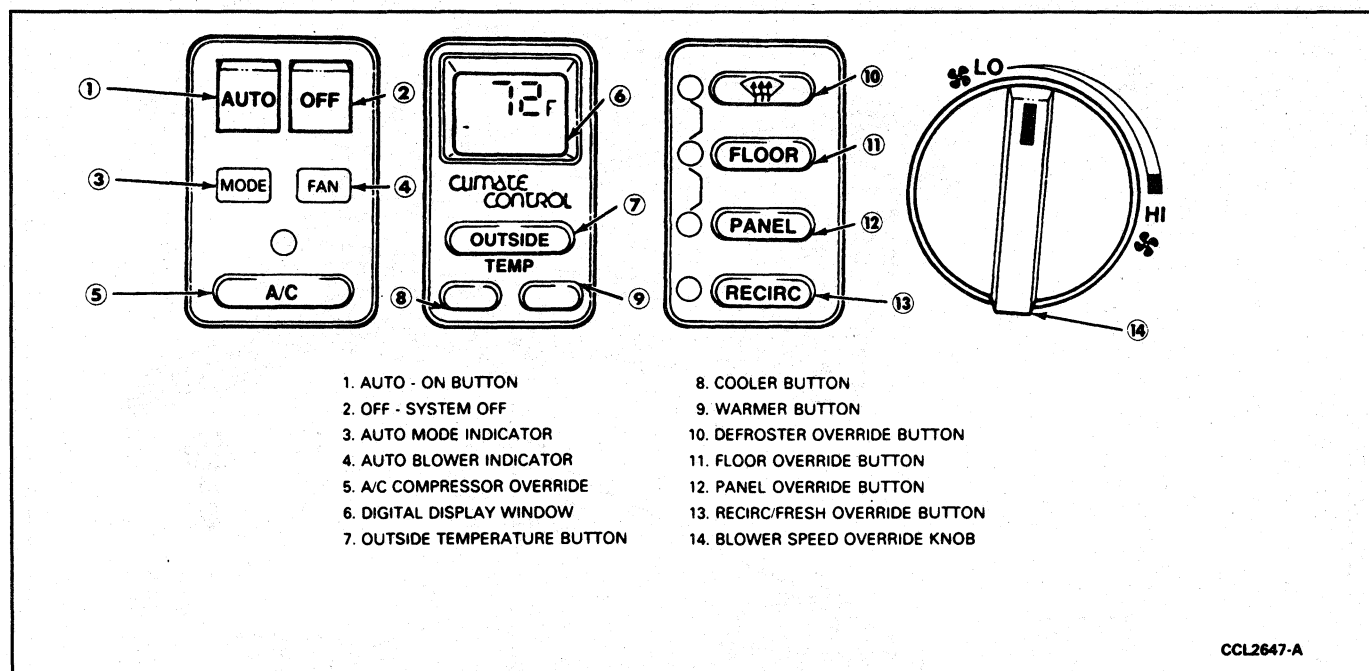


FIG. 10 Blend Door Electric Actuator and Mounting Assembly





**FIG. 11 Control Head Operational Diagram**

3. OFF when system is off.

Either °F or °C can be displayed by pressing the MILES/KM button on vehicles equipped with electronic cluster option. Only °F will be displayed on vehicles equipped with mechanical clusters (Canadian vehicles will display °C only).

#### Outside ⑦

Depressing this button will display the outside temperature for four seconds and will automatically change back to the previous display. Outside temperature may be selected any time the ignition switch is in the RUN position whether the system is on or off.

#### Cooler ⑧

The blue button is used to lower the temperature setting. Press the button once to lower the temperature one degree. Holding the button in will continuously reduce the temperature setting in one-degree increments to 18°C (65°F) and then to 15°C (60°F) in one step for continuous maximum cooling.

#### Warmer ⑨

The red button is used to raise the temperature setting. Press the button once to raise the temperature one degree. Holding the button in will continuously raise the temperature setting in one-degree increments to 29°C (85°F) and then to 32°C (90°F) in one step for continuous maximum heating.

#### Defrost ⑩

Depressing the DEFROST button lights the DEFROST indicator and locks the majority of the air distribution out the defroster nozzle, with a small bleed to the side window demisters and the floor ducts. The blower fan speed is automatically controlled unless manually overridden.

#### Floor ⑪

Depressing the FLOOR button lights the FLOOR indicator and locks the majority of the air distribution out the floor ducts with a small bleed to the side window

demisters and the defroster nozzle. The blower fan speed is automatically controlled unless manually overridden.

#### Defrost and Floor ⑩ and ⑪

Depressing the DEFROST and FLOOR buttons simultaneously lights both the DEFROST and FLOOR indicators and results in a MIX mode with the air distribution locked equally between the defroster nozzle and the floor ducts, with a small bleed out the side window demisters. The blower fan speed is automatically controlled unless manually overridden.

#### Panel ⑫

Depressing the PANEL button from either OFF or AUTO mode will result in the A/C compressor indicator and the panel mode indicator being lit and the air distribution locked out the panel registers. The RECIRC indicator may be lit if interior cooling conditions require it. The blower fan speed is automatically controlled unless manually overridden.

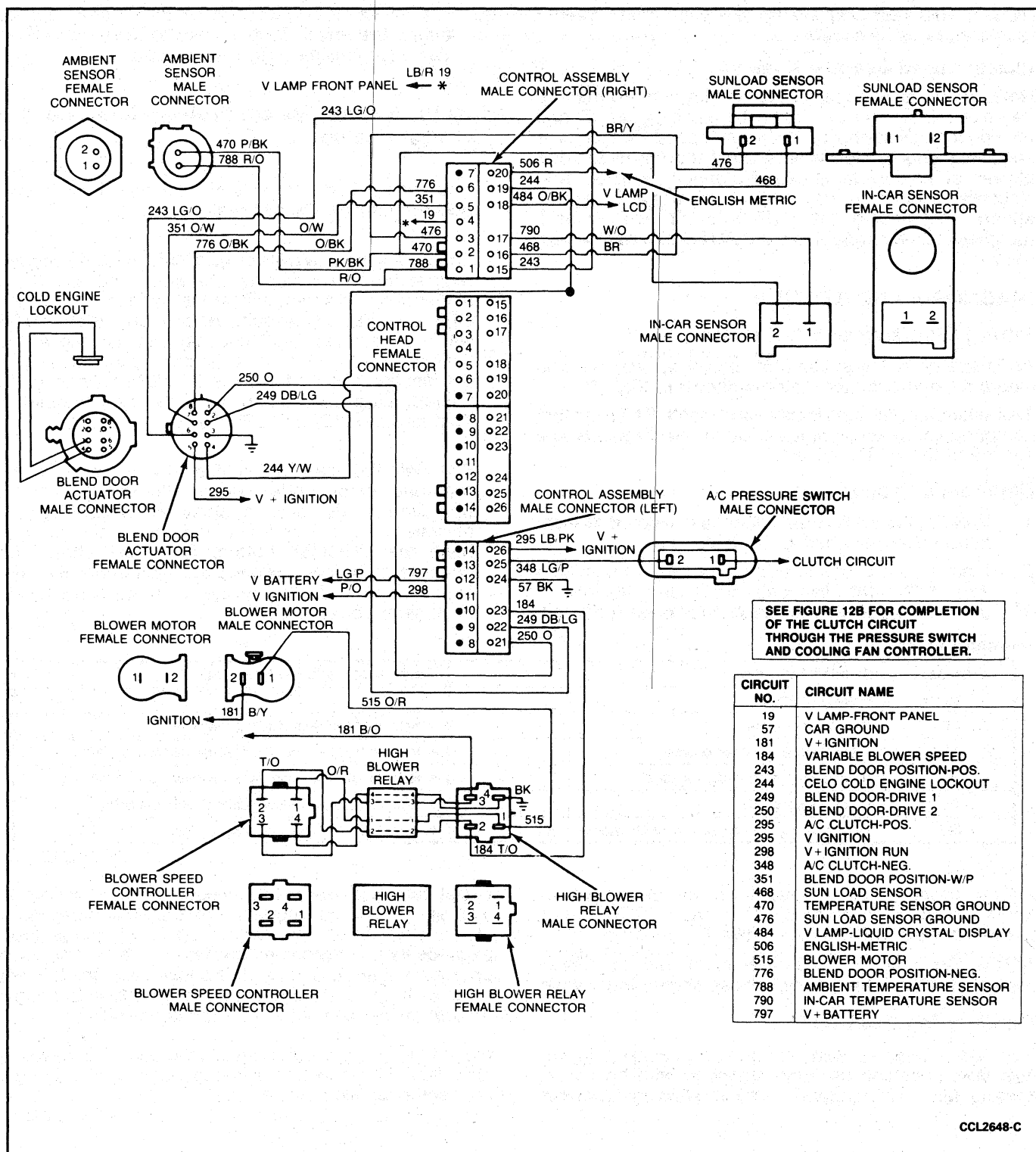
#### Panel and Floor ⑫ and ⑪

Depressing the PANEL and FLOOR buttons simultaneously from OFF or AUTO results in a HI-LO mode with the air distribution locked equally between the panel registers and the floor ducts. The panel and floor indicators will be lit. The A/C compressor override indicator will light. The RECIRC indicator may be lit if interior cooling conditions require it. The blower fan speed is automatically controlled unless manually overridden.

#### Recirc ⑬

Depressing the RECIRC button from OFF or AUTO lights the RECIRC indicator, and turns on the A/C indicator and the PANEL indicator. Interior air is recirculated with air distribution locked out of the panel registers. The RECIRC override is only available in PANEL, or PANEL and FLOOR modes and when the ambient temperature is greater than 4.5°C (40°F). Whenever the RECIRC mode is selected, the A/C override will also occur. Depressing the RECIRC button again will turn off the





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FIG. 12 EATC System Wiring Diagram

RECIRC indicator and the system will control interior temperature using outside air.

### Blower Speed Override Knob ⑭

Rotating the blower speed override knob more than 10 degrees will turn off the AUTO blower indicator ④ and provide manual control of the blower speed. Rotating the knob fully counterclockwise against the stop locks the blower at its lowest speed. Rotating the knob fully clockwise against the stop locks the blower at its highest speed. Depressing the AUTO button will resume automatic blower control and the AUTO blower indicator will light.

## DIAGNOSIS AND TESTING

### Wiring Diagrams and Actuators

An illustration of the evaporator assembly, system wiring diagrams, and actuator motor is shown in Fig. 12.

This illustration will help identify and locate EATC system components. In addition, it will aid in the diagnosis and service of the EATC system.

### Diagnostic Procedures

1. Perform the EATC Functional Test. Record all error codes displayed during the test.
2. If error codes appear during the EATC Functional Test, follow the diagnosis procedures outlined in the Error Code Key for each error code recorded.

#### ERROR CODE KEY

Error Code	Detected Condition	Troubleshooting/Repair Procedure
01	Replace control head	
02	Blend door problem	● Refer to Blend Door Actuator Diagnosis
03	In-car temp sensor open or short	● Refer to In-Car Temp Sensor Removal and Installation
04	Ambient temp sensor open or short	● Refer to Ambient Temp Sensor Removal and Installation
05	Sunload sensor short	● Refer to Sunload Sensor Removal and Installation
888	Testing complete — no test failure (all segments on)	● Refer to EATC System Functional Check

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- The program code level can be accessed by simultaneously pushing the OFF and FLOOR button, then the OUTSIDE button within two seconds.

NOTE: The in-vehicle temperature should be greater than 10°C (50°F) for all error codes shown to be valid.

### Cooling Fan Controller

Vehicles equipped with an engine mounted in the transverse position are also equipped with an engine cooling fan. An integrated relay module incorporates

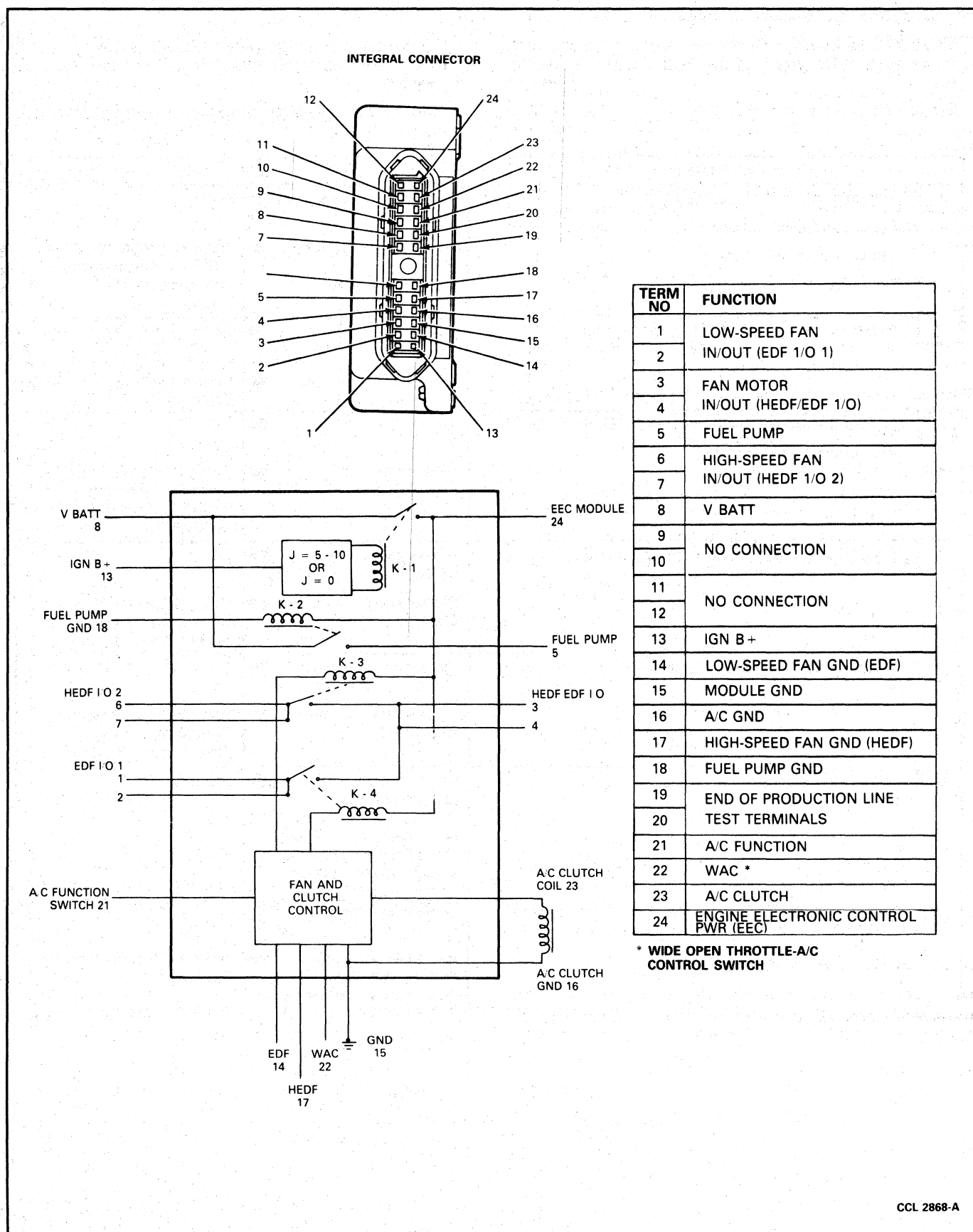
3. If a malfunction exists but no error code appears during the test in Step 1, refer to Diagnosis When Self-Test Indicates No Error Found.

### How to Use the System Problem Indication/Self-Test Feature

- The control head will detect electrical malfunctions occurring during the self test.
- Ensure engine is warm (at least 49°C (120°F) coolant temperature). To display the error codes for the malfunction detected, initiate the self test by pushing OFF and FLOOR simultaneously and then AUTO within 2 seconds. The test may run as long as 20 seconds, during which time the display will be blank. If the display is blank for more than 20 seconds, go to System Diagnosis When Self-Test and Functional Test indicate NO ERROR (Fig. 3).
- The Self Test can be initiated at any time with the resulting error codes being displayed. Normal operation of the system stops when Self Test is activated. To exit self-test and restart the system, push the COOLER button. Self Test should be deactivated before powering the system down. Refer to the Error Code Key in the following chart for an explanation of error codes.

circuit control provisions for various engine functions as well as for this cooling fan and the A/C compressor clutch coil. When the engine operating temperature exceeds its predetermined maximum, the cooling fan is energized. If an A/C function is chosen with the function selector knob, the compressor clutch coil will energize only when the engine cooling fan is operating.

Fig. 13 provides a schematic of the circuit involved. It also illustrates and charts the pin-outs in the integral connector for the module.



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**FIG. 13 Cooling Fan Controller Circuit and Pin-Outs**

**EATC System Functional Test**

- The EATC system functional test is designed to catch those system failures that the Self Test is unable to test.
- Ensure the engine is cold.
- The in-vehicle temperature should be greater than 10°C (50°F) for proper evaluation of system response.
- Refer to the following charts for testing instructions.

TEST STEP		RESULT	ACTION TO TAKE
1	Turn key to the RUN position. Press the AUTO button. Set control at 90°F setting.	Control powers up.	GO to 2.
		Control does not light.	Refer to Diagnosis When Self-Test And Functional Test Indicate No Errors Found.
2	Verify that the blower does not come on.	Blower Off	GO to 3.
		Blower On	Refer to CELO Inoperative.
3	Ensure that engine is warm (coolant temp. > 120°F). Set control at 75 setting.	Blower On	GO to 4.
		Blower Off	Refer to Blower Speed Controller and High Blower Relay Diagnosis-No Blower.
4	Rotate blower knob fully counterclockwise.	Blower goes to low blower.	GO to 5.
		Blower does not go to low blower.	Refer to Blower Speed Controller and High Blower Relay Diagnosis.
5	Rotate blower knob fully clockwise.	Blower goes to high blower.	GO to 6.
		Blower does not go to high blower.	Refer to Blower Speed Controller and High Blower Relay Diagnosis.
6	Press the DEFROST button.	Verify that air is discharged from defroster nozzle with small bleed through the side window demisters. Verify that the outside air/recirc door is in the outside air position.	GO to 7.
		Air is not discharged through the defroster or side window demisters.	Refer to Vacuum System Diagnosis.

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TEST STEP		RESULT	ACTION TO TAKE
7	Press the FLOOR button.	Verify that the air is discharged through the floor ducts.	GO to 8.
		Air is not discharged through the floor ducts.	Refer to Vacuum System Diagnosis.
8	Press the PANEL button.	Verify that the air is discharged through the panel ducts.	GO to 9.
		Air is not discharged through the panel ducts.	Refer to Vacuum System Diagnosis.
9	Make sure that the ambient temperature is greater than 40°F. Press the RECIRC button.	Verify that the outside air/recirc door is in the recirc position.	GO to 10.
		Outside air/Recirc door is not in the recirc position.	Refer to Vacuum System Diagnosis.
10	Press the A/C button.	Verify that the A/C and Recirc LED turns off. Verify that the clutch is off.	GO to 11.
		A/C clutch is still on.	Refer to Clutch Does Not Disengage When In OFF Diagnosis.
11	Press the A/C button again.	Verify that the A/C LED lights and that the clutch is on.	GO to 12.
		A/C clutch is off.	Refer to No Clutch Operation Diagnosis.
12	Press the AUTO button.	Verify that the Mode and Fan LEDs are lit.	Refer to Diagnosis When Self-Test And Functional Test Indicate No Errors Found.

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### Diagnosis When Self Test and Functional Test Indicate No Error Found

Refer to the chart below for symptoms, their possible causes, and the test or repair procedures required.

#### DIAGNOSIS WHEN SELF-TEST INDICATES NO ERRORS FOUND

CONDITION	POSSIBLE SOURCE	ACTION
Cool discharge air when system is set to Auto/90°F	Heater system malfunction Blend door not in max. heat	Refer to Section 36-10. Check position of blend door. Check coolant level. Check shaft attachment. Test per Blend Door Actuator Diagnosis (assume 2 was displayed in the Self-Test).
Warm discharge air in Auto/60°F	Clutch circuit malfunction Check refrigerant Blend door not in max. A/C position Outside/Recirc door not in recirc	Test clutch circuit per No Clutch Operation Diagnosis. Refer to Section 36-10. Check position of blend door. Check shaft attachment. Test per Blend Door Actuator Diagnosis (assume 2 was displayed in the Self-Test). Test per Vacuum System Diagnosis.
Cool air in 85°F, max. heat in 90°F Heat in 65°F max. cool in 60°F	Sensor shorted Sensor open	Troubleshoot according to Sensor Diagnosis. Troubleshoot according to Sensor Diagnosis.
No blower	Faulty CELO switch/wiring Faulty blower controller Faulty high blower relay Faulty control head Faulty blower motor Faulty wiring	Test per No Blower Section of Blower Speed Controller and Heat Blower Relay Diagnosis.
High blower only	Faulty control head Faulty high blower relay Faulty blower controller Faulty wiring	Test per High Blower Only Section of Blower Speed Controller and High Blower Relay Diagnosis.
Clutch is on in off mode	Faulty control head Faulty wiring or interface components	Test according to "Clutch does not Disengage when in off mode".

## DIAGNOSIS WHEN SELF-TEST INDICATES NO ERRORS FOUND (Continued)

CONDITION	POSSIBLE SOURCE	ACTION
Control head digits and LED's do not light up. Blower off.	Fuse	Replace fuse.
	Ignition Circuit NO. 298 open	Check Circuit No. 298.
	Ignition Circuit NO. 797 open	Check Circuit No. 797.
	Ground Circuit NO. 57A open	Check Circuit No. 57A.
	Faulty control head	Change control head.
One LED does not light	Control head malfunction	Replace control head.
Cold air is delivered during heating when engine is cold	Damaged wiring	Place system at 90°F/Auto. With ignition OFF, (ignition must be OFF when grounding Circuit No. 244 for valid results) ground Circuit No. 244 at engine temp. switch. Start vehicle. If blower is off, replace cold engine lockout (CELO). If blower is on, check wiring. If OK, replace control head.
	Damaged or inoperative engine temp. switch	Replace engine temperature switch.
Temp. set point does not repeat after turning OFF ignition.	Circuit NO. 797 not connected to control head	Remove control head connector. With ignition OFF, check for 12 volts at Pin 12 (Driver's side connector VA).
	Damaged or inoperative control head	If no voltage, check fuse/wiring. If voltage, replace control head.
The control head temperature display will not switch from Fahrenheit to Centigrade when the E/M trip computer button is pushed	Damaged or inoperative wiring, trip minder or control head	<b>CAUTION: ACCIDENTAL SHORTING OF THE WRONG PIN COULD DESTROY THE CONTROL HEAD.</b> Short Pin 20 of connector VA (Circuit No. 506) to ground. Turn ON ignition. If the display does not switch from F to C, Circuit No. 506 is open at the control head and the control head is damaged. Otherwise check the wiring and the trip minder.
System does not control temperature	Sensor hose not connected to aspirator or sensor	Inspect and service.
	Aspirator not secured to evaporator case	Inspect and service.
	Sensor seal(s) missing or not installed properly	Inspect and service.
	Aspirator or sensor hose blocked with foreign material or kinked	Inspect and service.
	Damaged aspirator hose	Inspect and service.

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**Self Test—Clutch Control**

Refer to the following charts for Self-Test instructions involving clutch operation.

**NO CLUTCH OPERATION DIAGNOSIS**

TEST STEP		RESULT	ACTION TO TAKE
<b>A</b>	Jump the LB-PK and LG-P wires Pin 26 and Pin 25 of driver side connector VA.	Clutch engages	Replace control head assembly.
		Clutch does not engage	Refer to Section 36-37. (Faulty wiring, faulty integrated controller or EEC-IV module, faulty pressure switch.)
		20A fuse blows	Clutch is shorted. Check diode in wiring harness across clutch in particular. Service short, then test to see if the control head will turn the clutch off and on. If not, replace control assembly.

**CL5080-A****CLUTCH DOES NOT DISENGAGE WHEN IN OFF POSITION**

TEST STEP		RESULT	ACTION TO TAKE
<b>A</b>	Disconnect connector VA (driver's side) from control assembly.	Clutch disengages	Change control head.
		Clutch stays on	Refer to Section 36-37. (Faulty wiring, faulty integrated controller or EEC-IV module, faulty pressure switch.)

**CL5081-A**



### Self Test—Blower Speed Controller (BSC) and High Blower Relay (HBR)

Testing requires a Rotunda 007-00001, Digital Volt-Ohmmeter or equivalent. Refer to Fig. 12 for terminal pin locations. Use the following charts for self-test procedures.

#### Condition #1

No blower, ignition in RUN, engine warm, auto mode, 32°C (90°F) setting.

TEST STEP (CELO TEST)		RESULT	ACTION TO TAKE
<b>A</b>	Change temp. setting to 60° Auto.	Blower On	GO to B.
		No blower	GO to C.
<b>B</b>	Disconnect cold engine lockout (CELO) switch and change temp. to 90° setting Auto.	Blower On	Faulty CELO switch.
		No blower	CELO wire grounded.
<b>C</b>	Connect voltmeter between BSC ignition Pin 3 and ground Pin 4.	0 volts	Check V ignition circuit fuse, continuity in wiring (thru HBR).
		More than 10 volts	GO to D.
<b>D</b>	Connect voltmeter between BSC input Pin 2 and ground Pin 4.	Fluctuating voltage less than 3 volts	GO to E.
		More than 3 volts	GO to F.
<b>E</b>	Connect voltmeter between BSC output Pin 1 and ground Pin 4.	Less than 1 volt	Faulty motor, B+ feed to motor.
		More than 1 volt	Replace BSC.
<b>F</b>	Connect voltmeter between control head Pin 23 and Pin 24.	More than 3 volts	Replace control head assy.
		Less than 3 volts	Check circuit continuity (thru HBR).

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#### Condition #2

High blower only: no low blower auto mode, blower switch in LOW position.

TEST STEP (Voltmeter Connections)		RESULT	ACTION TO TAKE
<b>A</b>	Disconnect HBR and BSC electronic connections.	Blower in high	Faulty blower motor or blower wire circuit.
		Blower Off	GO to B.
<b>B</b>	Connect 14401 harness directly to the BSC (do not connect HBR) (auto mode). Rotate blower switch from high to low blower.	Blower in high	GO to C.
		Blower in low	Faulty HBR.
<b>C</b>	Connect voltmeter between BSC input Pin 2 and ground Pin 4 (auto mode). Rotate blower switch from high to low blower.	Less than 7 volts fluctuating	Replace control head assy.
		More than 7 volts fluctuating	Replace BSC.

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**Condition #3**

Blower operates but does not vary with blower control switch.

TEST STEP (Voltmeter Connection)		RESULT	ACTION TO TAKE
<b>A</b>	Connect voltmeter between BSC input Pin 2 and ground Pin 4 (Auto mode). Rotate blower switch from min. to max. then back to min.	Voltage fluctuation from below 7 volts to above 7 volts then back below 7 volts	GO to B.
		No change in voltage	Replace control head assy.
<b>B</b>	Connect voltmeter between BSC output Pin 1 and ground Pin 4 (Auto mode). Rotate blower switch from min. to max.	Voltage changes from less than 1 volt to 7 volts	Faulty blower motor, or B+ feed to motor.
		No change in voltage	Replace BSC.

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**Condition #4**

Cold Engine Lockout (CELO) inoperative: blower turns on immediately in AUTO, 32°C (90°F) setting, with cold engine.

TEST STEP		RESULT	ACTION TO TAKE
<b>A</b>	Cold engine (engine coolant temp. below 120°) control set at auto 90°.	Blower on	CHECK coolant and retest. If blower turns on again, REPLACE CELO.
		Blower off	CELO Ok.

CL5085-B

## Control Head Connector and Blend Actuator Self Test

Refer to the following chart for control head connector and blend door Self-Test procedures. To test the control

head vacuum valve, apply 50 kPa (15 in-Hg) of vacuum to the number five terminal.

	TEST STEP	RESULT	ACTION TO TAKE
Letters in parentheses indicate (wire color, circuit no.). See Fig. 12 for wiring schematic and connector pin diagrams.			
<b>A</b>	Check error code during EATC functional test.	02 Any other number	GO to <b>B</b> . REVIEW error code key
<b>B</b>	Disconnect both connectors from EATC control head and drive actuator in both directions using any 9-12 volt battery.  The following pins can be jumped to utilize the vehicle battery. Insure the ignition is in the RUN position.  All pins are located on the LEFT connector (E6DB-14489-VA).  Trial 1: Pin 24 (BK, 57) to Pin 22 (DB/LG, 249)  Trial 2: Pin 24 (BK, 57) to Pin 21 (O,250)	Actuator drives both directions	GO to <b>C</b> .
		Actuator does not drive both directions	GO to <b>F</b> .
<b>C</b>	Reconnect control head and test according to EATC functional test.	Test successful Test fails	Done GO to <b>D</b> .
<b>D</b>	Disconnect both connectors from EATC control head. Measure resistance as shown below at the control head connector with the connector disconnected.  All pins are located on the RIGHT connector (E6DB-14489-UA).  Pin 15 (LG/O, 243) to Pin 6 (O/BK, 776) 5000-7000 ohms  Pin 5 (O/W, 351) to Pin 6 (O/BK, 776) 300-7300 ohms  Pin 5 (O/W, 351) to Pin 15 (LG/O, 243) 300-7300 ohms	All resistances OK	GO to <b>E</b> .
		Any resistance not OK	GO to <b>F</b> .
<b>E</b>	Change control head and test according to EATC functional test.	Test successful Test fails	Done GO to <b>A</b> .
<b>F</b>	Check vehicle wiring harness and connector continuity as shown below. Disconnect connectors from both control head and blend door actuator. Blend door actuator connector is accessible through glove compartment.  Control head connector      Blend door actuator connector E6DB-14489-VA      E6DB-14A459-BA (right hand)  Pin 5 (O/W, 351)      to      Pin 7 (O/W) Pin 6 (O/BK, 776)      to      Pin 8 (O/BK) Pin 15 (LG/O, 243)      to      Pin 6 (LG/O)  E6DB-14489-UA (left hand)  Pin 21 (O, 250)      to      Pin 1 (O) Pin 22 (DB/LG, 249)      to      Pin 2 (DB/LG) Pin 24 (BK, 57)      to      Pin 3 (BK)  Reconnect all three connectors at end of this test.	Continuity bad	GO to <b>H</b> .
		Continuity good	GO to <b>G</b> .
<b>G</b>	Change blend door actuator and test according to EATC functional test.	Test successful Test fails	Done GO to <b>A</b> .
<b>H</b>	Fix/replace wiring harness, connect and test according to EATC functional test.	Test successful Test fails	Done GO to <b>A</b> .

## Vacuum System Diagnosis

To test the EATC vacuum system, start the engine and depress the function buttons slowly from one position to another. A momentary hiss should be heard as each button is depressed from one position to another, indicating that vacuum is available at the control assembly. A continuous hiss at the control assembly indicates a major leak somewhere in the system. It does not necessarily indicate that the leak is at the control assembly.

If a momentary hiss cannot be heard as each function button is depressed from one position to another, check for a kinked, pinched, or disconnected vacuum supply hose (Fig. 14). Also, inspect the check valve between the vacuum intake manifold and the vacuum reservoir to ensure it is working properly.

If a momentary hiss can be heard as each function button is depressed from one position to another, vacuum is available at the control assembly. Cycle the function buttons through each position with the blower on HI and check the location(s) of the discharge air. The airflow schematic and vacuum control chart (Fig. 15) shows the vacuum motors applied for each function selection along with an airflow diagram of the system. The airflow diagram shows the position of each door when vacuum is applied and their no-vacuum position. With this chart, airflow for each position of the control assembly can be determined. If a vacuum motor fails to operate, the motor can readily be found because the airflow will be incorrect.

If a vacuum motor is inoperative, check the operation of the motor with Rotunda Vacuum Tester 021-00014 or equivalent. If the vacuum motor operates properly, the vacuum hose is probably pinched, kinked, disconnected or has a leak (Fig. 14).

If the function system functions normally at idle, but goes to defrost during acceleration, a small leak exists in the system. The leak can best be located by shutting off the engine and using a gauge to check for vacuum loss while selectively blocking off vacuum hoses.

To check electrical system operation between the control head connector and the blend door actuator, refer to Diagnostic procedures.

## REMOVAL AND INSTALLATION

### Control Assembly Dial Liquid Crystal Bulb Replacement

The following service procedure is to be used only for replacement of the liquid crystal light bulb. The procedure does not apply to the backlighting bulbs or the function indicator lamps (LEDs).

If any of the function LEDs are inoperative, the control assembly must be replaced.

#### Removal and Installation

1. Remove control assembly from vehicle.
2. Place control assembly on a clean cardboard surface.
3. Remove two screws from back of control housing which retains top cover (Fig. 16).
4. Lift off cover. (Do not turn module upside down).

**CAUTION: Do not touch the components or traces on the circuit board, as damage to the circuit and/or components may result.**

**CAUTION: Care should be exercised not to excessively flex the ribbon cable between the switch board assembly and the circuit board.**

5. The grey rectangular plastic bulb and socket assemblies protrude from the back of the switch board assembly mid-position. To remove bulb and socket assembly, carefully start rotation counterclockwise with pliers, taking care not to touch any other components with pliers. Continue rotation by hand about 45 degrees to stop, and pull bulb socket assembly straight out from button housing.
  6. Pull old bulb from socket and install new bulb Part No. D4AZ-13466-A (Trade No. 37) in socket.
  7. Install bulb and socket assembly into button housing and rotate clockwise about 45 degrees to lock socket assembly in place.
- CAUTION: Do not use pliers to install the socket assembly.**
8. Replace cover on top of control by carefully inserting locating tabs into front portion of control head and install screw. Install control assembly in vehicle, and perform EATC Functional Test as outlined.

## Control Assembly Blower Knob

### Removal and Installation

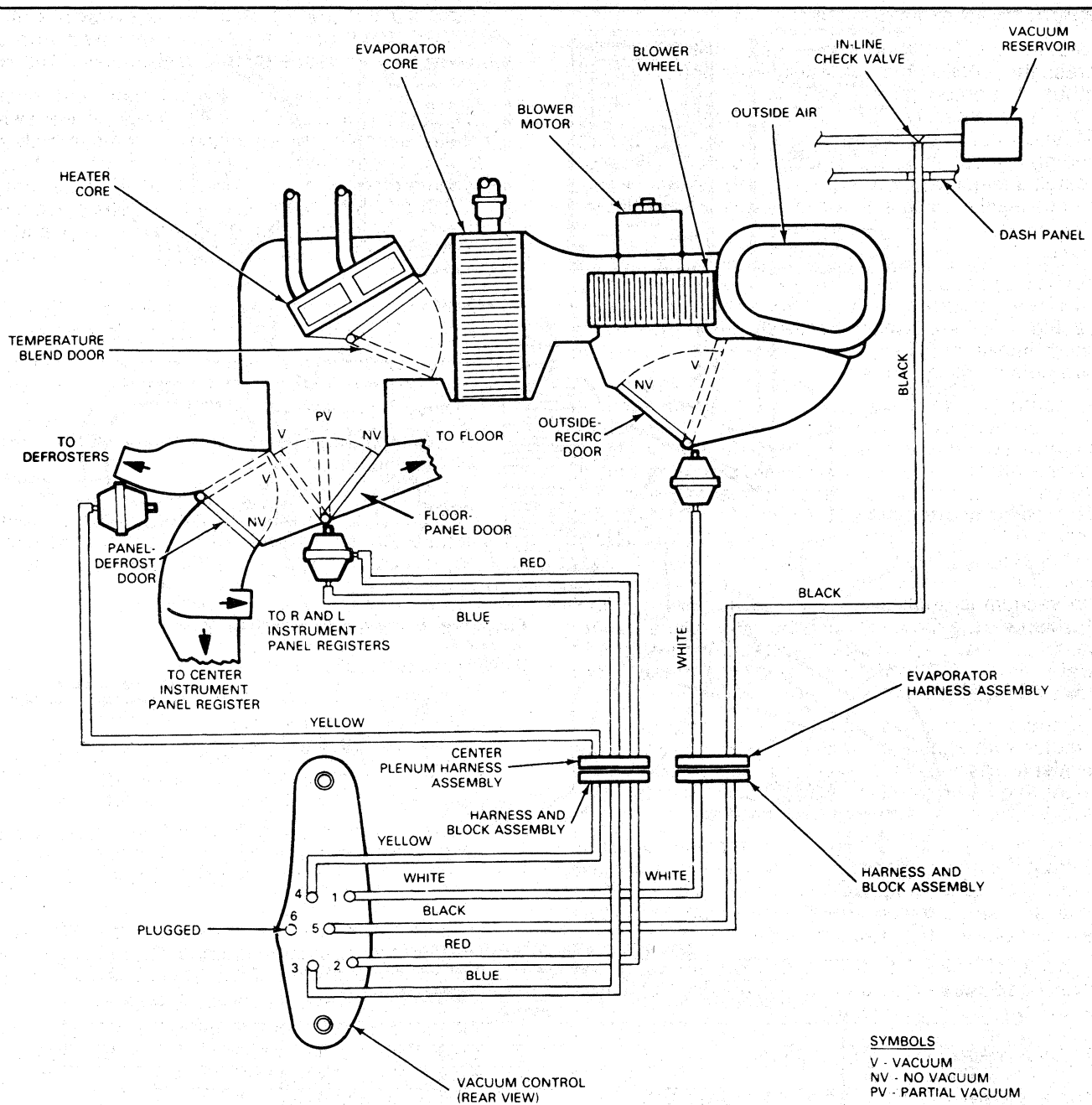
1. Grasp blower knob and pull it rearward from control assembly bezel (Fig. 17).
- NOTE: Do not use a sharp instrument to pry the knob off the potentiometer shaft as damage to the surface of the bezel is likely to occur.
2. If the D-shaped spring clip which seats inside back end of knob remains on potentiometer shaft when knob is pulled off, remove it using needlenose pliers.
  3. To install knob, align its keyed surface with mating surface on potentiometer shaft. Press knob forward until its back edge is flush with surface of control assembly bezel.

NOTE: This knob removal and installation procedure applies only to the control assembly blower knob. The buttons on the control assembly are not serviced in detail.

## Control Assembly

### Removal

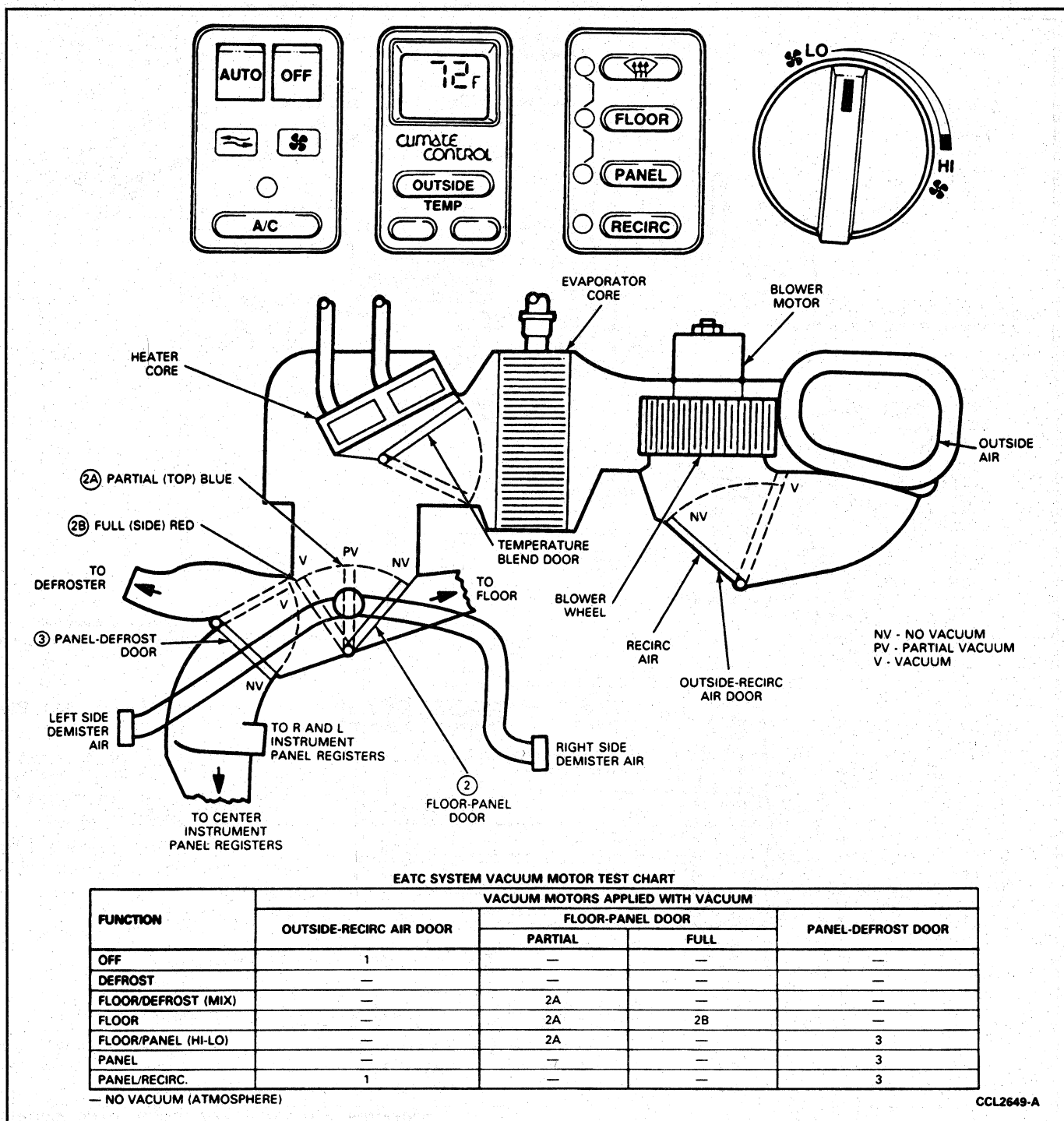
1. Disconnect battery ground cable.
2. Pull out lower LH and lower RH instrument panel snap-on finish panel inserts. Remove eight screws retaining upper finish panel (Fig. 18).
3. Pull lower edge of upper finish panel away from instrument panel. It is best to grasp finish panel from lower LH corner, and pull panel away by walking hands around panel in a clockwise direction.
4. Remove four Torx® head screws retaining control head. Pull control head away from instrument panel (Fig. 19) into a position which provides access to rear connections.
5. Disconnect two harness connectors from control assembly by depressing latches at top of connectors and pulling.



VACUUM PORT	FUNCTION	SELECTION						
		OFF	DEFROST	FLOOR — PANEL (MIX)	FLOOR	FLOOR — PANEL (HI-LO)	PANEL	RECIRC.
1	Outside — Recirc.	V	NV	NV	NV	NV	NV	V
2	Full Floor	NV	NV	NV	V	NV	NV	NV
3	Floor — Panel (Partial)	NV	NV	V	V	V	NV	NA
4	Panel — Defrost	NV	NV	NV	NV	V	V	V
5	Source	V	V	V	V	V	V	V
6	Plugged	—	—	—	—	—	—	—

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FIG. 14 EATC System Vacuum Schematic and Selector Test



CCL2649-A

FIG. 15 EATC System Airflow Schematic and Vacuum Control Chart

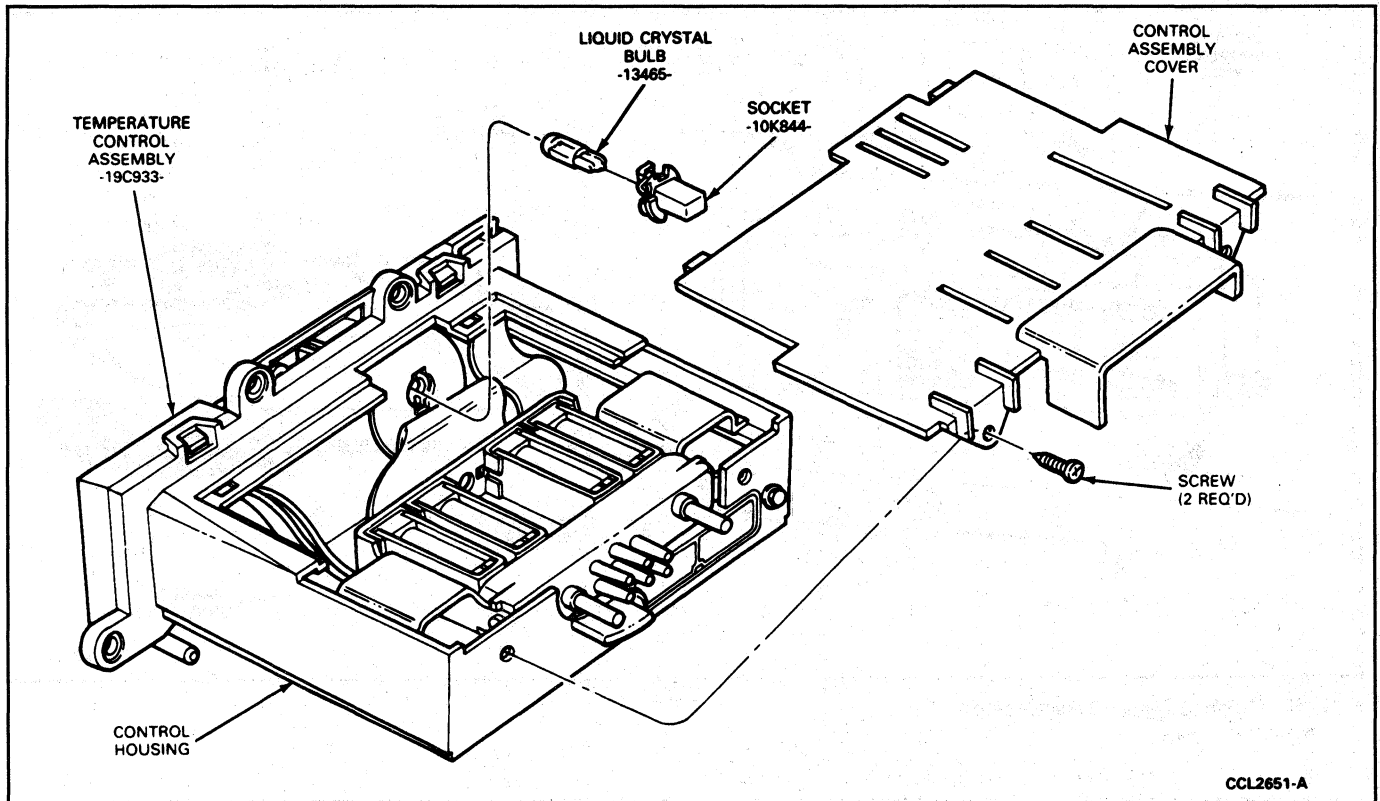


FIG. 16 Control Assembly Opened for Bulb Replacement

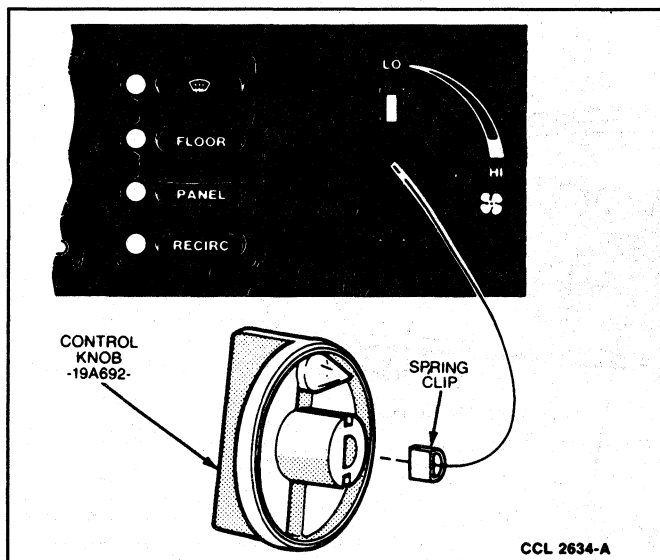


FIG. 17 Blower Speed Control Knob

6. Remove two nuts which retain vacuum harness. Pull control assembly away from instrument panel.

#### Installation

1. Connect two harness connectors to control assembly. Push keyed connectors in until a click is heard (Fig. 18).
2. Attach vacuum harness to vacuum port assembly. Secure harness by tightening two nuts.
3. Position control assembly into instrument panel opening and install four attaching Torx® head screws. Ensure that, as control is positioned,

locating posts are correctly aligned with their respective holes.

4. Carefully place instrument panel applique into its assembly position. Note that spring clips are aligned with their proper holes. Press applique into place. Ensure that all spring clips are secure.
5. Install eight screws which retain upper finish panel. Insert lower LH and lower RH instrument panel snap-on finish panel inserts.
6. Connect battery ground cable.

### Sunload Sensor Assembly

#### Removal

1. Disconnect battery ground cable.
2. Remove LH radio speaker grille assembly and remove sunload sensor assembly from two mounting studs (Figs. 18 and 19).
3. Disconnect electrical connector from sunload sensor.

#### Installation

1. Connect electrical connector to sunload sensor.
2. Install sunload sensor assembly to LH speaker grille by pushing sunload sensor firmly over two mounting studs.
3. Install LH radio speaker grille assembly.
4. Connect battery ground cable.

### In-Vehicle Sensor Assembly

#### Taurus

#### Removal

1. Disconnect battery ground cable.

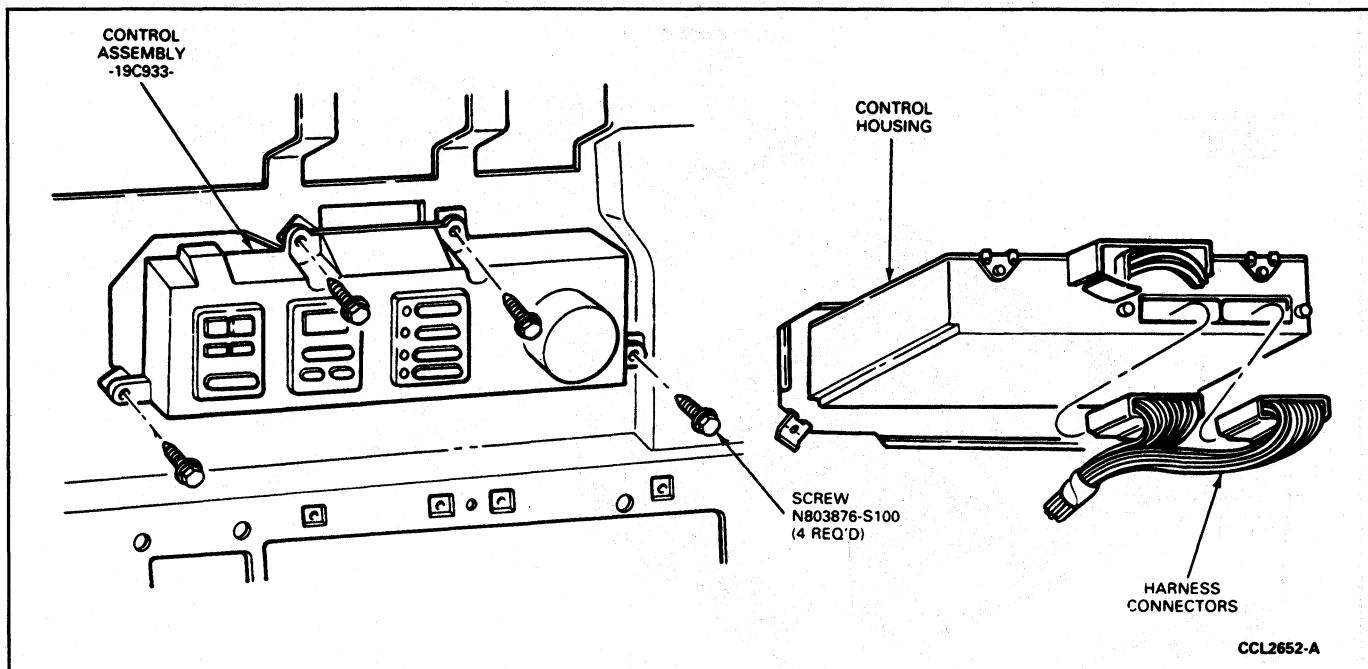


FIG. 18 Control Head Attachments

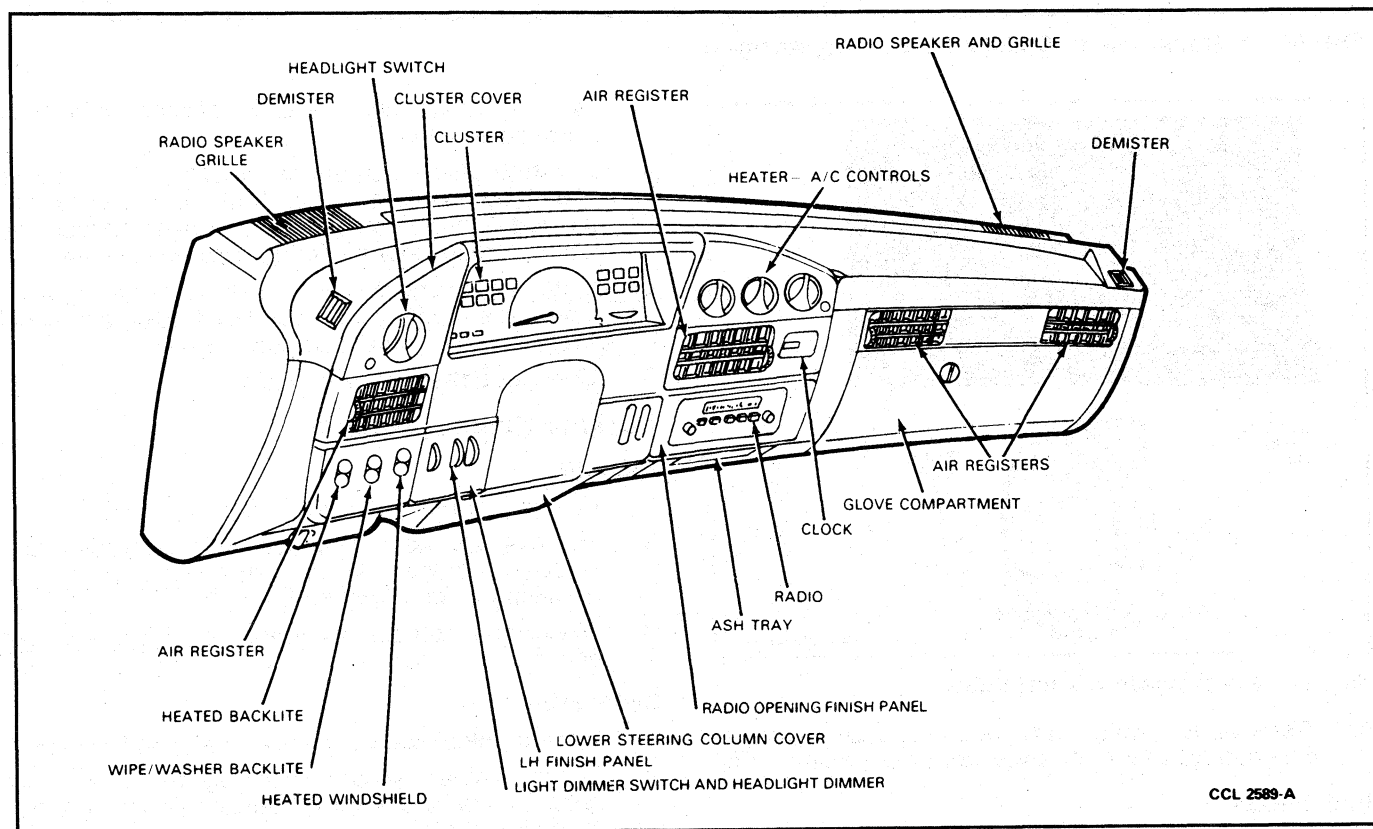


FIG. 19 Instrument Panel Assembly, Front View—Taurus



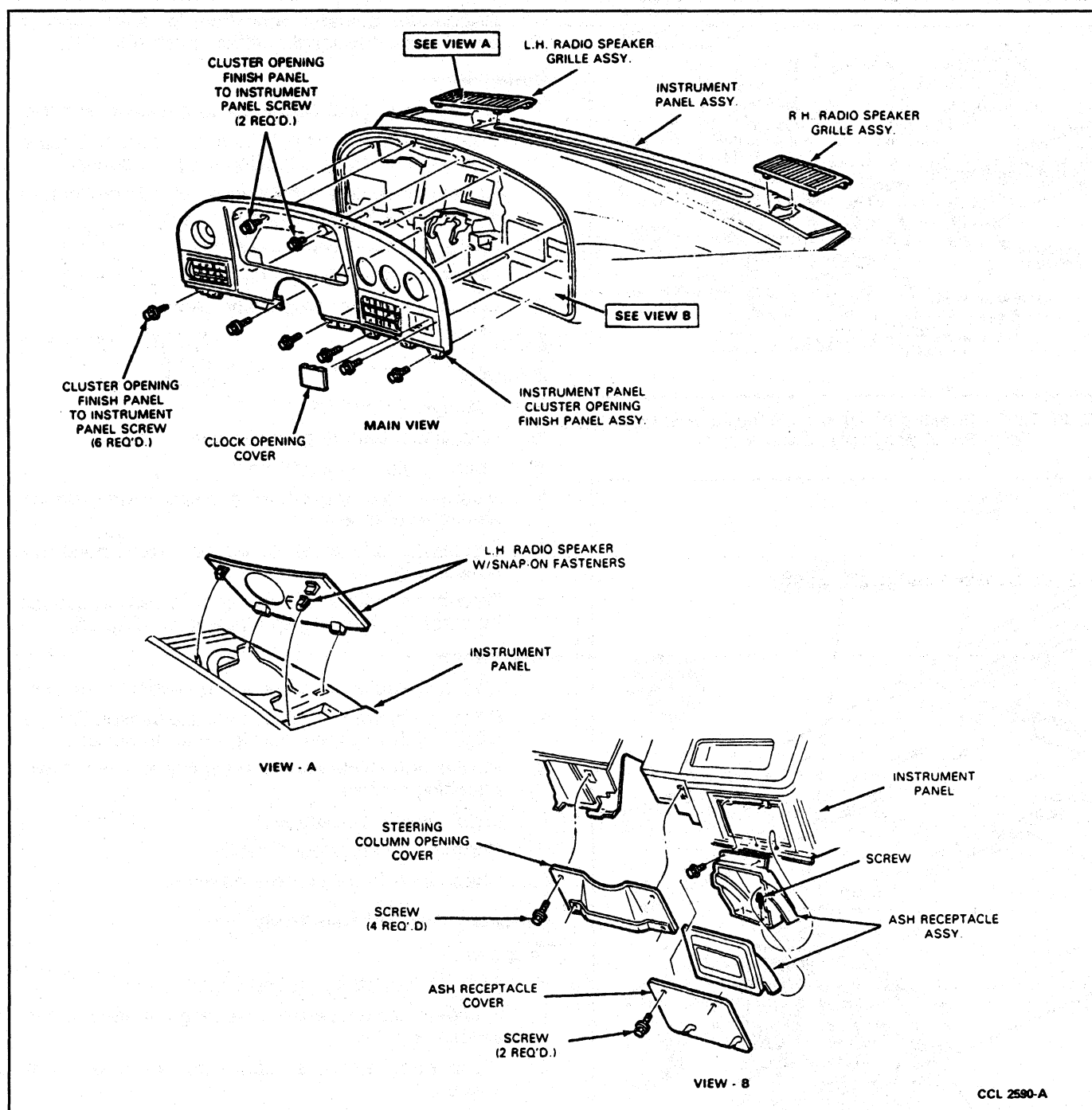
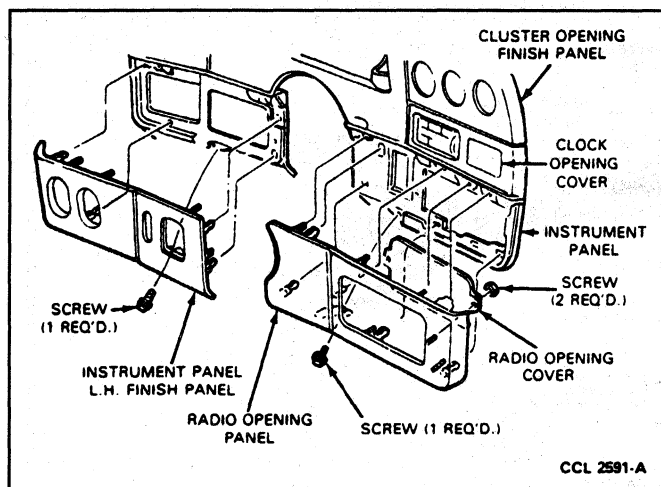
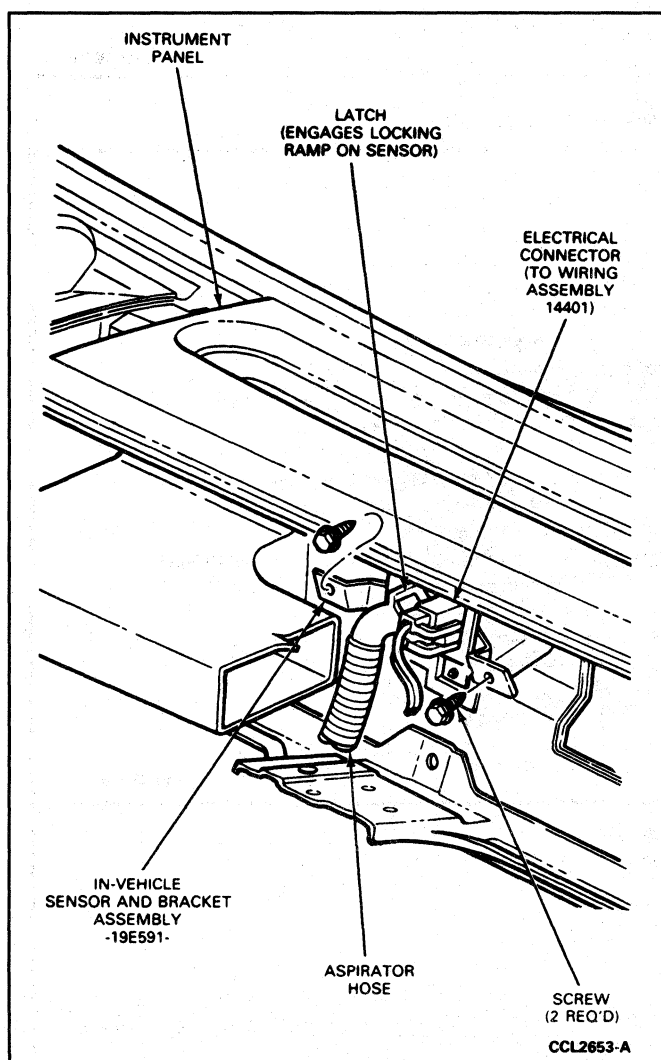


FIG. 20 Instrument Panel Assembly, Disassembled View—Taurus



**FIG. 21 Radio Opening Panel and LH Instrument Panel Finish Panel Assembly—Taurus**



**FIG. 22 In-Vehicle Sensor Installation—Taurus**

2. Remove RH finish panel assembly (Fig. 21).
3. Remove two mounting screws from sensor assembly (Fig. 22).
4. Disconnect electrical connector from in-vehicle sensor (Fig. 22).

5. Disconnect aspirator hose from in-vehicle sensor by carefully disengaging elbow latch (Fig. 21).

### Installation

1. Connect electrical connector to in-vehicle sensor.
2. Connect aspirator hose to in-vehicle sensor. Ensure elbow latch engages locking ramp on sensor.
3. Position in-vehicle sensor assembly to bracket and install two attaching screws.
4. Install RH finish panel assembly.
5. Connect battery ground cable.
6. Check system for proper operation.

### Sable

### Removal

Refer to Figs. 23 and 24.

1. Disconnect battery ground cable.
2. Remove glove compartment.
3. Remove two mounting screws from sensor assembly (Fig. 25).
4. Disconnect electrical connector from in-vehicle sensor (Fig. 25).
5. Disconnect aspirator hose from in-vehicle sensor by carefully disengaging elbow latch (Fig. 25).

### Installation

1. Connect electrical connector to in-vehicle sensor.
2. Connect aspirator hose to in-vehicle sensor. Ensure elbow latch engages locking ramp on sensor.
3. Position in-vehicle sensor assembly and install two attaching screws.
4. Install glove compartment.
5. Connect battery ground cable.
6. Check system for proper operation.

### Ambient Sensor Assembly

### Removal

1. Disconnect battery ground cable.
2. Remove ambient sensor mounting nut and remove sensor (Fig. 26).
3. Disconnect electrical connector from ambient sensor.

### Installation

1. Connect electrical connector to ambient sensor.
2. Position ambient sensor and install mounting nut. Tighten to 6.2-7.3 N·m (55-65 lb-in).
3. Connect battery ground cable.
4. Check system for proper operation.

### Blower Motor Controller

### Removal

Refer to Figs. 27 and 28.

1. Disengage glove compartment door stops and allow door to hang by hinge.
2. Working through glove compartment opening, disconnect electrical snap-lock connector and aspirator hose at blower motor controller. Also,

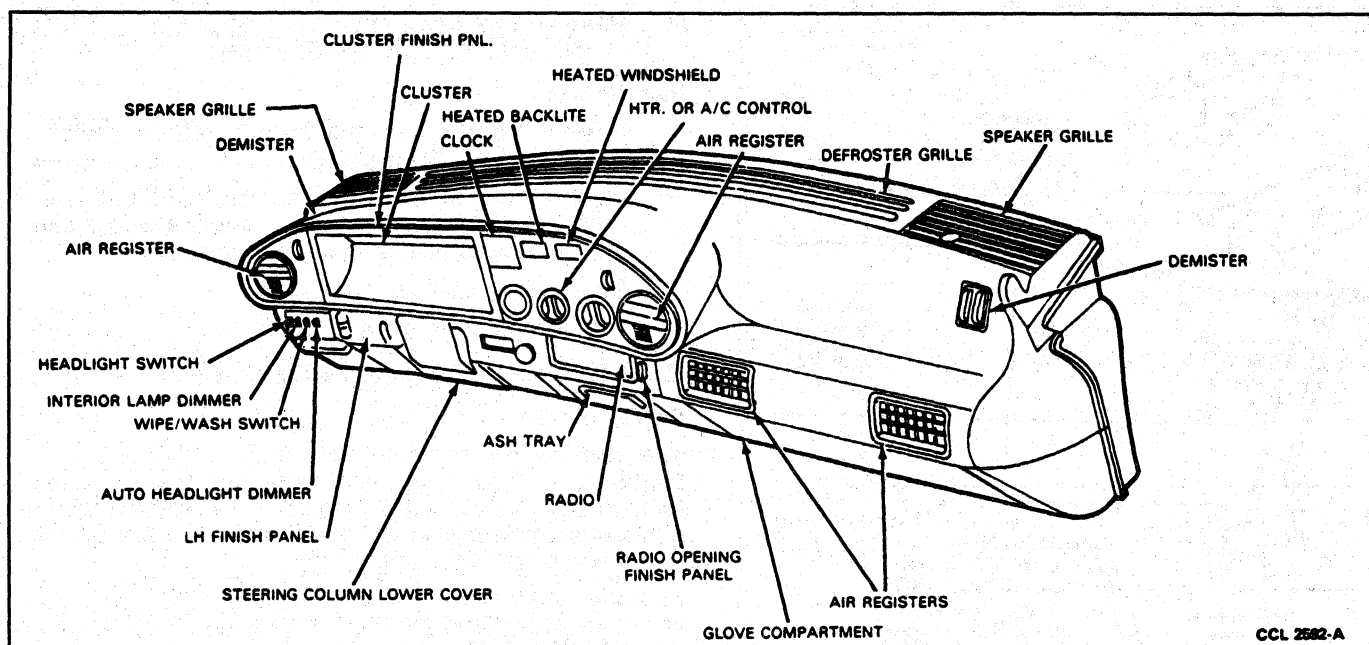


FIG. 23 Instrument Panel Assembly, Front View—Sable

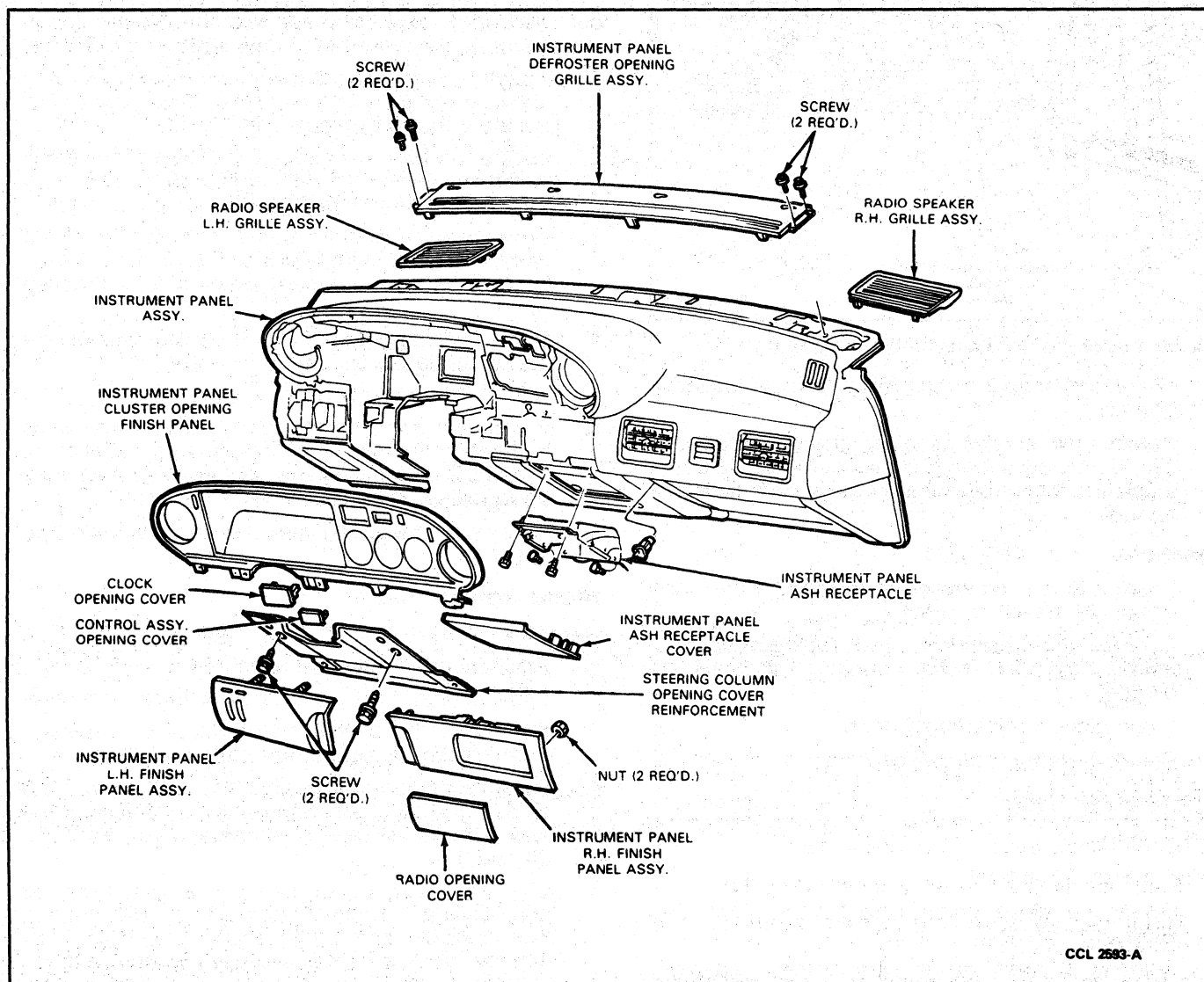
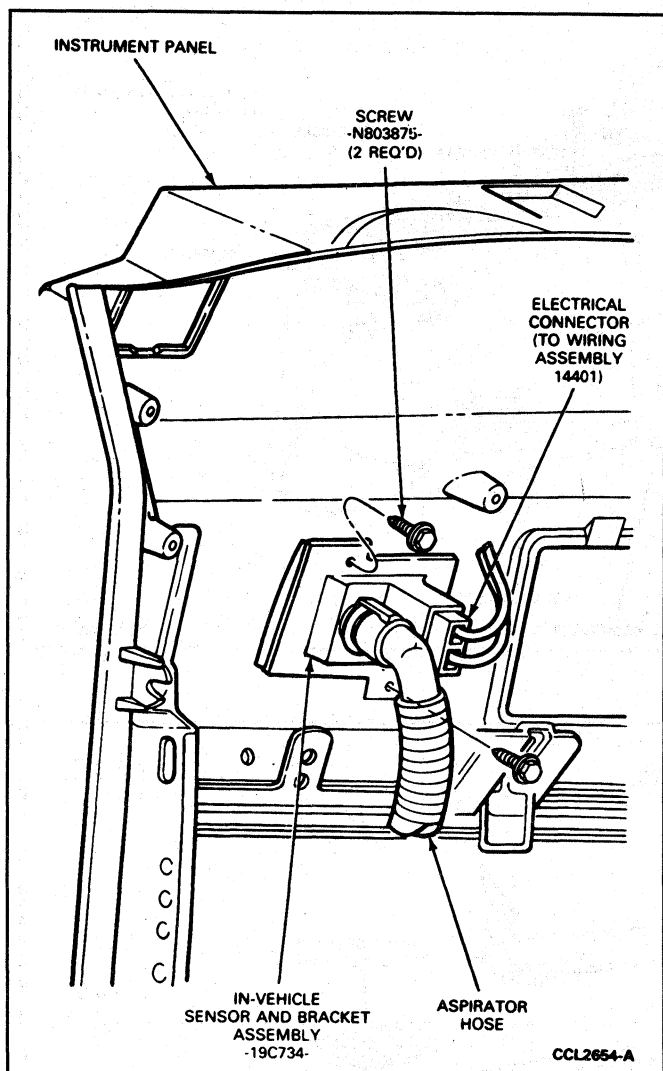


FIG. 24 Instrument Panel Assembly, Disassembled View—Sable



**FIG. 25 In-Vehicle Sensor Installation—Sable**

disconnect snap-lock connector from its mounting bracket.

3. Remove two screws attaching blower controller to evaporator case and remove controller. Do not touch fins of controller until it has had sufficient time to cool.

#### Installation

1. Position blower controller on evaporator case and install two attaching screws.
2. Connect wire connector and aspirator hose to blower controller. Install connector on mounting bracket.
3. Close glove compartment door.
4. Check system for proper operation.

#### High-Blower Relay

##### Removal

Refer to Figs. 27 and 28.

1. Disengage glove compartment door stops and allow door to hang by hinge.
2. Working through glove compartment opening, disconnect two electrical snap-lock connectors and remove from mounting bracket.

3. Remove two screws attaching high-blower relay to evaporator case and remove relay.

#### Installation

1. Position high-blower relay on evaporator case and install two attaching screws.
2. Connect two electrical connectors (one to blower controller and one to 14401 harness assembly). Install connectors on mounting bracket.
3. Close glove compartment door.
4. Check system for proper operation.

#### Cold Engine Lock Out Switch (CELO)

##### Replacement

The cold engine lock out switch ends at the outermost heater core tube where it is attached with a spring tension clip. The two leads to the clip start in the wire and connector assembly which feeds into the electronically controlled blend door actuator.

Between the points where the CELO wires leave the wiring assembly and attach to the spring clip, they pass through retaining loops moulded into the upper surface of the actuator.

If it should be necessary to service the cold engine lock out switch, it can be done without removing the instrument panel or the blend door actuator as follows:

1. Reach upward behind instrument panel to a point above and slightly to the right of accelerator pedal. Locate outermost heater core tube.
  2. Locate two wires at base of CELO switch and firmly pull them downward until spring clip is released from heater core tube (Fig. 29).
  3. Cut both white (circuit 57) and yellow/white (circuit 244) wires at a point 80-120mm (3-5 inches) from base of switch and discard switch and its attached wires.
  4. Using a crimping type of wire connector, attach new service replacement switch to wires.
- NOTE: Wire polarity is not critical.
5. Grasp new switch by its base and snap it into place on heater core tube. If, in the course of installation, the CELO switch attaches so that it is on its side, performance will not be affected.
  6. Route wires through guide on evaporator case (Fig. 29).

#### Blend Door Actuator

##### Removal

1. Disconnect battery ground cable.
2. Loosen instrument panel and pull back from cowl.
3. Remove blend door actuator electrical connector from bracket on evaporator case (Fig. 28).
4. Remove three actuator attaching screws and the cold engine lock out switch which is attached by a spring clip to the outermost heater core tube (Figs. 30 and 31).
5. Lift actuator vertically for a distance of approximately 12mm (1/2-inch) to disengage it from bracket and blend door shaft; then, pull actuator back toward passenger compartment.

NOTE: The mounting bracket remains in place on the evaporator case.

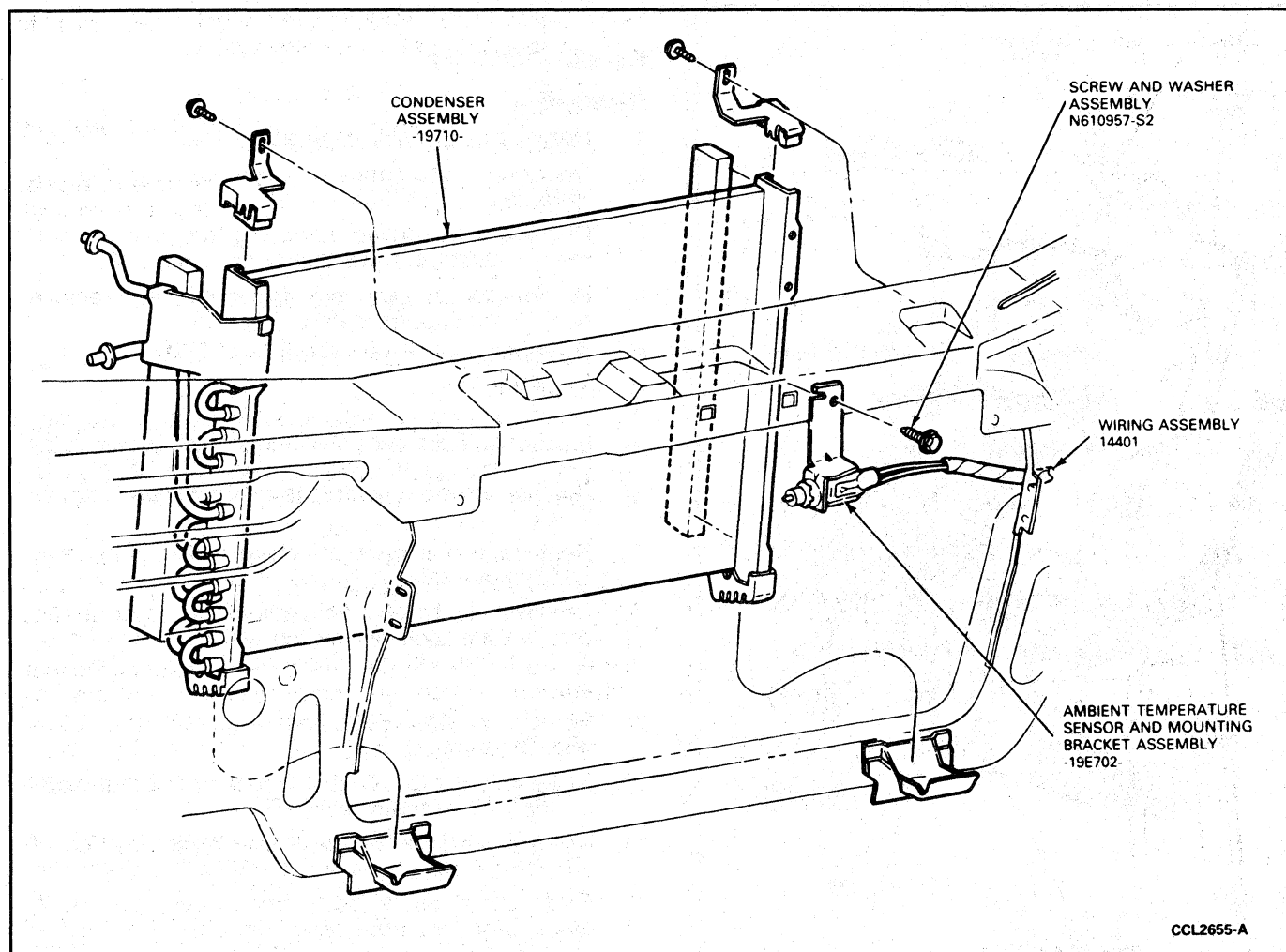


FIG. 26 Ambient Sensor Assembly

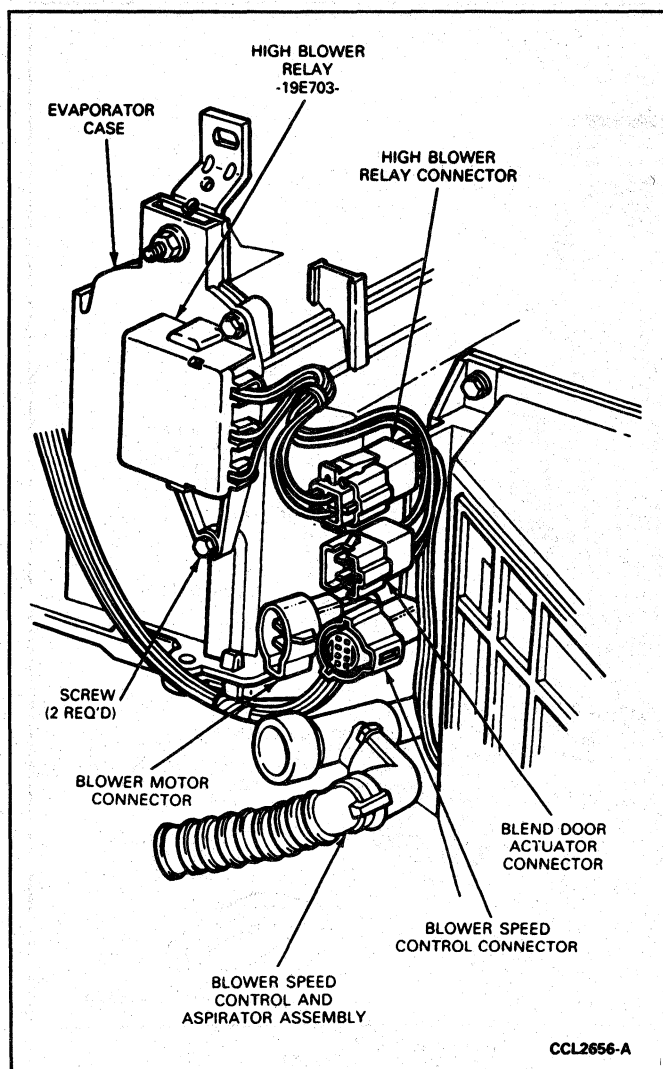
**Installation**

1. Insert blend door actuator horizontally over actuator bracket on evaporator case.
2. Insert actuator shaft into blend door. (Manually moving door will help engage shaft.)
3. Attach actuator bracket with three attaching screws.
4. Attach actuator electrical connector to bracket on evaporator case.
5. Install instrument panel.
6. Connect battery ground cable.

NOTE: After replacement of the blend door actuator, the system **MUST BE RECALIBRATED** for proper operation. To recalibrate, remove the positive (+) lead from the battery terminal. After 30 seconds, install the terminal. Calibration will be performed automatically when the EATC control assembly is energized.

**Evaporator Case Assembly****Removal**

1. Disconnect battery ground cable.
2. Drain coolant from radiator into a clean container.
3. Discharge refrigerant from A/C system. Observe all safety precautions. Refer to Section 36-32.
4. Disconnect heater hoses from heater core. Plug heater core tubes, or blow any coolant from heater core with low-pressure air.
5. Disconnect vacuum supply hose from in-line vacuum check valve in engine compartment.
6. Disconnect liquid line and accumulator from evaporator core at dash panel. Cap refrigerant lines and evaporator core to prevent entrance of dirt and moisture.
7. Remove instrument panel as outlined, and place it on front seat.
8. Remove screw holding instrument panel shake brace to evaporator case and remove instrument panel shake brace.
9. Remove two screws attaching floor register (or rear seat adapter) to bottom of evaporator case (Fig. 31, View B).
10. Remove three nuts attaching evaporator case to dash panel in engine compartment (Fig. 31, Main View).
11. Remove two screws attaching support brackets to cowl top panel (Fig. 31, View A).
12. Carefully pull evaporator assembly away from dash panel and remove evaporator from vehicle.



**FIG. 27 Blower Motor Speed Controller and High Blower Relay**

#### Installation

1. Position evaporator case assembly to dash panel and cowl top panel at air inlet opening. Install two screws to attach support brackets to cowl top panel.
2. Install three nuts in engine compartment to attach evaporator case to dash panel.
3. Install floor register (or rear seat adapter) to evaporator case and tighten two attaching screws.
4. Install instrument panel shake brace and screw to evaporator case.
5. Install instrument panel as outlined.
6. Connect liquid line and suction accumulator to evaporator core.
7. Connect heater hoses to heater core.
8. Connect black vacuum supply hose to vacuum check valve in engine compartment.
9. Fill radiator to correct level with removed coolant or specified mixture of coolant and water.
10. Connect battery ground cable.
11. Leak test, evacuate and charge A/C refrigerant system. Refer to Section 36-32.

12. Check system for proper operation.

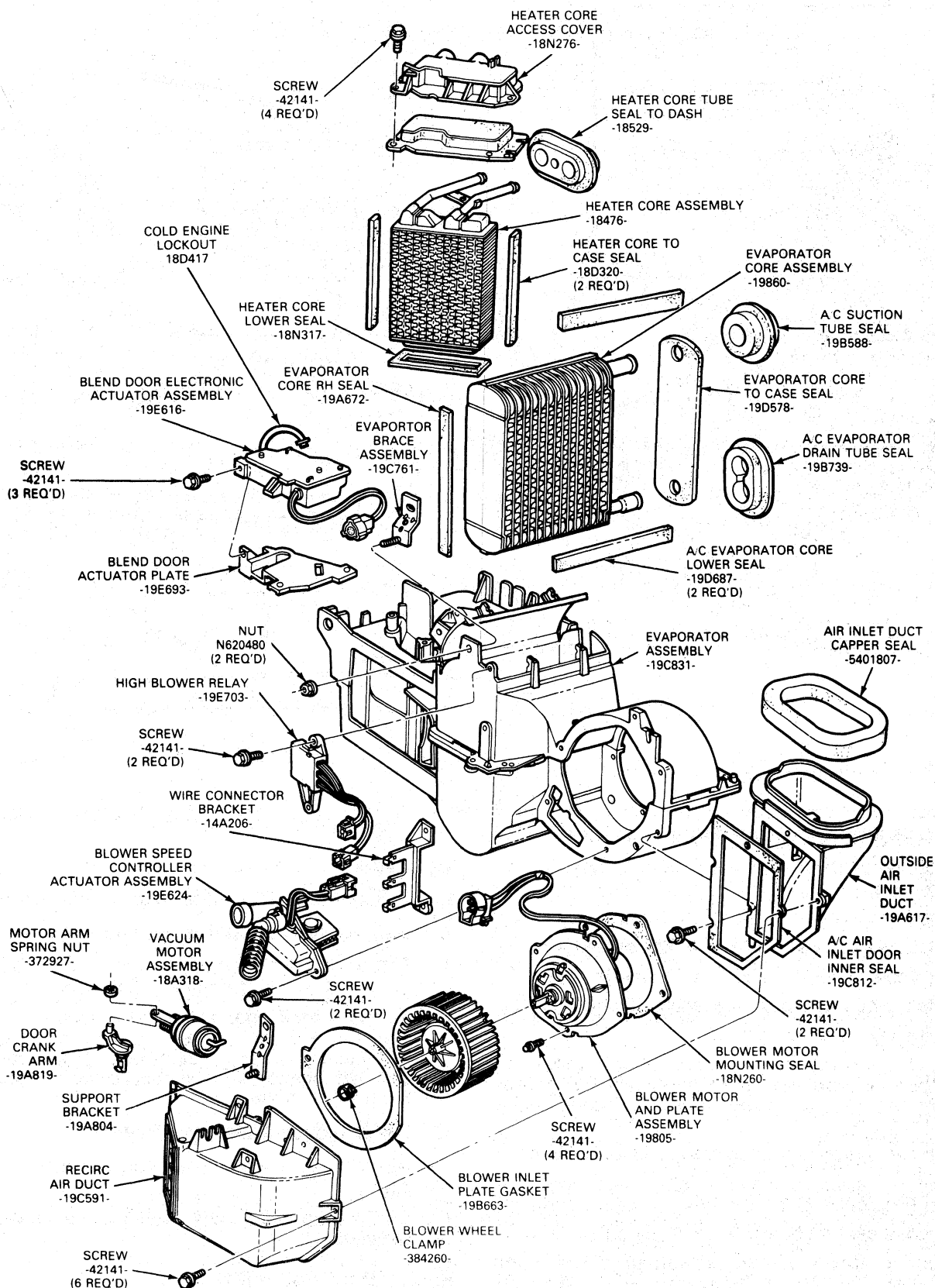
### Evaporator Core

#### Removal

1. Remove evaporator case as outlined.
2. Disconnect and remove vacuum harness (Fig. 31, View A).
3. Remove six screws attaching recirc duct and remove duct from evaporator case (Fig. 32).
4. Remove two screws from air inlet duct and remove duct from evaporator case (Fig. 33).
5. Remove support bracket from evaporator case (Fig. 31, View A).
6. Remove screws holding electrical connector bracket to recirc duct. Disconnect high-blower relay lead from speed control connector (Fig. 34). Release three connectors from bracket and remove bracket.
7. Remove two screws attaching high-blower relay and remove relay (Fig. 35).
8. Remove blend door actuator (three screws) and cold engine lock out switch which is held on by spring tension at outermost heater core tube (Fig. 36).
9. Remove moulded seals from evaporator core tubes (Fig. 31, View A).
10. Drill a 4.75mm (3/16-inch) hole in both upright tabs on top of evaporator case (Fig. 37).
11. Using a hot knife or small saw blade, cut top of evaporator case between raised outline (Fig. 38).
12. Fold cutout cover back from opening and lift evaporator core from case (Fig. 39).

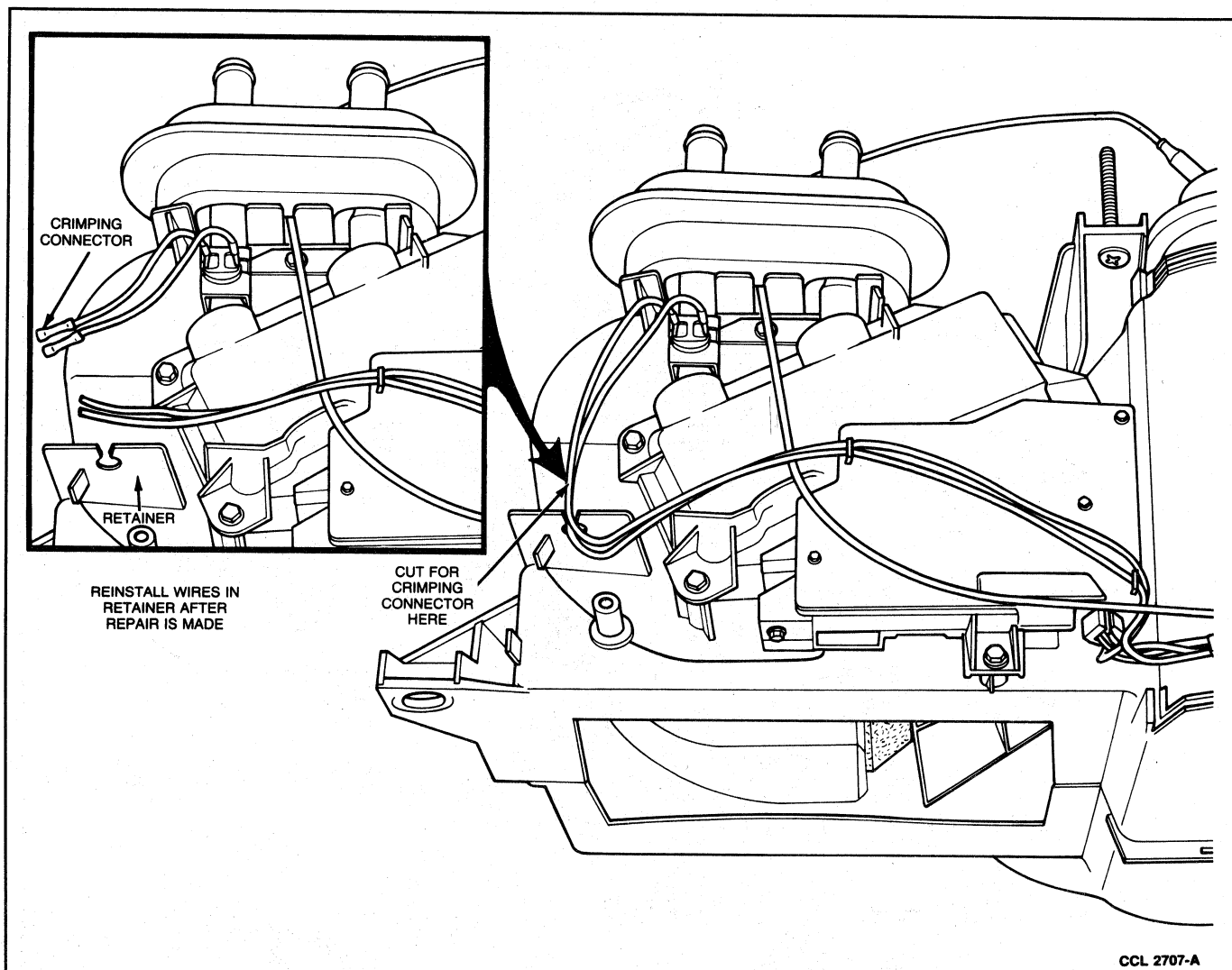
#### Installation

1. Transfer four foam core seals to new evaporator core.
2. Position evaporator core in case and close cutout cover.
3. Install a spring nut on each of two upright tabs with two holes drilled in front flange. Ensure hole in spring nut is aligned with 4.75mm (3/16-inch) holes drilled in tab and flange. Install and tighten screw in each spring nut (through hole in tab or flange) to secure cutout cover in closed position (Fig. 40).
4. Install Caulking Cord D9AZ-19560-A or equivalent to seal evaporator case against leakage along cut line (Fig. 41).
5. Install air inlet duct to evaporator case and tighten two screws.
6. Install recirc duct to evaporator case and tighten six screws.
7. Install electrical connector bracket to recirc duct with one screw.
8. Install speed controller connector to bracket.
9. Attach high-blower relay to evaporator case and tighten two screws. Connect one lead to speed controller connector and install other lead onto bracket (Fig. 35).
10. Attach blend door actuator to evaporator case and tighten three screws. Install electrical connector to bracket. Attach cold engine lock out switch by



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FIG. 28 EATC Evaporator Assembly—Disassembled View



**FIG. 29 Cold Engine Lock Out Switch Replacement**

snapping spring clip in place on outermost heater core tube.

11. Install vacuum harness to evaporator case.
12. Install foam seals over evaporator tubes.
13. Assemble support bracket to evaporator case.
14. Install evaporator case assembly as outlined.

## Heater Core

### Removal

1. Remove instrument panel as outlined, and place it on front seat.
2. Remove evaporator case assembly as outlined.
3. Remove vacuum source line from heater core tube seal (Fig. 42).
4. Remove seal from heater core tubes (Fig. 31).
5. Remove three screws attaching blend door actuator (Fig. 10) to evaporator case. Remove actuator and cold engine lock out switch (held on by spring tension) from case (Fig. 31).
6. Remove four heater core access cover attaching screws, and remove access cover and seal from evaporator case (Fig. 43).
7. Lift heater core and seals from evaporator case.

### Installation

1. Transfer three foam core seals to new heater core.
2. Install heater core and secure into evaporator case.
3. Position heater core access cover on evaporator case and install four attaching screws.
4. Position blend door actuator to blend door shaft. Install three screws attaching blend door actuator to evaporator case. Attach cold engine lock out switch by snapping spring clip in place on outermost heater core tube.
5. Install seal on heater core tubes.
6. Install vacuum source line through heater core tube seal.
7. Install evaporator case assembly into vehicle as outlined.

## Recirc Duct Assembly

### Removal

1. Open glove compartment and release retainers and lower door.
2. Remove screw attaching recirc duct (Fig. 32) support bracket to cowl (Fig. 31).



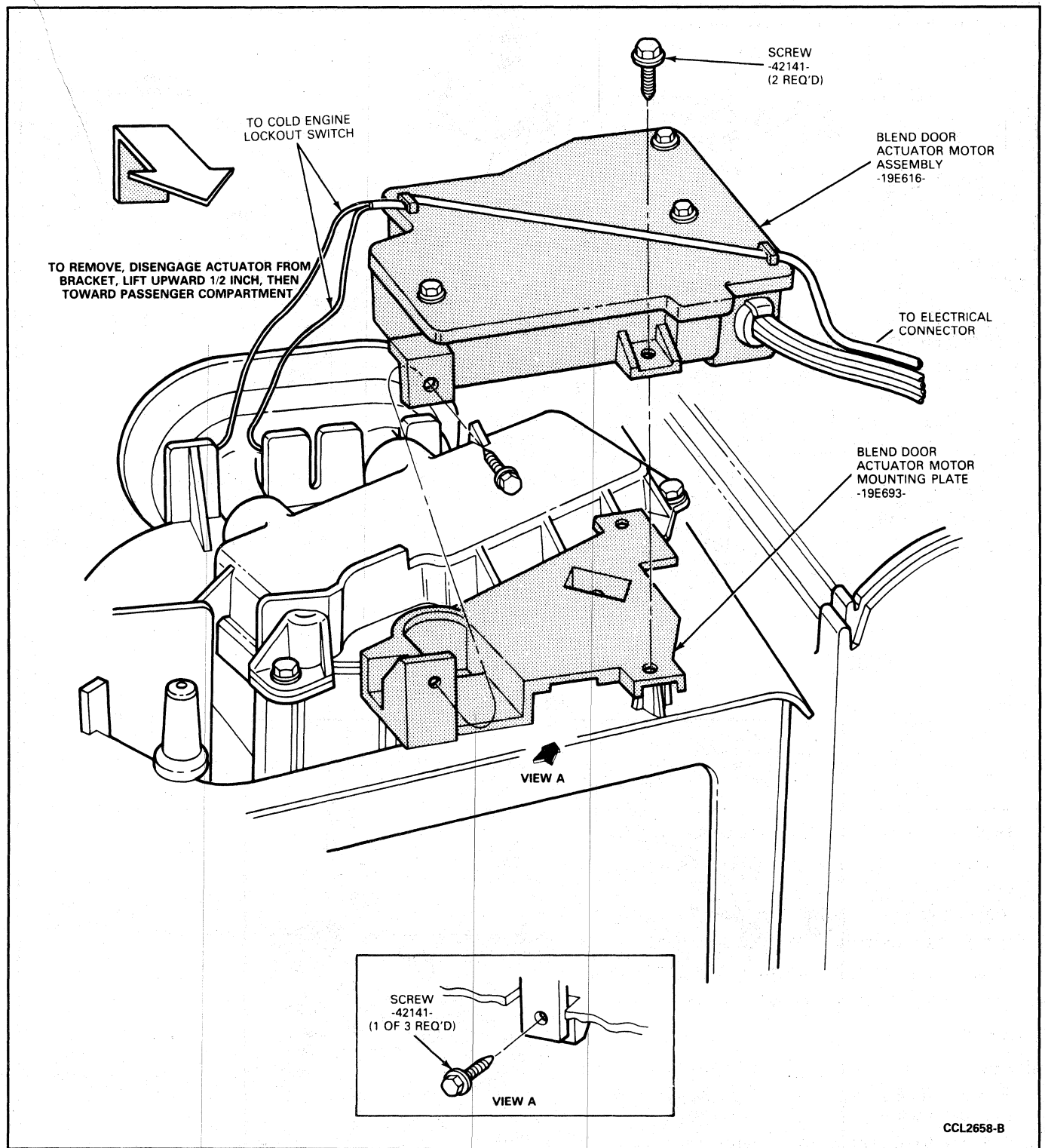


FIG. 30 Electric Blend Door Actuator Attachments

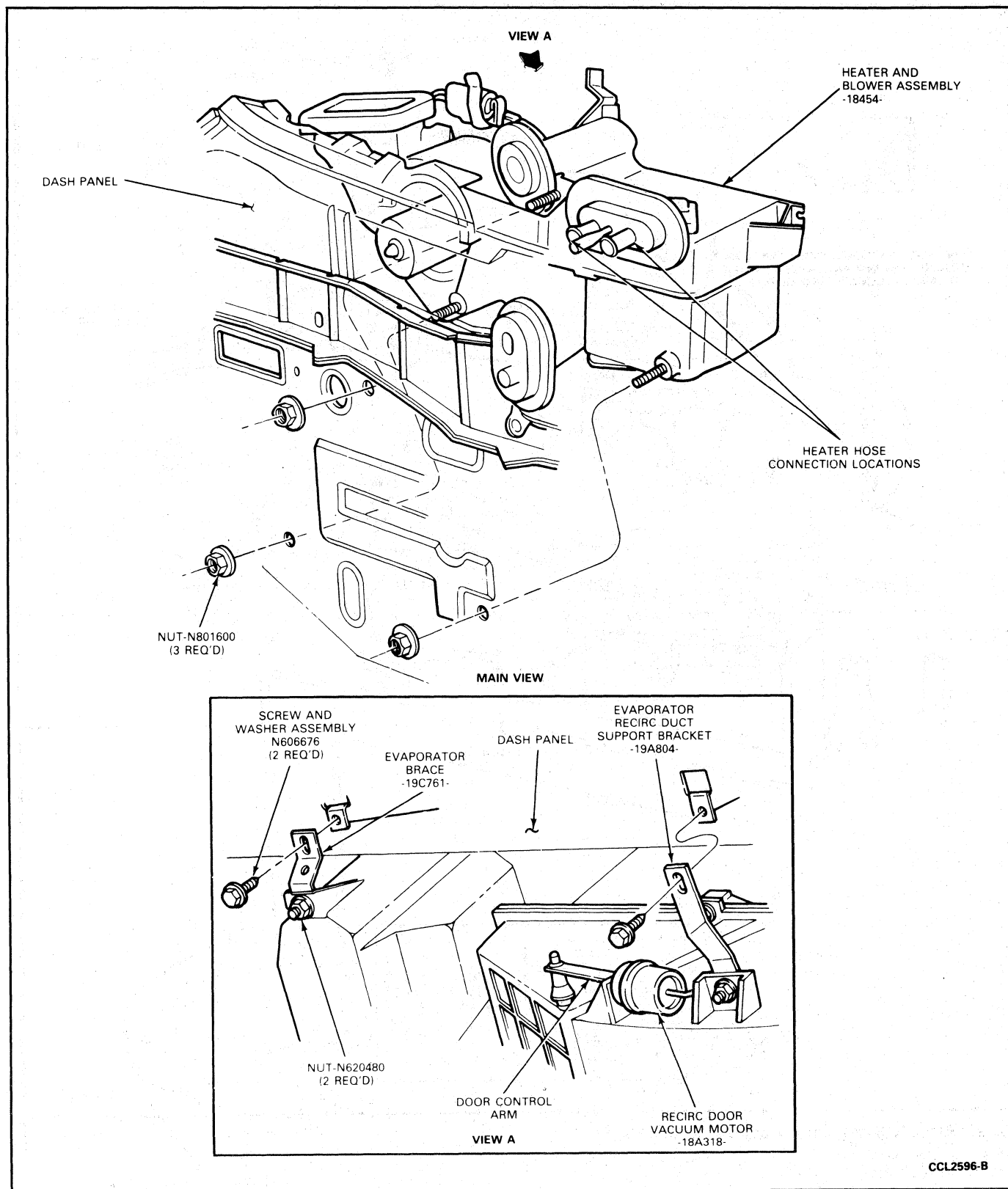


FIG. 31 Heater and A/C Evaporator Installation

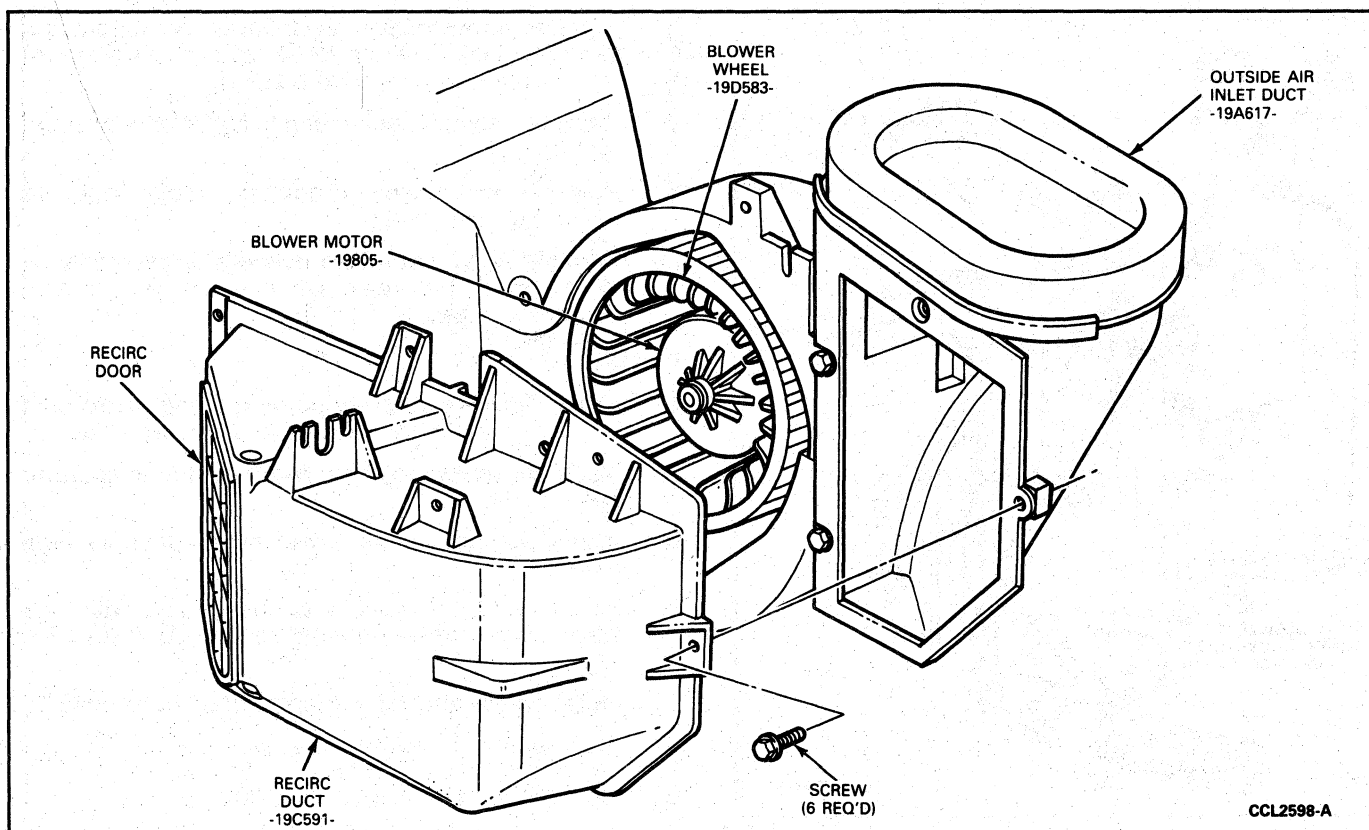


FIG. 32 Recirc Duct Removal from Evaporator Case

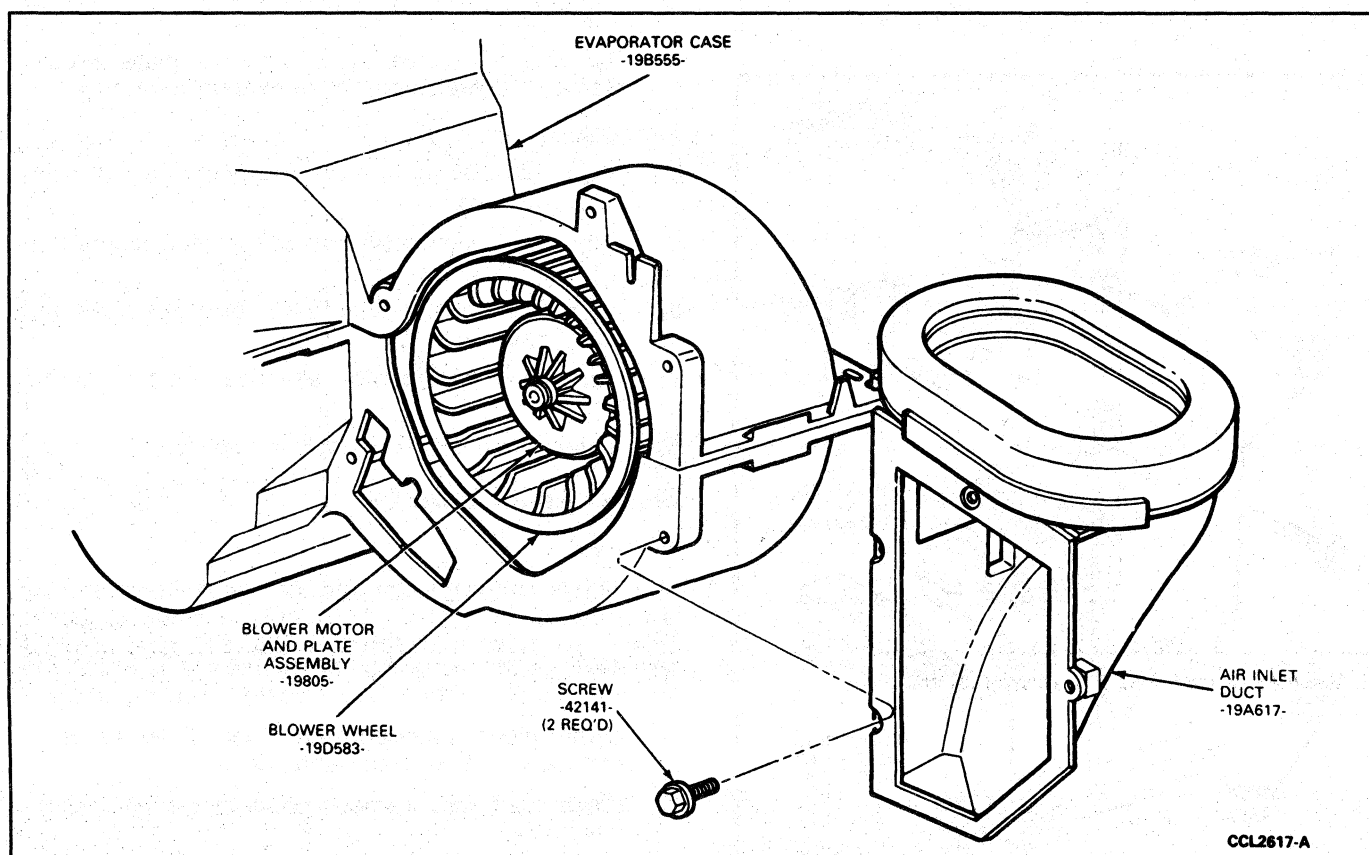
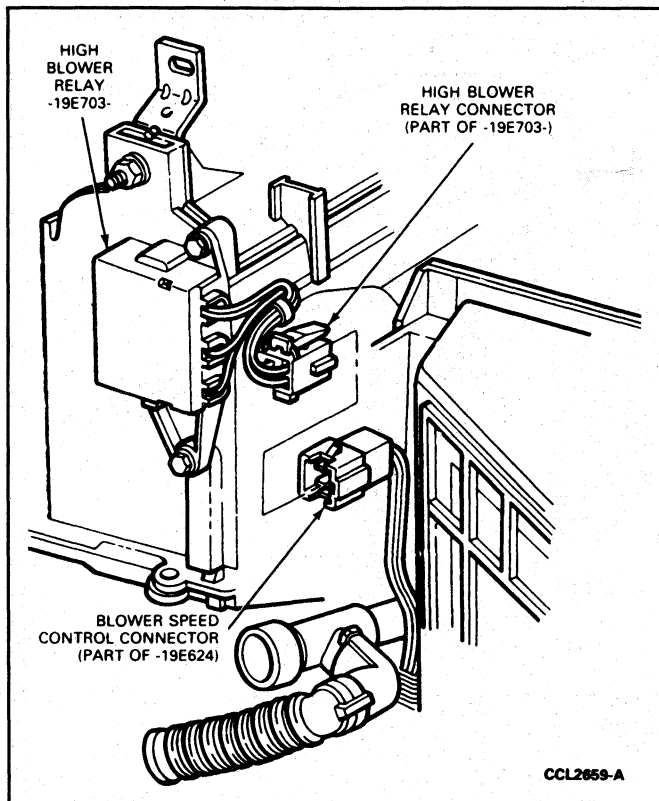
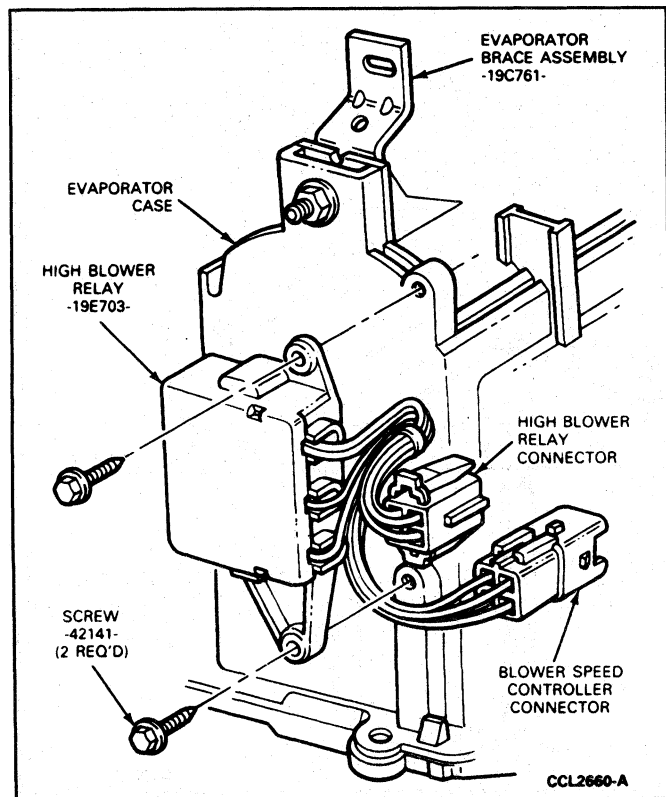


FIG. 33 Air Inlet Duct Removal from Evaporator Case



**FIG. 34 High-Blower Relay Lead Disconnection from Speed Control Connector**



**FIG. 35 High-Blower Relay Removal**

3. Remove screw holding electrical connector bracket to recirc duct. Release three connectors (Fig. 44) from bracket and remove bracket.
4. Remove vacuum connection to recirc door vacuum motor.
5. Remove six screws attaching recirc duct to evaporator assembly.
6. Remove recirc duct from evaporator assembly by lowering it between instrument panel and evaporator case.

#### Installation

1. Install recirc duct to evaporator, lifting recirc duct between instrument panel and evaporator case.
2. Install six screws to retain recirc duct to evaporator case.
3. Install vacuum connector to recirc door vacuum motor.
4. Install electrical bracket to recirc duct with one screw. Snap three connectors onto bracket (Fig. 44).
5. Install screw attaching support bracket to cowl.
6. Close glove compartment door.

#### Blower Motor and Wheel Assembly

##### Removal

1. Remove recirc duct assembly as outlined.
2. Disconnect blower electrical lead.
3. Remove blower wheel clip and blower wheel (Fig. 45).
4. Remove four blower motor mounting plate screws. Remove blower motor from evaporator case.

##### Installation

1. Assemble blower motor electrical lead through evaporator case.
2. Position blower motor into evaporator. Install four attaching screws.
3. Assemble blower wheel to blower motor shaft and install retaining clip.
4. Connect blower motor electrical lead to wiring harness.
5. Install recirc duct assembly in vehicle.

#### Blower Motor Resistor

##### Removal

The blower motor resistor and thermal limiter assembly is installed on the passenger side of the evaporator case behind the glove compartment (Fig. 46). Use only the specified resistor assembly for service replacement. Do not apply sealer to the resistor board mounting surface.

1. Open glove compartment door. Release door retainers so that door hangs down.
2. Disconnect wire harness connector from resistor assembly.
3. Remove two resistor attaching screws and remove resistor from evaporator case.

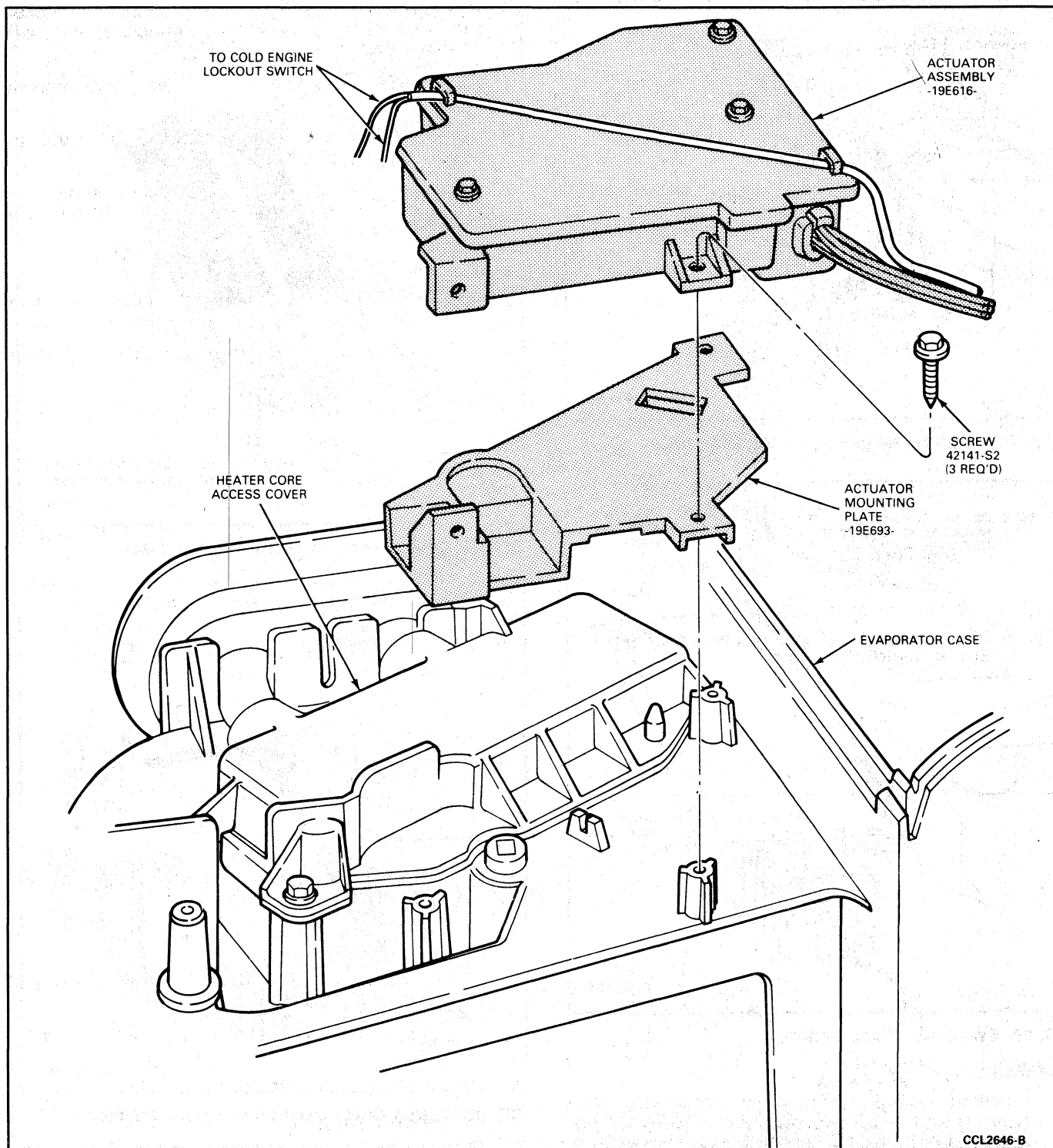


FIG. 36 Blend Door Actuator

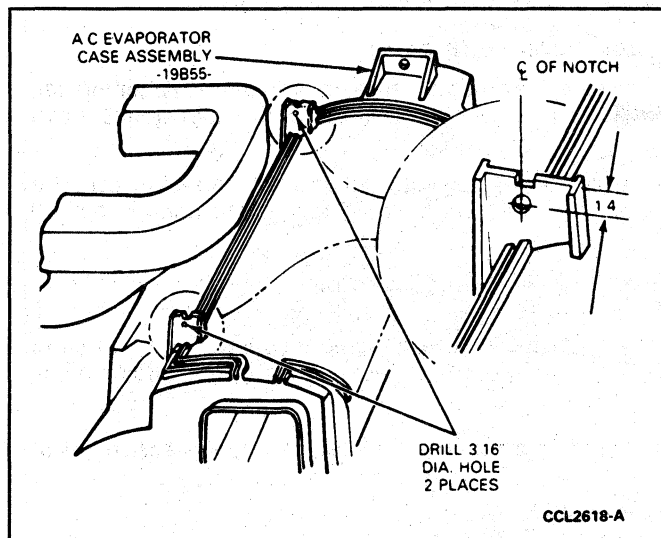


FIG. 37 Drilling Holes in Evaporator Case Tabs

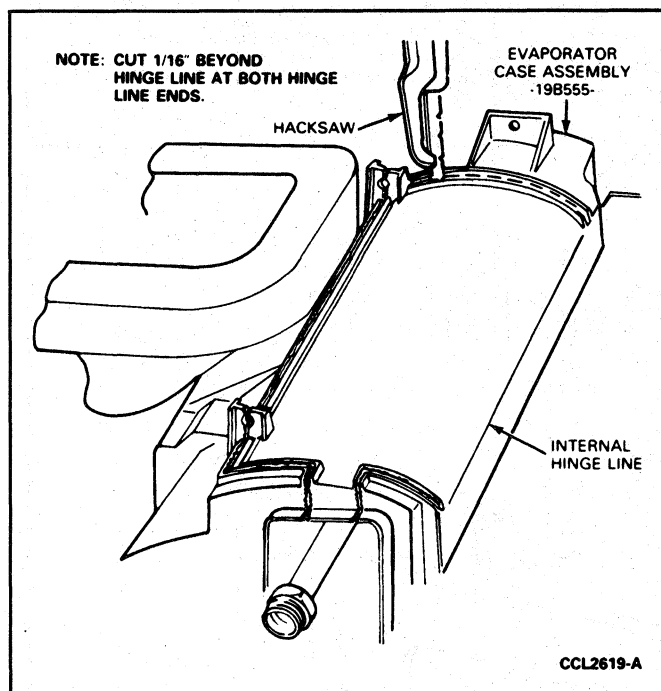


FIG. 38 Evaporator Case Cutting

### Installation

1. Position resistor assembly in evaporator case opening and install two attaching screws. Do not apply sealer to resistor assembly mounting surface.
2. Connect wire harness connector to resistor.
3. Check operation of blower motor.
4. Connect glove compartment door retainers and close glove compartment door.

### Outside-Recirc Door Vacuum Motor

#### Removal

1. Lower glove compartment door to provide access to recirc duct assembly.
2. Disconnect vacuum hose from end of vacuum motor.

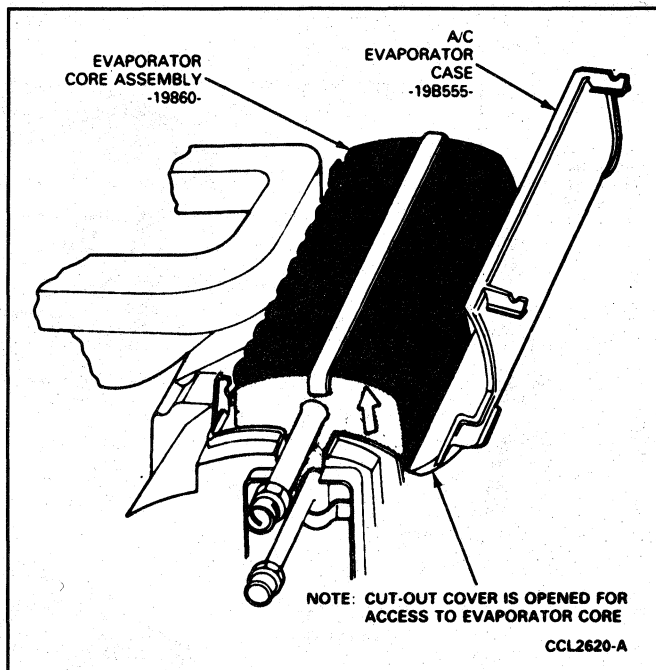


FIG. 39 Evaporator Core Removal from Case

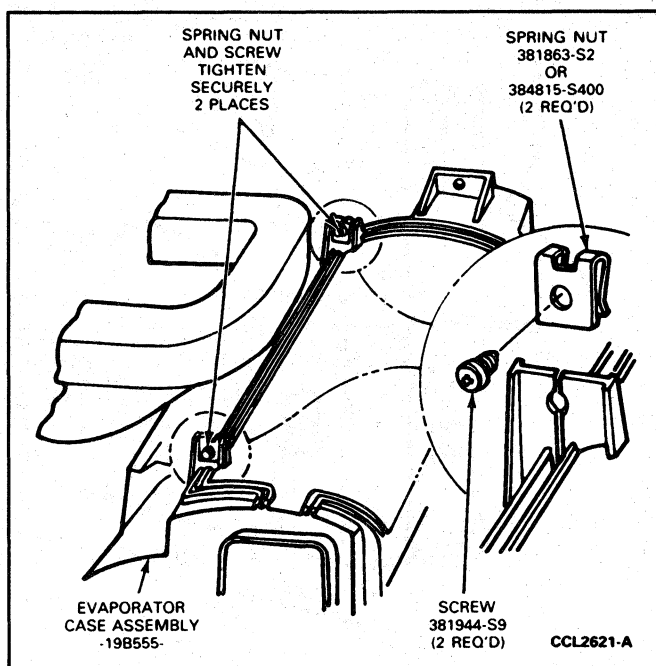


FIG. 40 Cutout Cover Secured in Closed Position

3. Remove motor arm retainer from the door crank arm (Fig. 47).
4. Remove two nuts retaining vacuum motor to recirc duct and remove motor.

#### Installation

1. Position vacuum motor to outside-recirc door crank arm, position motor to recirc duct and install two retaining nuts.
2. Install retainer on door crank arm.
3. Connect white vacuum hose to vacuum motor and check operation of vacuum motor.
4. Close glove compartment door.

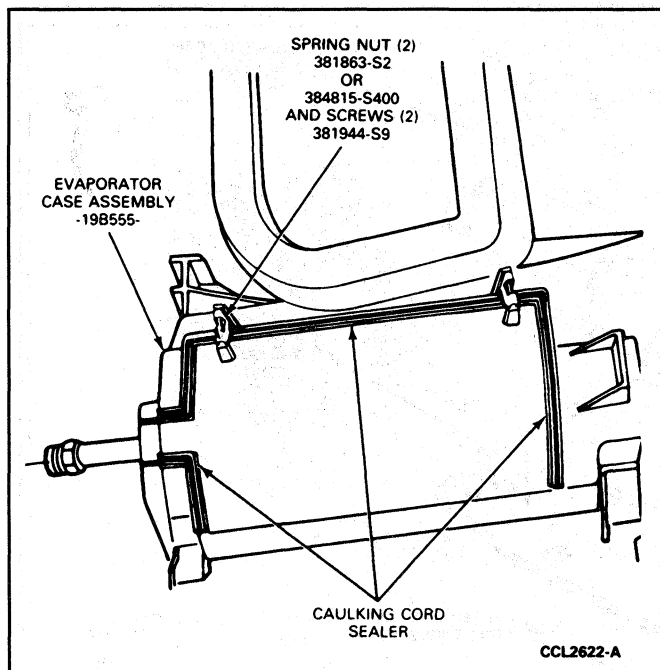


FIG. 41 CaULKING Cord Installation

## Louver Assemblies—Rectangular

### Removal and Installation

1. Insert a flat-blade screwdriver under retaining tab and pry it toward louvers until retaining tab pivot clears hole in register opening (Fig. 48).
2. Pull end of register out from its housing only far enough to prevent pivot from going back into pivot hole.
3. Repeat Steps 1 and 2 for retaining tab on opposite side of louvers. Pull louver assembly from opening.
4. To install louver assembly, push it into register housing opening and engage retaining tab pivots in pivot holes.

## Register Assembly and Housing—Rectangular

### Sable

### Removal and Installation

1. Remove louver assembly (Fig. 48).
2. Depress retaining tabs on upper surface of housing and pull it out of instrument panel opening.
3. To install housing, reverse Steps 1 and 2.

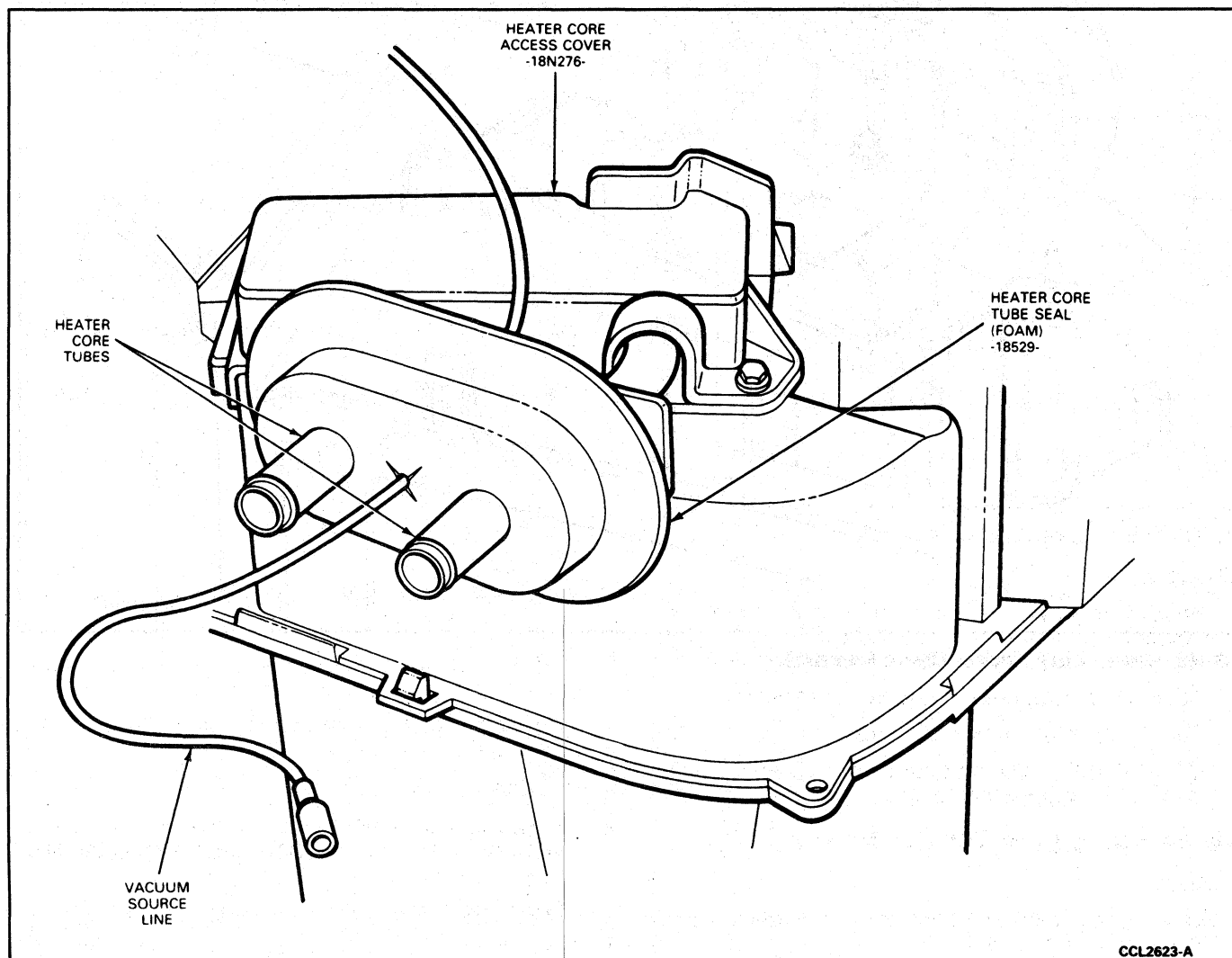
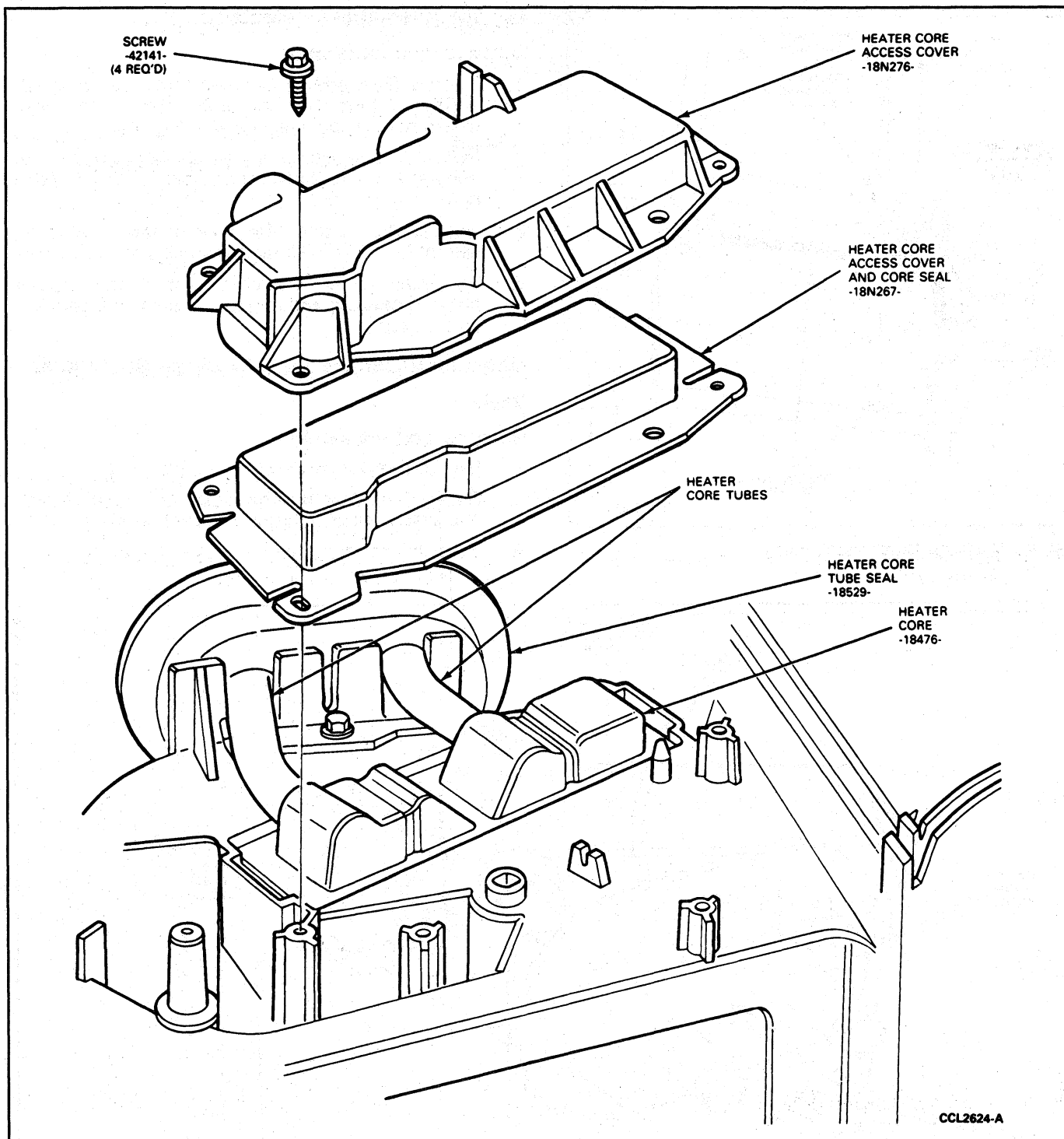
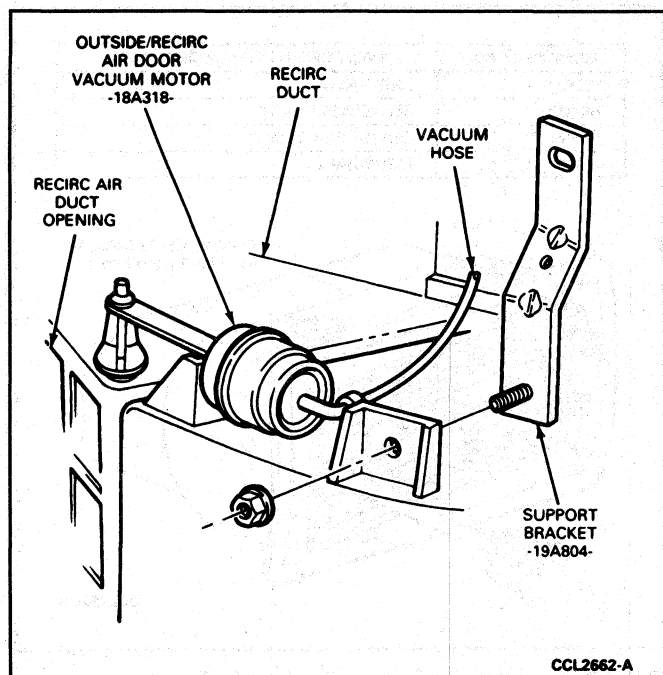


FIG. 42 Vacuum Line From Heater Core Tube Seal

**FIG. 43 Heater Core Access Cover Removal**





**FIG. 44 Electrical Connector Bracket to Recirc Duct Attachment**

## Register Assemblies—Round (RH)

### Sable

#### Removal

1. Remove applique which contains register (Fig. 49).
2. Remove retaining ring from rear of register.
3. Pull register out of opening in applique.

#### Installation

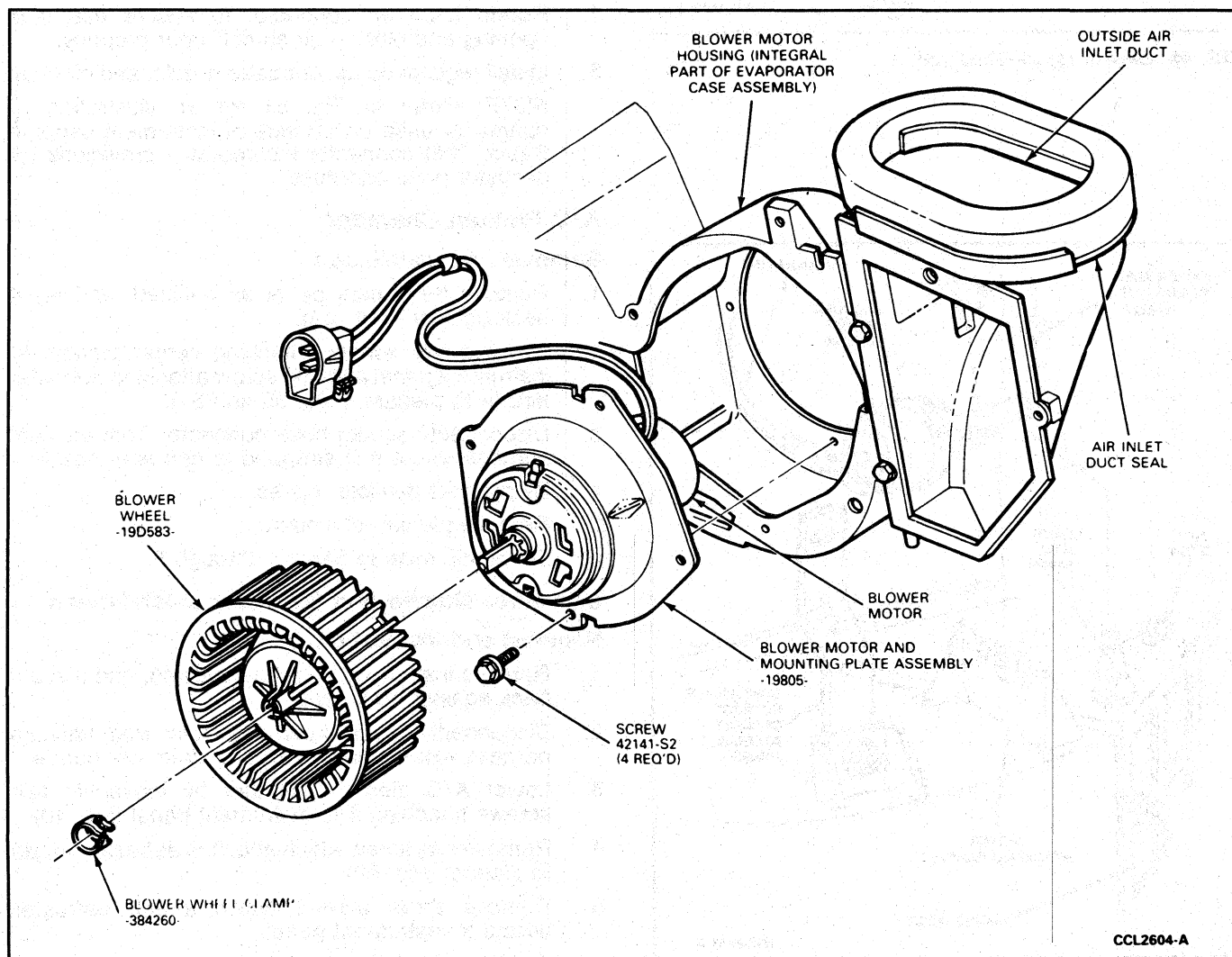
1. Position register assembly in opening.
2. Install retaining ring.
3. Install applique.

## Round Register Connector Assembly (RH)

### Sable

#### Removal and Installation

1. Remove plenum, defroster nozzle, and register ducts, as described previously in this Section.
2. Refer to Figure 49.
3. Remove three screws which attach connector housing to instrument panel.



**FIG. 45 Blower Wheel Clip and Blower Motor Removal**

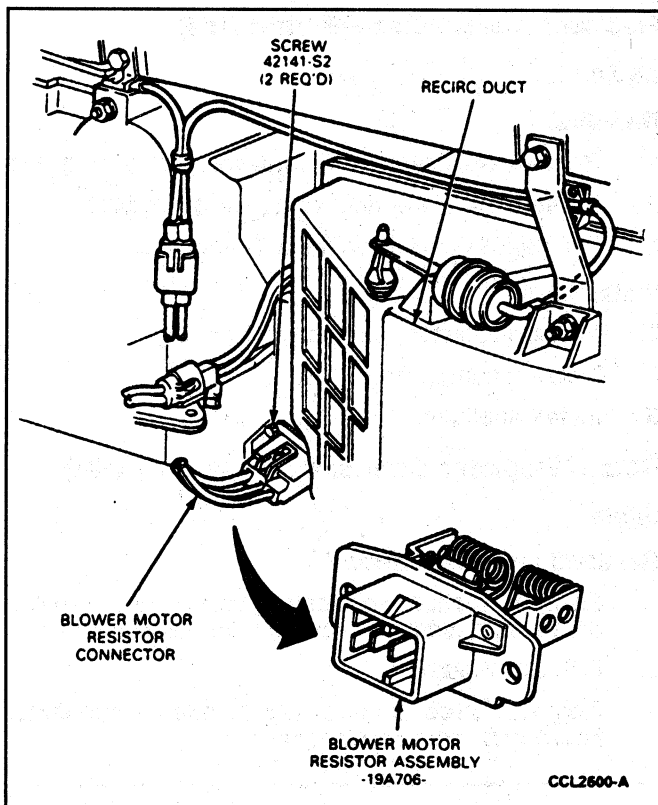


FIG. 46 Blower Motor Resistor

BASIC PART NO.	LOCATION IN INSTRUMENT PANEL
19C696	LEFT-HAND
19C682	CENTER/LEFT-HAND
19C681	CENTER/RIGHT-HAND
19893	RIGHT-HAND

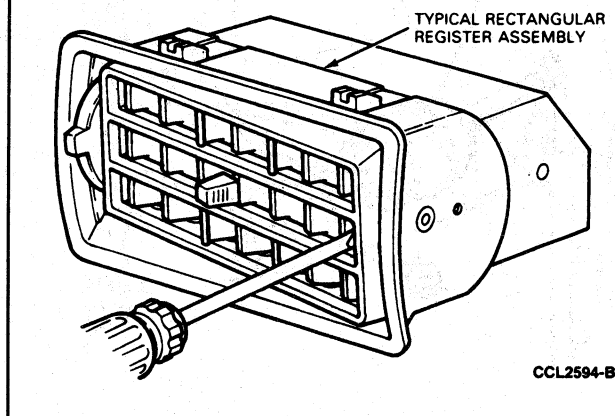


FIG. 48 Rectangular Louver Assembly Removal

- To install housing, position it against instrument panel. Install three attaching screws.
- Rotate knob on connector to ensure that it is opening and closing air shutoff door properly.
- Install register ducts, defroster nozzle, and plenum.

NOTE: Refer to Fig. 51 for an illustration of connector used on LH side of instrument panel in Sable. That connector incorporates provisions for demister hose and duct.

### A/C Plenum Chamber

#### Removal and Installation

- Remove instrument panel as outlined, and lay it back against front seat.
- Remove two screws attaching center plenum to instrument panel and one screw attaching defroster nozzle to plenum (Figs. 50 and 51).
- Disconnect vacuum hose connector from vacuum harness where it is strapped to defroster nozzle.
- Disconnect demister hoses.
- Remove plenum chamber.
- To install, reverse Steps 1 through 5.

### Defroster Nozzle and Demister Duct/Hoses

#### Removal and Installation

- Remove instrument panel as outlined, and place it back against front seat.
- Disconnect vacuum hose connector from vacuum harness where it is strapped to defroster nozzle.
- Lower A/C plenum chamber by loosening two screws attaching it to instrument panel (Fig. 40).
- Remove one screw which attaches defroster nozzle to plenum (Fig. 52).
- Remove three screws which attach defroster nozzle to instrument panel.
- Disconnect LH demister hose from defroster nozzle and both RH hoses from plenum.

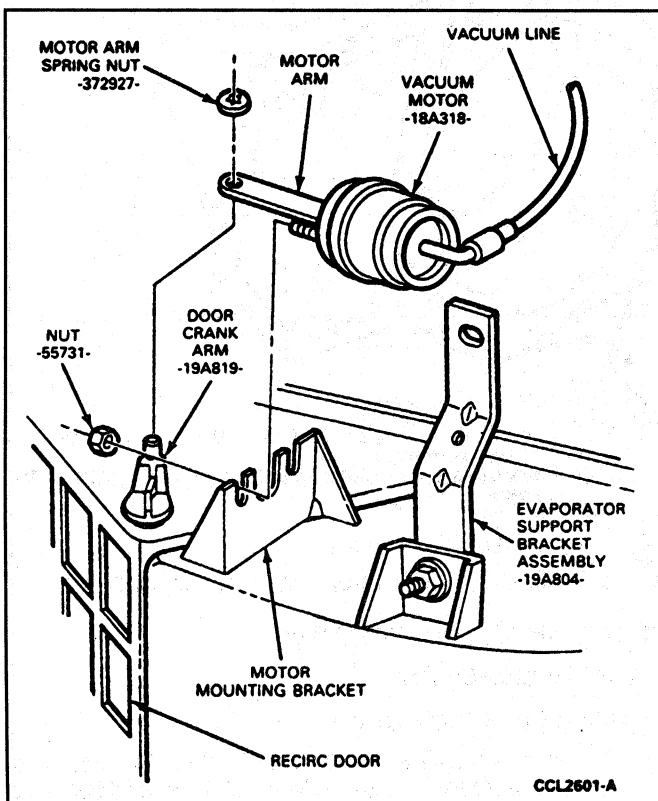
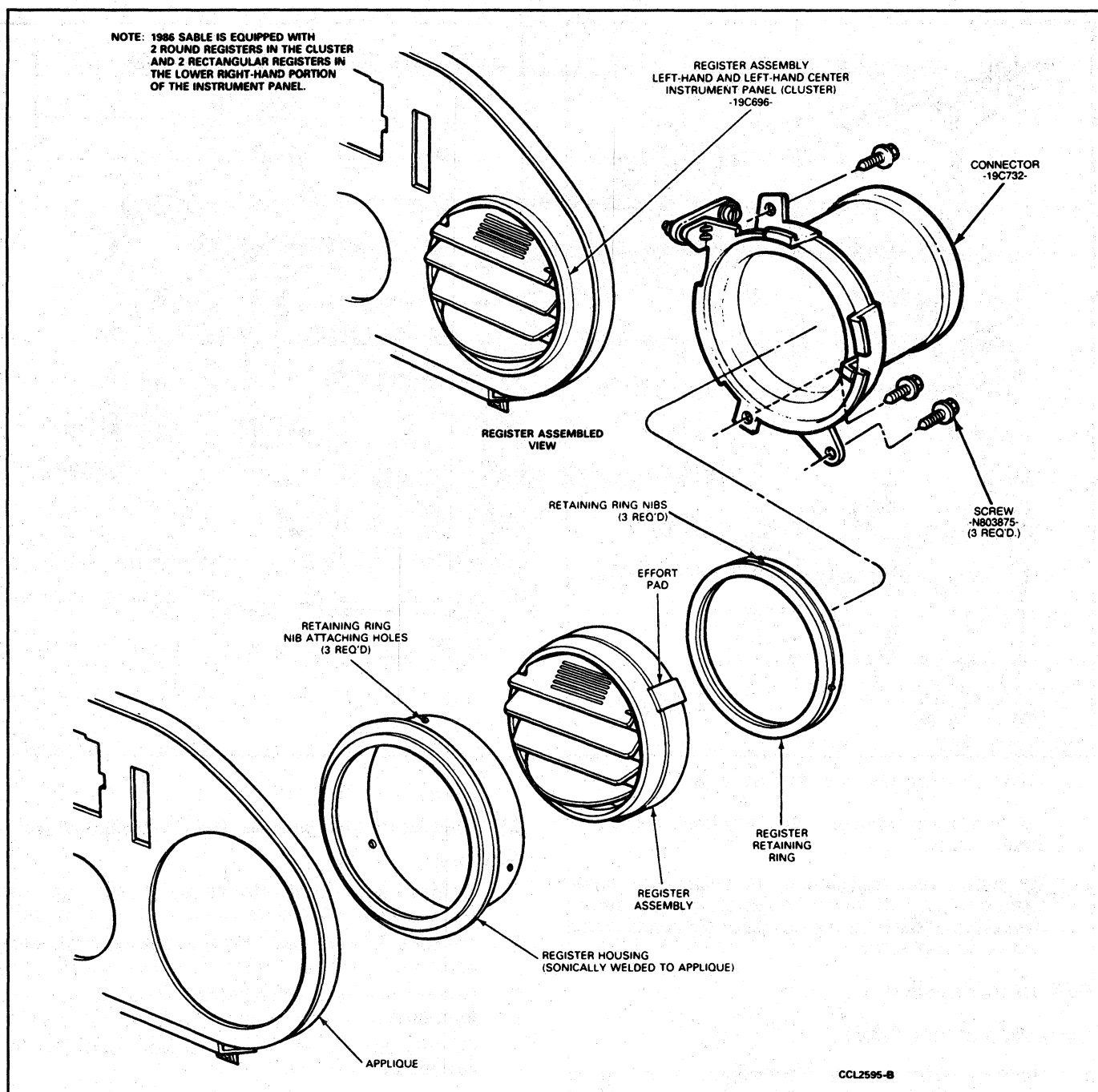


FIG. 47 Motor Arm Retainer from Door Crank Arm



**FIG. 49 Round Register Assembly—Removal**

7. Remove two screws holding demister and hose assembly to instrument panel.
8. To install, reverse Steps 1 through 7.

### Register Ducts

#### Removal

1. Remove instrument panel as outlined, and lay it back against front seat.
2. Lower A/C plenum chamber.
3. Remove defroster nozzle.
4. Remove four screws, center, and/or LH and RH ducts as required (Fig. 53).

#### Installation

1. Assemble LH, RH and center ducts together.
2. Position ducts to instrument panel and install four attaching screws.
3. Install defroster nozzle.
4. Position center plenum chamber as outlined.

### Floor Air Distribution Duct

#### Front Heater System

#### Removal and Installation

1. Remove two screws attaching duct to evaporator case assembly just below A/C heat distribution duct.

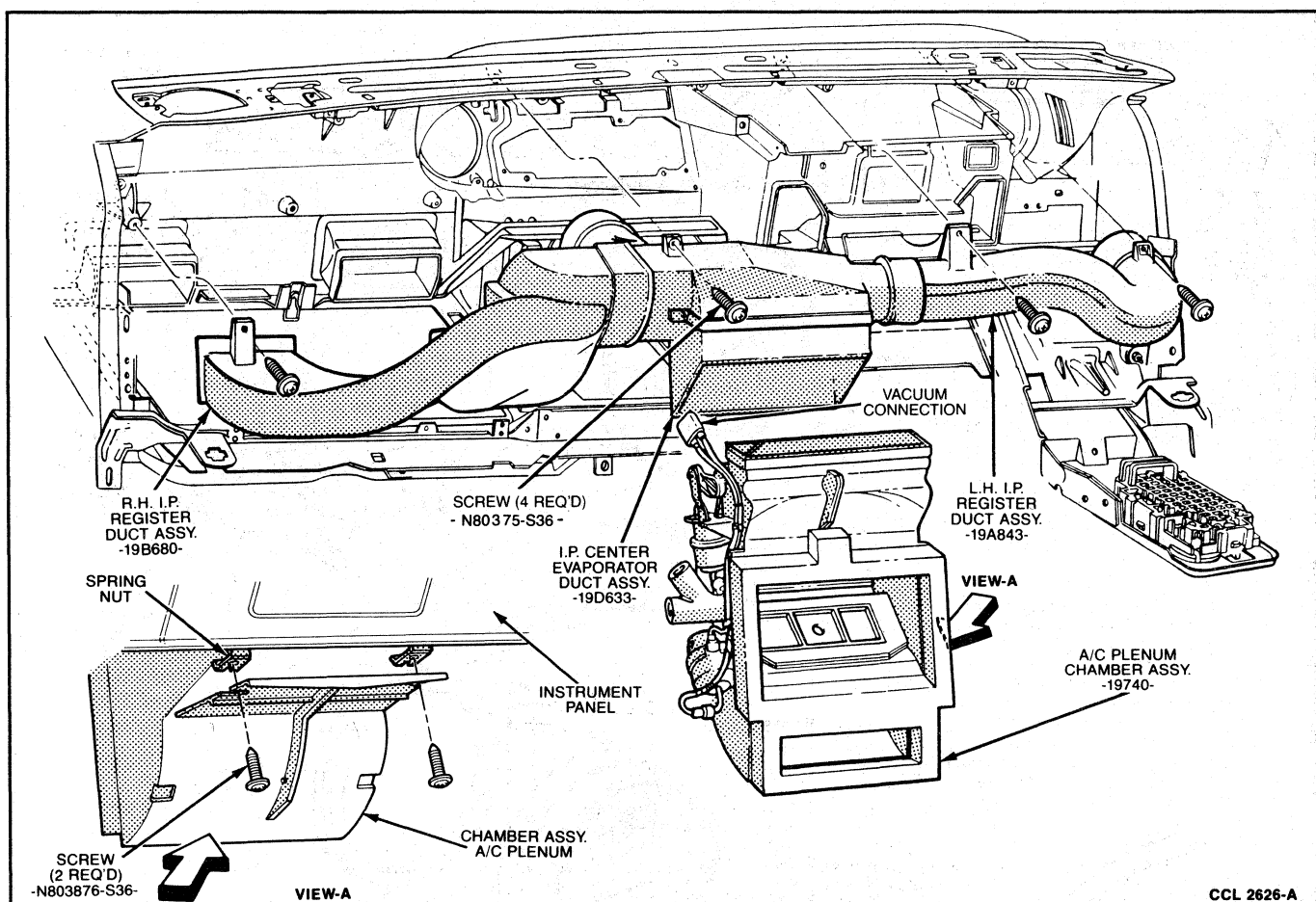


FIG. 50 A/C Plenum Chamber Attachments

2. Pull floor air distribution duct away from evaporator case.
3. To install duct, position it on evaporator case. Ensure retainer at forward edge of duct is inserted over edge of opening in evaporator case, and install two attaching screws.

### Rear Heater System

#### Removal and Installation

1. Remove either or both front seats depending on which duct is to be removed. Refer to Section 41-01 for manual seats or 41-08 for power seats.
2. Move carpet back far enough to clear duct attaching parts.
3. If RH duct is to be removed:
  - a. Remove nut attaching front of duct to driveshaft tunnel.
  - b. Remove two screws attaching rear of duct to crossmember.
  - c. Slide duct down and rearward to free it from adapter at forward end of duct.
4. If LH duct is to be removed, remove two screws attaching duct to crossmember.
5. To install, reverse Steps 1 through 4.

### Air Inlet Duct and Blower Housing Assembly

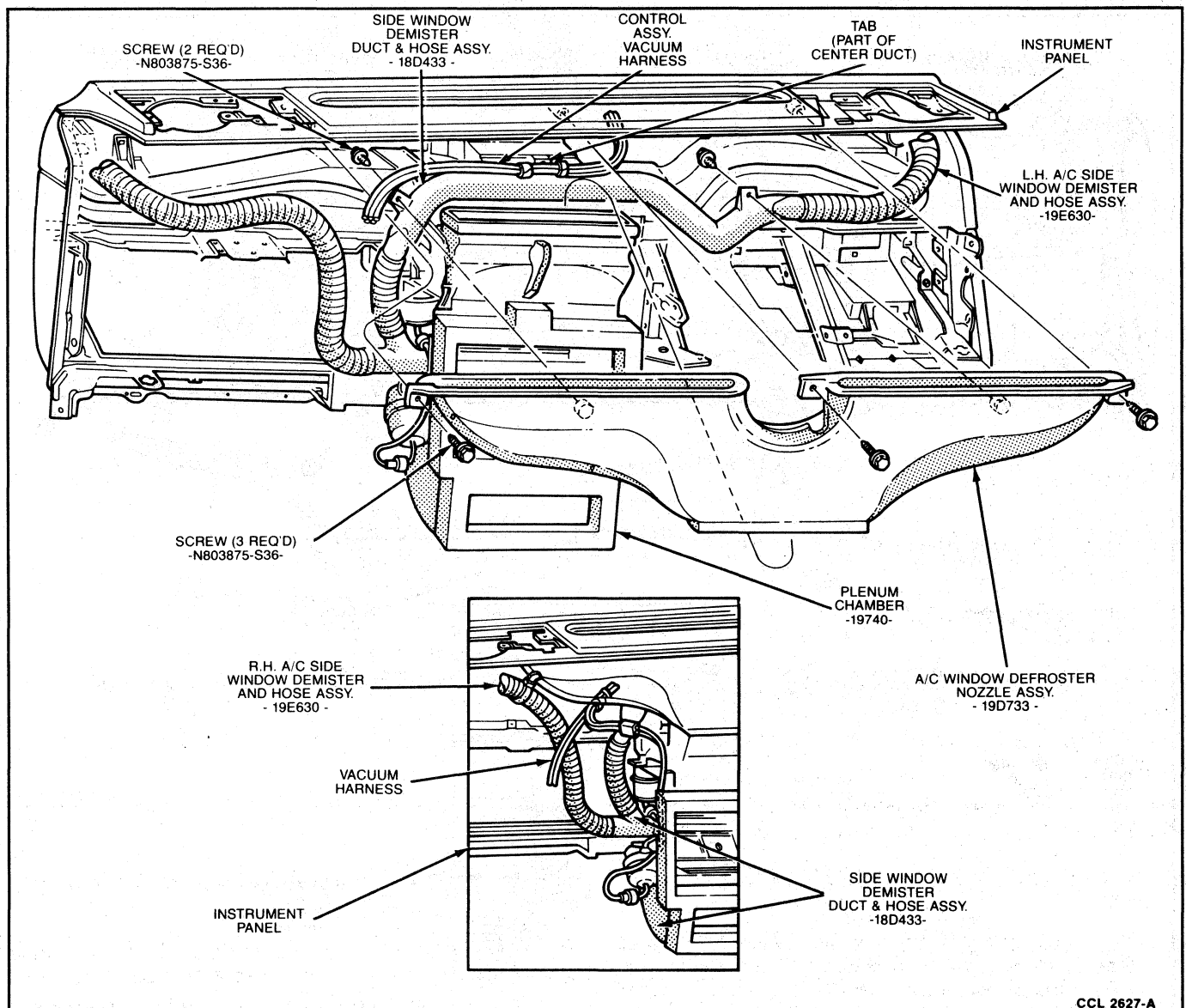
#### Removal

1. Remove glove compartment and disconnect hose from outside-recirc door vacuum motor (Fig. 54).
2. Remove RH instrument panel to side cowl attaching bolt.
3. Remove screw attaching support brace to top of air inlet duct.
4. Disconnect blower motor power lead at wire connector.
5. Remove nut retaining blower housing lower support bracket to evaporator case (Fig. 54).
6. Remove side cowl trim panel.
7. Remove one screw attaching top of air inlet duct to evaporator case (Fig. 54).
8. Move air inlet duct and blower housing assembly down and away from evaporator case.

#### Installation

1. Tape blower motor power lead to air inlet duct to keep wire away from blower outlet during installation.
2. Position air inlet duct and blower housing assembly to evaporator case, inserting flange at top of blower outlet into opening in evaporator case. Slide blower housing lower bracket over stud and install retaining nut. Ensure blower wire is routed to passenger side of evaporator case.

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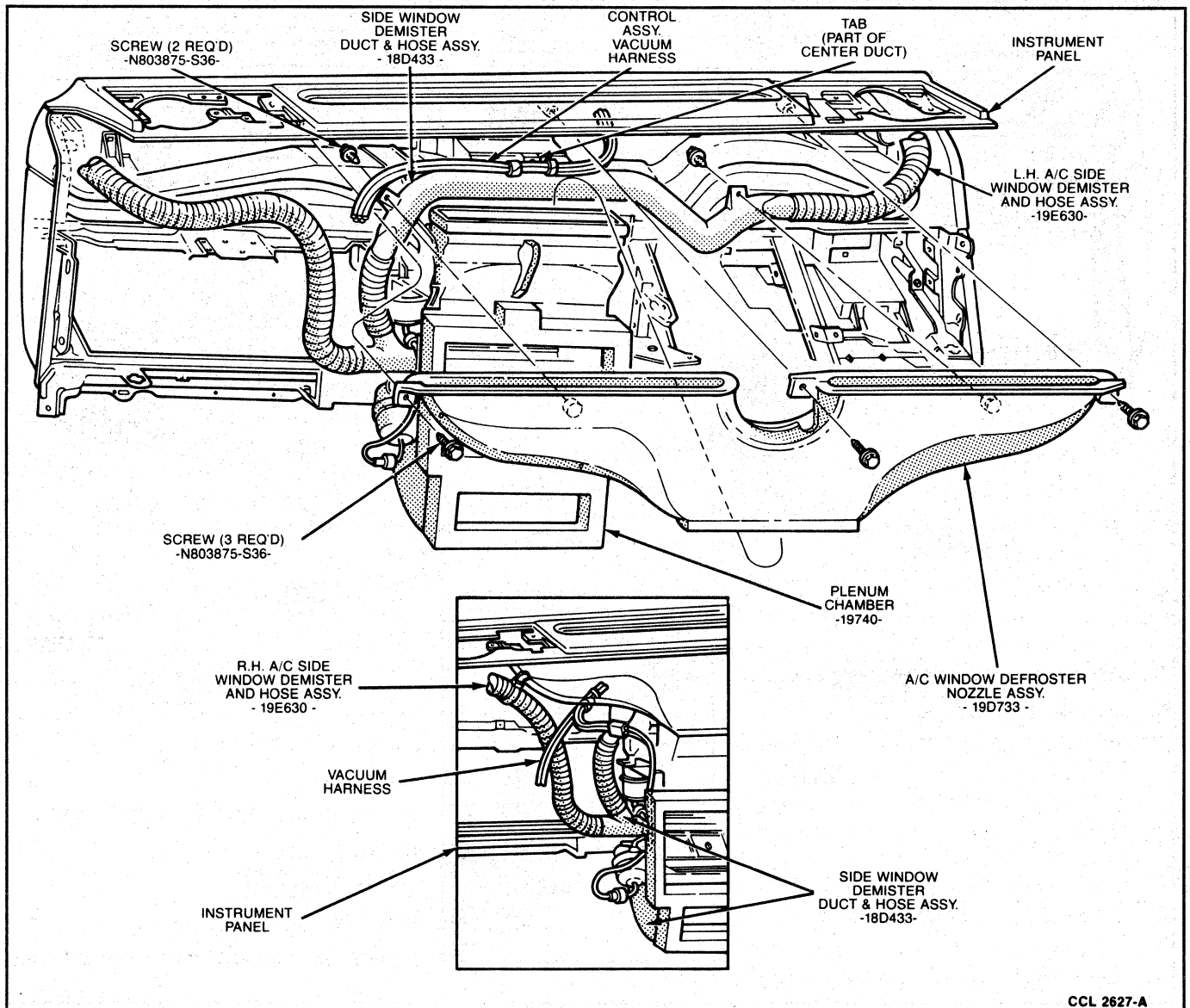
**FIG. 51 Defroster Nozzle and Demister Hose Assemblies**

3. Install screw to retain air inlet duct to evaporator case.
4. Hold outside-recirc door open and rotate blower wheel to ensure it rotates freely. If an interference exists, remove blower motor and wheel and correct condition.
5. Connect blower motor power lead to harness at connector.
6. Install air inlet duct-to-cowl support brace attaching screw.
7. Connect vacuum hose to outside-recirc door vacuum motor and install glove compartment.
8. Install instrument panel lower RH side attaching bolt. Then, install RH cowl side trim panel.
3. Remove nuts retaining evaporator case to dash panel.
4. Remove instrument panel as outlined.
5. Remove steering column bottom trim panel.
6. Remove RH mirror remote control bezel nut and bezel, if so equipped.
7. Remove steering column opening cover panel.
8. Remove steering column shroud.
9. Remove steering column retaining nuts and lower to seat.
10. Remove instrument panel-to-brake support screw.
11. Remove glove compartment door.
12. Disconnect temperature control cable at A/C-heater assembly.
13. Disconnect vacuum multiple plug from back of A/C-heater control.
14. Disconnect blower motor and resistor (Fig. 46).
15. Remove ash receptacle and disconnect electrical connector.

### Panel/Floor Door Vacuum Motor

#### Removal

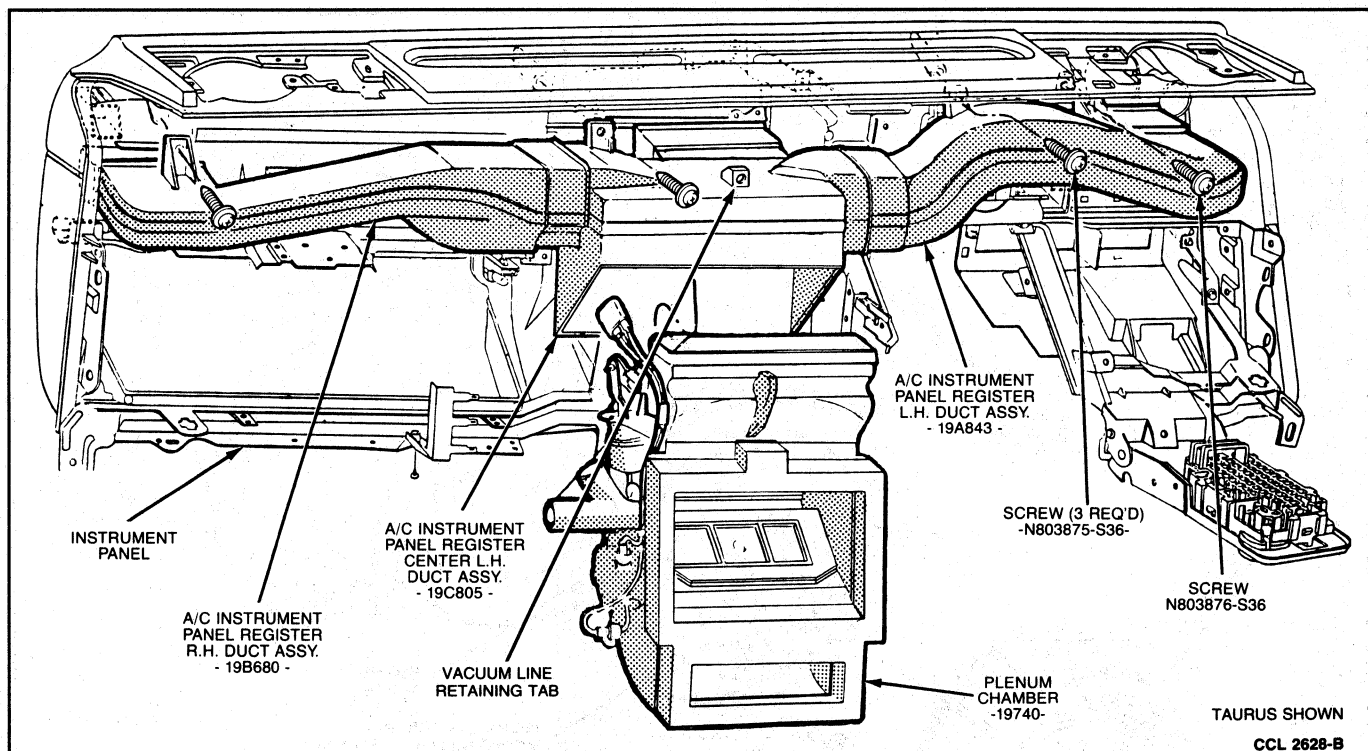
1. Disconnect battery ground cable.
2. Disconnect both heater hoses at dash panel.



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**FIG. 52 Demister Nozzles**

16. Remove instrument panel-to-floor retaining screws.
  17. Remove LH and RH cowl side panels.
  18. Pull carpet back and remove screw at lower flange of heater housing.
  19. Disconnect wire harness retainer.
  20. Raise vehicle on hoist. Refer to Pre-Delivery manual, Section 50-04.
  21. Disconnect wire harness and push grommet through floor.
  22. Lower vehicle.
  23. Disconnect speedometer cable from instrument cluster.
  24. Remove screws from LH side and under evaporator case.
  25. Disconnect wiring harness at evaporator case.
  26. Remove top instrument panel screws.
  27. Remove instrument panel-to-pillar bolts.
  28. Pull instrument panel rearward and lay on steering column.
  29. Remove two case support-to-cowl bracket attaching screws.
  30. Carefully pull case from dash panel until core cover screws can be removed.
  31. Disconnect arm and pivot shaft assembly from motor clip.
  32. Remove two nuts retaining motor to bracket on LH side of plenum and disconnect vacuum hose.
- Installation**
1. Position motor to bracket and secure with two nuts.
  2. Connect vacuum hose to motor.
  3. Install motor arm clip.
  4. Position evaporator case to dash panel. Install one screw to dash bracket.
  5. Install case-to-dash bracket screws.
  6. Install screws on LH side and under evaporator case.
  7. Install evaporator case-to-dash panel retaining nuts inside engine compartment.



**FIG. 53 Instrument Panel Register Duct**

8. Connect heater hoses.
9. Install instrument panel to dash panel and install center screw.
10. Install instrument panel top screws.
11. Install instrument panel-to-brake support bolt over steering column.
12. Install two lower instrument panel support screws.
13. Connect wiring under instrument panel.
14. Install instrument panel-to-floor retaining screws.
15. Connect ash receptacle and install in instrument panel.
16. Connect speedometer cable.
17. Connect control cables to heater.
18. Connect blower motor and resistor.
19. Raise steering column to instrument panel and install retaining bolts.
20. Install hood release handle.
21. Position remote mirror control in instrument panel and install bezel and bezel nut.
22. Connect multiple vacuum plug to back of A/C-heater control.
23. Install glove compartment door.
24. Install LH and RH cowl panels.
25. Feed wires through floor seat grommet and install retainer.
26. Position carpet back in position.
27. Install steering column shroud.
28. Install steering column lower trim panel.
29. Raise vehicle on hoist. Refer to Pre-Delivery manual, Section 50-04.
30. Connect backup lamp switch wire.

31. Lower vehicle.
32. Connect battery ground cable.
33. Refill cooling system.
34. Check operation of all instrument panel items.

### Panel-Defrost Door

#### Removal

1. Remove instrument panel as outlined.
2. Remove screw retaining panel-defrost door to door shaft.
3. Slide door off shaft and remove door from evaporator case.

#### Installation

1. Position panel-defrost door in evaporator case and slide it on shaft. Ensure it is firmly seated on shaft.
2. Install panel-defrost door retaining screw.
3. Install instrument panel as outlined.

### Panel-Defrost Door Vacuum Motor

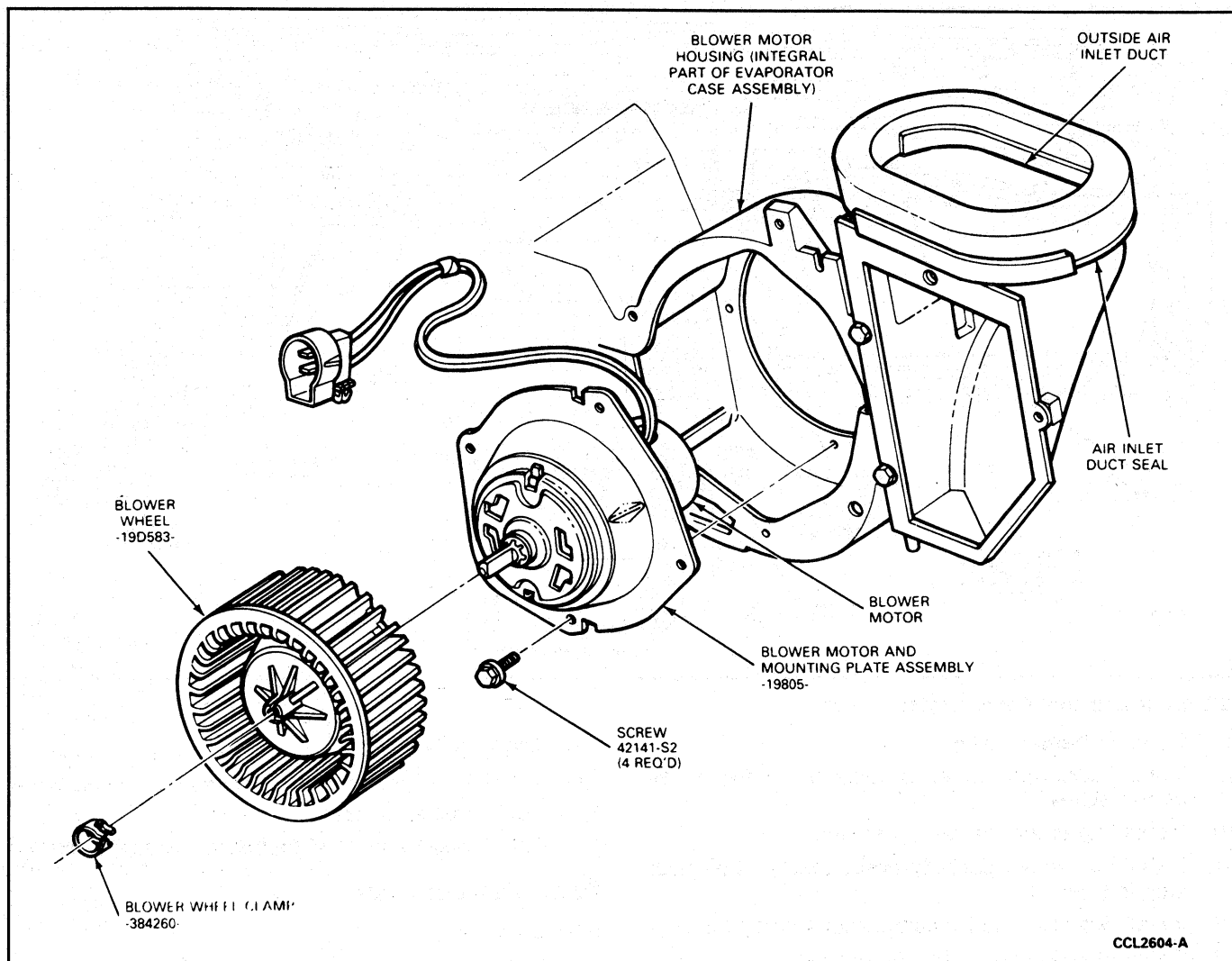
#### Removal

1. Disconnect battery ground cable.
2. Remove instrument panel as outlined.
3. Remove spring nut retaining panel-defrost door vacuum motor arm to door shaft.
4. Remove two nuts retaining vacuum motor to mounting bracket.
5. Remove vacuum motor from mounting bracket and disconnect vacuum hose.

#### Installation

1. Position vacuum motor to mounting bracket and door shaft.





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**FIG. 54 Air Inlet Duct and Blower Housing Assembly**

2. Install two nuts attaching panel-defrost vacuum motor to mounting bracket.
3. Connect vacuum hose to panel-defrost vacuum motor.
4. Install instrument panel as outlined.
5. Connect battery ground cable.

**Panel-Defrost Door****Removal**

1. Remove panel-defrost distribution duct.
2. Remove one screw retaining panel-defrost door to door crank, and pull door from door crank.
3. To replace door crank, remove spring nut retaining crank to vacuum motor arm. Disengage vacuum motor arm from door crank and remove crank from panel-defrost distribution duct.

**Installation**

1. Place door crank in panel-defrost distribution duct. Place flatwasher on crank end of shaft, then vacuum motor arm, and install a new spring nut to retain vacuum motor arm on door crank.
2. Position panel-defrost door on crank so door is on same side of crank as vacuum motor. Install retaining screw.

3. Install panel-defrost distribution duct.

**Suction Accumulator/Drier****Removal**

1. Discharge refrigerant from A/C system following recommended service procedures. Observe all safety precautions. Refer to Section 36-32.
2. Disconnect suction hose at compressor. Cap suction hose and compressor to prevent entrance of dirt and moisture.
3. Disconnect accumulator/drier inlet tube (Fig. 55) from evaporator core outlet. Use Spring Lock Coupling Tool T85L-19623-A or equivalent to reverse inlet tube.
4. Disconnect wire harness connector from pressure switch on top of accumulator/drier.
5. Remove screw holding suction accumulator/drier in accumulator bracket and remove suction accumulator/drier.

**Installation**

1. Position suction accumulator/drier to vehicle and route suction hose to compressor.



2. Using a new O-ring lubricated with clean refrigerant oil, connect accumulator/drier inlet tube to evaporator core outlet.
3. Install screw in suction accumulator/drier bracket.
4. Using a new O-ring lubricated with clean refrigerant oil, connect suction hose to compressor. Tighten connection to 26-36 N·m (21-27 lb-ft).
5. Leak test, evacuate, and charge the system following recommended service procedures. Observe all safety precautions. Refer to Section 36-32.
6. Check system for proper operation.

### Clutch Cycling Pressure Switch

#### Removal

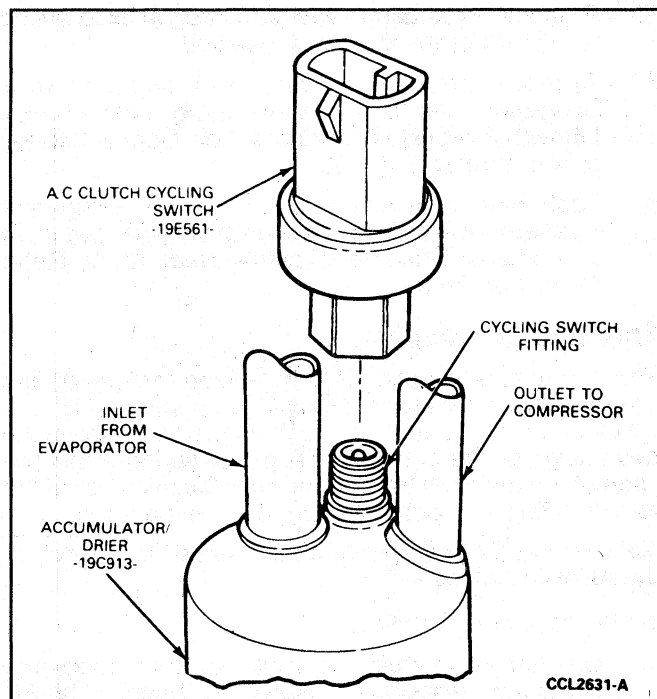
1. Disconnect wire harness connector from pressure switch (Fig. 56).
2. Unscrew pressure switch from top of suction accumulator/drier.

#### Installation

1. Lubricate O-ring accumulator nipple with clean refrigerant oil.
2. Screw pressure switch on accumulator nipple and tighten switch hand-tight.
3. Connect wire connector to pressure switch.
4. Check pressure switch installation for refrigerant leaks.
5. Check system for proper operation.

### Fixed Orifice Tube

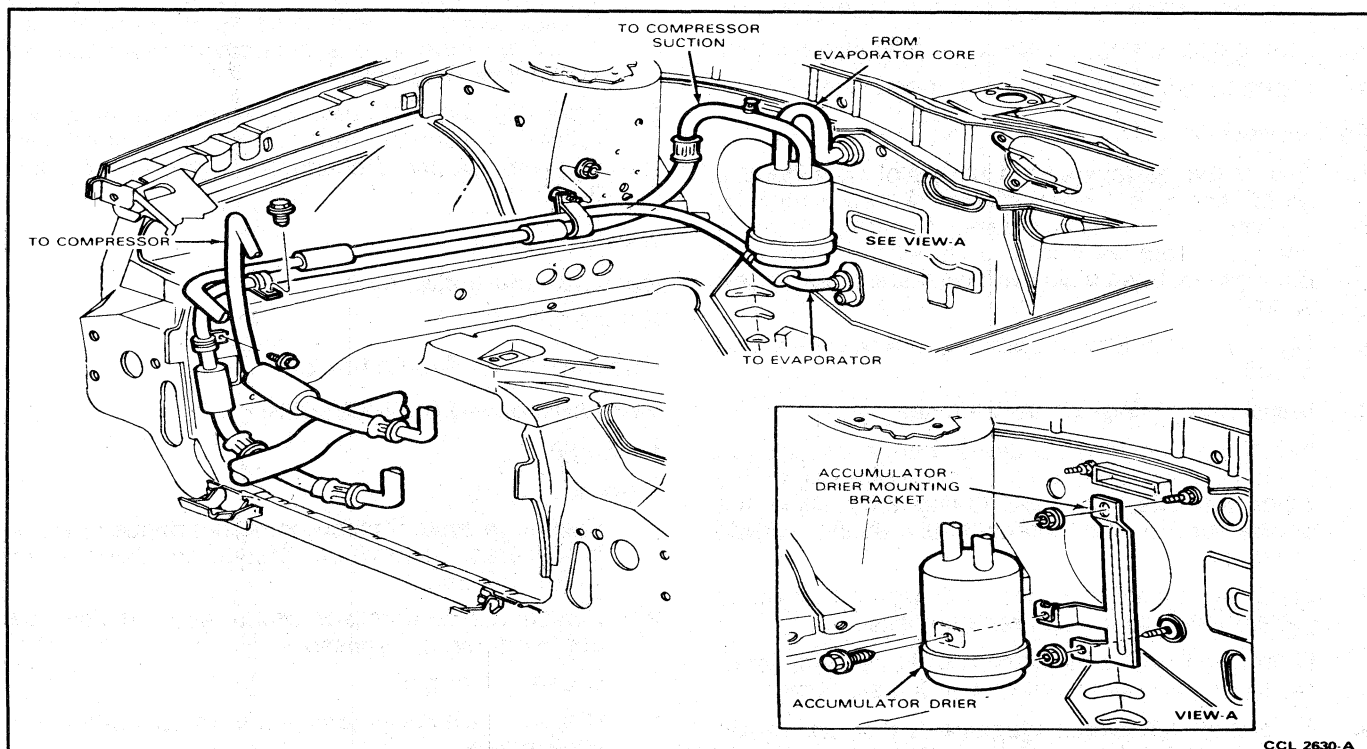
**NOTE: Do not attempt to remove the fixed orifice tube.** The fixed orifice tube is an integral part of the liquid line. When a new fixed orifice tube is required, a new liquid line (with integral fixed orifice tube) must be installed.



**FIG. 56 Clutch Cycling Pressure Switch Harness Connector**

#### Removal and Installation

1. Discharge refrigerant from A/C system following recommended service procedures. Observe all safety precautions. Refer to Section 36-32.
2. Disconnect refrigerant line at condenser outlet and evaporator inlet connections using procedure and one of the spring lock coupling tools shown (Fig. 57).
3. Remove line from vehicle.



**FIG. 55 Suction Accumulator Drier**

4. Route new refrigerant line (and integral fixed orifice tube) with protective caps installed.
5. Remove protective caps and connect new refrigerant line into system using new O-rings lubricated with clean refrigerant oil. Connect spring lock couplings (Fig. 57).
6. Leak test, evacuate and charge the refrigerant system following recommended service procedures. Observe all safety precautions. Refer to Section 36-32.

### Spring Lock Coupling

The spring lock coupling is a two-piece refrigerant line coupling that is held together by a garter spring (Fig. 57). When connected together, two O-rings seal between the two fittings of the connector. A garter spring within the cage of the male fitting expands over the flared lip of the female fitting and prevents connector separation.

Refer to Fig. 57 and relate the numbered illustrations to the following Steps:

#### To Disconnect Coupling

1. Discharge refrigerant from system following approved procedures. Refer to Section 36-32. Then, fit Tool T81P-19623-G for 3/8-inch and 1/2-inch couplings or Spring Lock Coupling Disconnect Tool T83P-19623-C for 5/8-inch couplings or equivalent to coupling as shown. The larger opening end of Disconnect Tool T81P-19623-G is for 1/2-inch compressor discharge lines and smaller end is for 3/8-inch liquid lines. The 3/4-inch coupling Disconnect Tool T85L-19623-A, is required for servicing the accumulator suction connection to the evaporator outlet.
2. Close tool and push tool into open side of cage to expand garter spring and release female fitting.  
**NOTE:** The garter spring may not release if the tool is cocked while pushing it into the cage opening.
3. After garter spring is expanded, pull fittings apart.
4. Remove tool from disconnected coupling.

#### To Connect Coupling

1. Ensure that garter spring is in cage of male fitting. If garter spring is missing, install a new spring by pushing it into cage opening. If garter spring is damaged, remove it from cage with a small wire hook (**do not use a screwdriver**) and install a new spring.
2. Clean all dirt or foreign material from both pieces of coupling.
3. Install new O-rings on male fitting.  
**NOTE:** Use only the specified O-rings, as they are made of a special material. The use of any O-ring other than the specified O-ring may allow the connection to leak intermittently during vehicle operation.
4. Lubricate male fitting and O-rings, and inside of female fitting with clean refrigerant oil.
5. Fit female fitting to male fitting and push until garter spring snaps over flared end of female fitting.
6. To ensure coupling engagement, pull on female fitting and visually check to verify garter spring is over flared end of female fitting.

### Condenser

#### Removal

1. Discharge refrigerant from A/C system at service access gauge port valve located on suction line. Observe all safety precautions. Refer to Section 36-32.
2. Disconnect two refrigerant lines at fittings on RH side of radiator (Fig. 58) following procedure for disconnecting spring lock couplings.
3. Remove four bolts attaching condenser to radiator support and remove condenser from vehicle.

#### Installation

1. Position condenser assembly to radiator support brackets. Install attaching bolts.
2. Connect refrigerant lines to condenser assembly using procedures for connecting spring lock couplings as outlined.
3. Leak test, evacuate and charge refrigerant system following recommended service procedures. Observe all safety precautions. Refer to Section 36-32.

### Refrigerant Lines

#### Removal and Installation

1. Discharge refrigerant from A/C system at low-pressure access gauge port valve located on suction line near compressor following recommended service procedure. Observe all safety precautions. Refer to Section 36-32.
2. Disconnect and remove refrigerant lines. At condenser, use disconnect procedure for spring lock couplings.
3. Route new refrigerant line with protective caps installed (Fig. 59).
4. Connect refrigerant line into system using new O-rings lubricated with clean specified refrigerant oil. At condenser, use connecting procedure for spring lock couplings.
5. Leak test, evacuate and charge refrigerant system following recommended service procedures. Observe safety precautions. Refer to Section 36-32.

### Heater Hoses

#### Removal and Installation

Refer to Fig. 60.

### Compressor FS-6-Cylinder

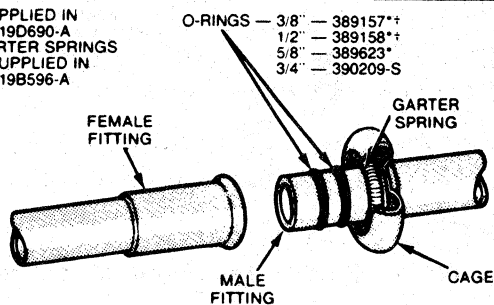
#### Taurus/Sable—3.0L V-6 Engine

#### Removal

Refer to Fig. 61.

1. Discharge system following recommended service procedures. Observe all safety precautions. Refer to Section 36-32.
2. Disconnect compressor clutch wires at field coil connector on compressor.
3. Loosen drive belt.
4. Disconnect hose assemblies from condenser and suction line.
5. Remove four bolts.

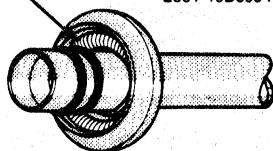
\*ALSO SUPPLIED IN  
KIT E35Y-19D690-A  
WITH GARTER SPRINGS  
† ALSO SUPPLIED IN  
KIT E1ZZ-19B596-A



SPRING LOCK COUPLING DISCONNECTED

### TO CONNECT COUPLING

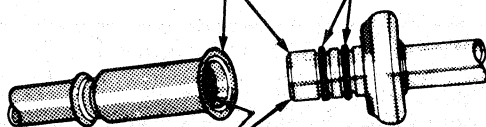
GARTER  
SPRING



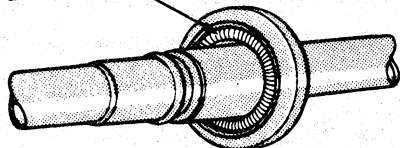
CHECK FOR MISSING OR DAMAGED GARTER SPRING — REMOVE DAMAGED SPRING WITH SMALL HOOKED WIRE — INSTALL NEW SPRING IF DAMAGED OR MISSING.

REPLACEMENT GARTER SPRINGS  
3/8 INCH — E1ZZ-19E576-A\*  
1/2 INCH — E1ZZ-19E576-B\*  
5/8 INCH — E35Y-19E576-A\*  
3/4 INCH — E69Z-19E576-A\*  
\*ALSO AVAILABLE IN  
E35Y-19D690-A KIT WITH O-RINGS

A — CLEAN FITTINGS  
B — INSTALL NEW O-RINGS — USE ONLY SPECIFIED O-RINGS  
C — LUBRICATE WITH CLEAN REFRIGERANT OIL  
D — ASSEMBLE FITTING TOGETHER BY PUSHING WITH A SLIGHT TWISTING MOTION



GARTER SPRING

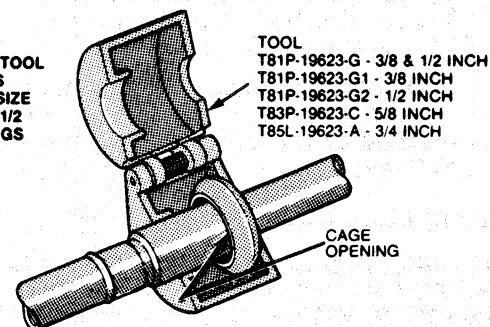


TO ENSURE COUPLING ENGAGEMENT, VISUALLY CHECK TO BE SURE GARTER SPRING IS OVER FLARED END OF FEMALE FITTING.

### TO DISCONNECT COUPLING

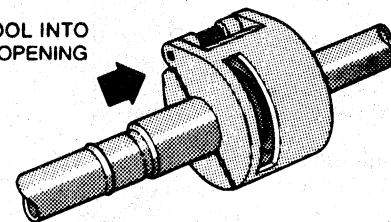
CAUTION — DISCHARGE SYSTEM BEFORE DISCONNECTING COUPLING

NOTE:  
EACH END OF TOOL  
T81P-19623-G IS  
A DIFFERENT SIZE  
TO FIT 3/8 and 1/2  
INCH COUPLINGS

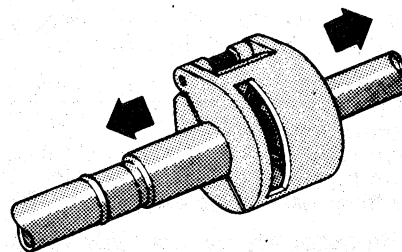


① FIT TOOL TO COUPLING SO THAT TOOL CAN ENTER CAGE OPENING TO RELEASE THE GARTER SPRING.

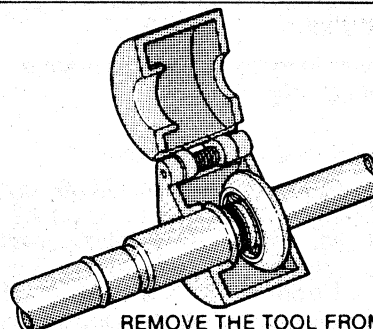
PUSH TOOL INTO  
CAGE OPENING



② PUSH THE TOOL INTO THE CAGE OPENING TO RELEASE THE FEMALE FITTING FROM THE GARTER SPRING.



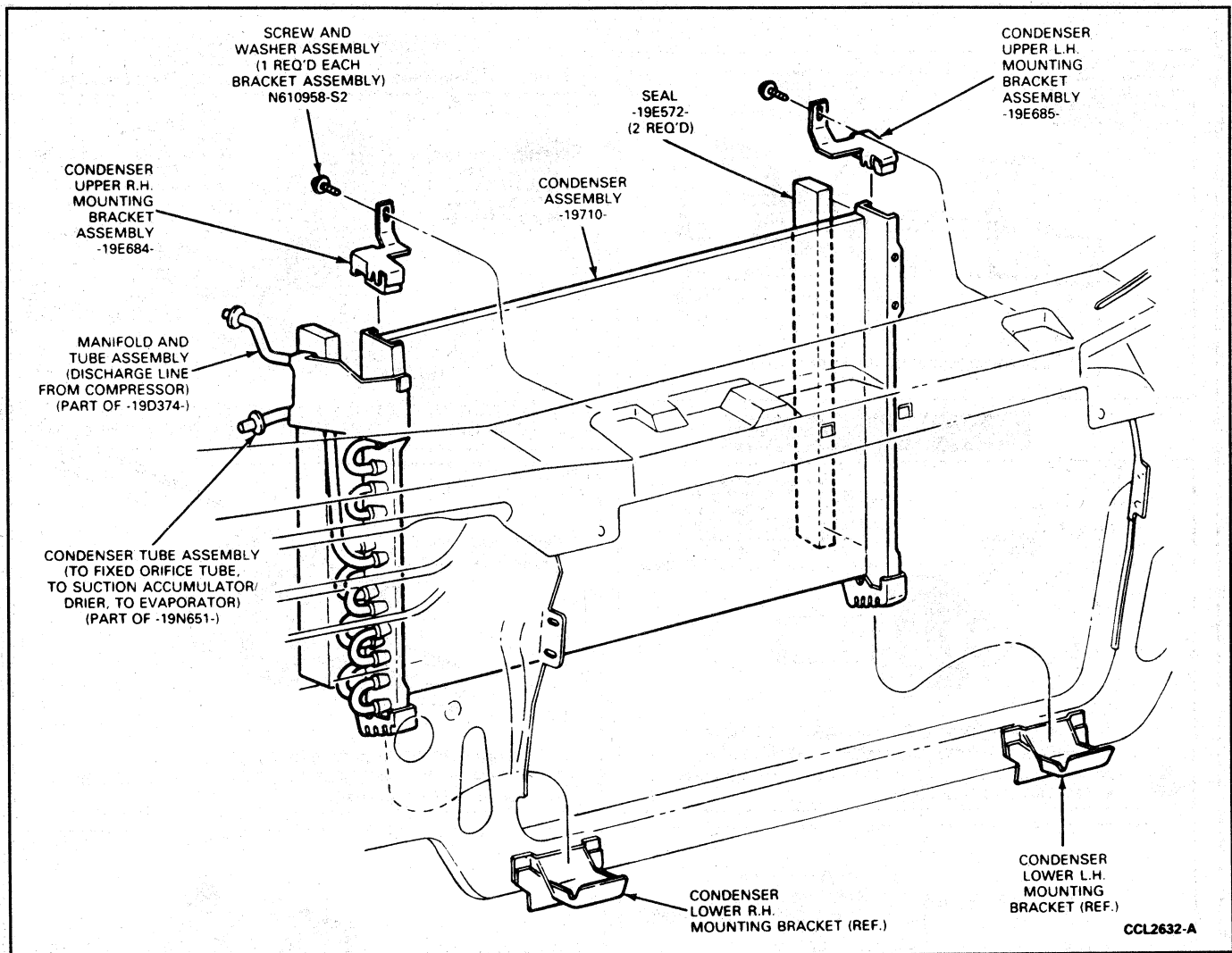
③ PULL THE COUPLING MALE AND FEMALE FITTINGS APART.



④ REMOVE THE TOOL FROM THE DISCONNECTED SPRING LOCK COUPLING.

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FIG. 57 Spring Lock Coupling



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**FIG. 58 Condenser Assembly**

6. Remove compressor and manifold, and tube assembly from vehicle as a unit.

NOTE: The assembly will not clear the sub-frame and radiator support if an attempt is made to remove the unit from the bottom. It must be removed from the top.

7. Remove manifold and tube assembly as an on-the-bench operation.
8. If compressor is to be replaced, remove clutch and field coil assembly.

#### Installation

1. A new service replacement, FS-6 compressor, contains 295.7ml (10 fluid ounces) of specified refrigerant oil. Prior to installing replacement compressor, drain 118.28ml (4 fluid ounces) of refrigerant oil from compressor. This will maintain total system oil charge within specified limits.

2. Install manifold and tube assembly on A/C compressor. Tighten two bolts to specification.
3. Install the compressor and manifold and tube assembly on the A/C mounting bracket. Tighten four mounting bolts to specification.
4. Using new O-rings lubricated with clean refrigerant oil, connect suction line to compressor manifold and tube assembly. Attach discharge line to A/C condenser.
5. Connect clutch wires to field coil connector.
6. Install drive belt. Adjust drive belt to specification. Refer to Section 27-02.
7. Leak test, evacuate, and charge system following recommended service procedures. Observe all safety precautions. Refer to Section 36-32.
8. Check system for proper operation.

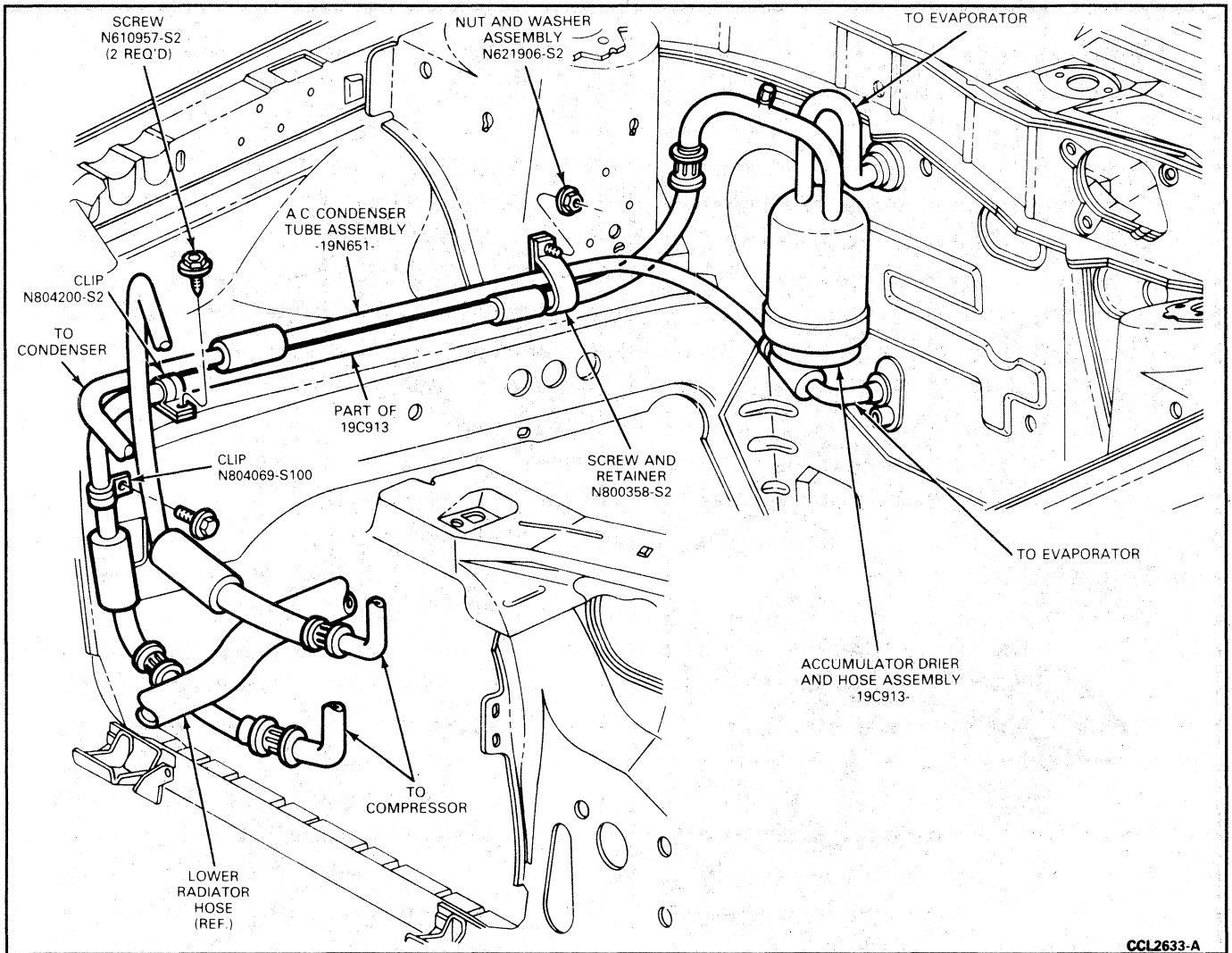


FIG. 59 A/C Hose Installation

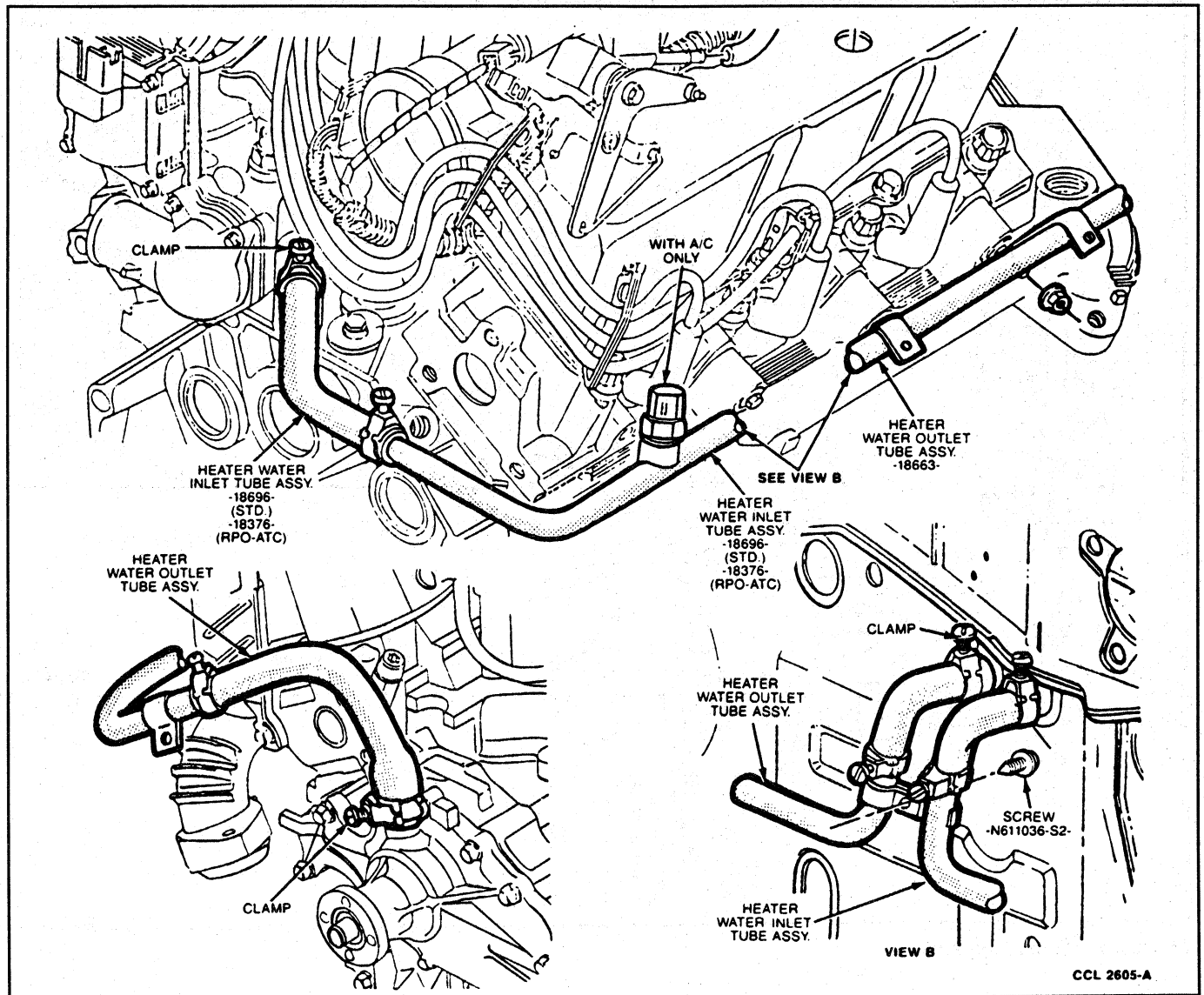
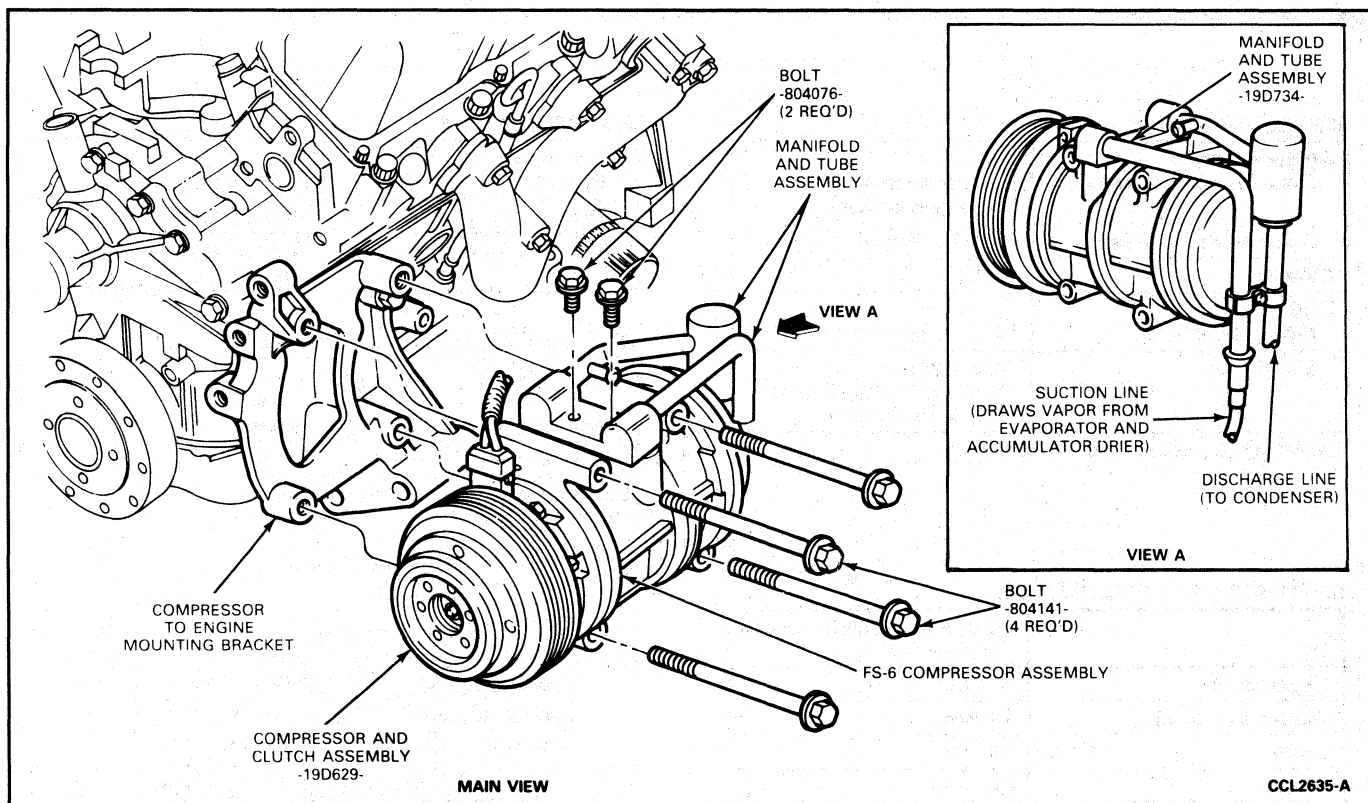


FIG. 60 Heater Hose Installation

**FIG. 61 FS-6 Compressor Installation—3.0L Engine**

## SPECIFICATIONS

## REFRIGERANT SYSTEM

<b>System Protection</b>	
Clutch Cycling Pressure Switch	Close Maximum 47 psi Open Minimum 23 psi
High Pressure Relief Valve*	3103 kPa (450 psi)
<b>Capacity</b>	44 Oz. $\pm$ 2 Oz.
<b>Type</b>	
Refrigerant 12 (R-12)	Dichlorodifluoromethane CCL <sub>2</sub> F <sub>2</sub>
ESA-M17B2A	D4AZ-19B519-A, Ford YN1-A, 14 Oz. Can, Motorcraft YN-7, 30 Lb. Container

\*Located in high pressure hose near compressor.

## ELECTRICAL SYSTEM

<b>System Protection</b>	
Blower Circuit	30 Amp. Fuse
Clutch Circuit	15 Amp. Fuse
<b>Blower Resistor Circuit</b>	Thermal Limiter (Integral w/ Resistor)

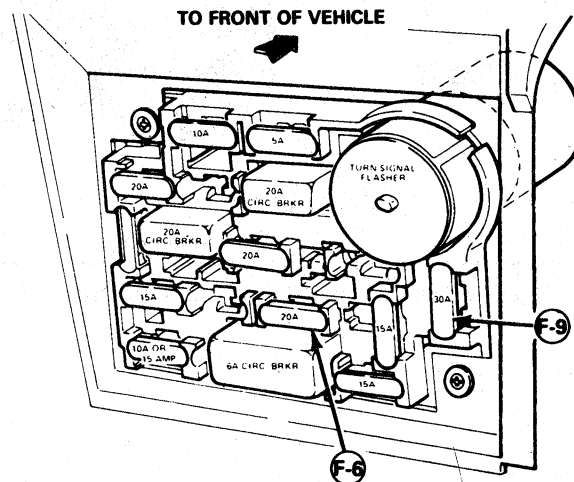
## DRIVE BELT TENSION — FS-6 COMPRESSOR

Belt Type	New	Used Minimum*	Used Reset Limits
6 Rib	120-160	90	75-120

\*Used is any belt in operation 10 minutes or more.

## COMPRESSOR, FS-6 SPECIFICATIONS

<b>Type</b>	Swash Plate, 3 Double Acting Pistons — Axial Type
<b>Displacement</b>	10.4 CID
<b>Cylinder Bore (Dia.)</b>	1.4 Inch
<b>Stroke</b>	1.2 Inch
<b>Rotation</b>	Clockwise
<b>Rotational Torque</b> (Maximum Manifold Removed)	10 N·m (7 Lb-Ft)
<b>Refrigerant Oil</b>	
Type	ESA-M2C31-A — 500 Viscosity
Capacity	10 Fluid Ounces
Part Number	C9AZ-19577-B Motorcraft YN-2
<b>Magnetic Clutch</b>	
Air Gap Between Pulley and Hub	0.021-0.036 Inch
Current Draw	4.67 Amps @ 12.8 Volts
Run-Out (Maximum)	0.02 Inch — Radial or Axial



The fuse panel is located in the lower left side of the instrument panel, behind a cover which must be removed for access.

CL4929-A

## REFRIGERANT SYSTEM COMPONENTS AND CAPACITIES

Vehicle ②	Compressor	Clutch Cycling Pressure Switch ①	Fixed Orifice Tube	Refrigerant Capacity*	
	FS-6			(oz.)	(kg.)
Taurus/Sable	X	X	X	40	1.134

\*Plus (2 oz.) (.056 kg.) minus (2 oz.) (.056 kg.)

① Pressure switch opens at 169 kPa (24.5 psi)

② All models equipped with Suction Accumulator Drier

CL4930-A



**SPRING LOCK COUPLING COMPONENTS**

O-Ring	3/8 Inch — 389157
	1/2 Inch — 389158
	5/8 Inch — 389623
	3/4 Inch — 390209-S
Garter Springs	3/8 Inch — E1ZZ-19E576-A (YF-990)
	1/2 Inch — E1ZZ-19E576-A (YF-991)
	5/8 Inch — E35Y-19E576-A (YF-1134)
	3/4 Inch — E69Z-19E576-A
<b>Service Kits</b>	
E1ZZ-19B596-A (YF-982)	Contains 6 ea. 389157 & 389158 O-Rings
E35Y-19D690-A (YF-1158)	Contains 389157, 389158 & 389623 O-Rings. E1ZZ-19E576-A & B and E35Y-19E576-A Springs

CL4933-A

**TORQUE SPECIFICATIONS**

Description	N-m	Lb-Ft
Pressure Switch to Accumulator Nipple (Plastic Base)	Finger Tight Only	
Liquid Line to Evaporator Core	Spring Lock Coupling	
Accumulator to Evaporator Core	Spring Lock Coupling	
Liquid Line to Condenser	Spring Lock Coupling	
Discharge Line to Condenser	Spring Lock Coupling	
Suction Hose to Accumulator	Spring Lock Coupling	
Hose Manifold to Compressor	18-23	13-17
Clutch Hub Nut	13-20	10-14
Compressor Attaching Bolts	34-47	25-35
Compressor Bracket to Engine	42-58	31-43

CL5117-A

**SPECIAL SERVICE TOOLS**

Part Number	Motorcraft Part Number	Description
T63L-8620-A	YT-371	Belt Tension Gauge
D81L-19703-A	YT-367	Service Access Adapter (High Pressure)
Rotunda 007-00001	—	Digital Volt-Ohm Meter
Rotunda 055-00014	YT-288	Electronic Leak Detector
Rotunda 023-00006	YT-202	Flame Type Leak Detector
Rotunda 023-00007	YT-227	Dial Thermometer
—	YT-204	Safety Shield Goggles
Rotunda 023-00009	YT-229	Small Can Adapter
Rotunda 063-00010	YT-201	Manifold Gauge Set
T81P-19623-G1	YF-1056	Spring-Lock Coupling Disconnect Tool — 3/8 inch
T81P-19623-G2	—	Spring-Lock Coupling Disconnect Tool — 1/2 inch
T83P-19623-C	—	Spring-Lock Coupling Disconnect Tool — 5/8 inch
T85L-19623-A	—	Spring-Lock Coupling Disconnect Tool — 3/4 inch
T57L-500-B	—	Bench Mounted Holding Fixture
T83P-18532-AH	—	Control Cable Removal Tool

CL5118-B



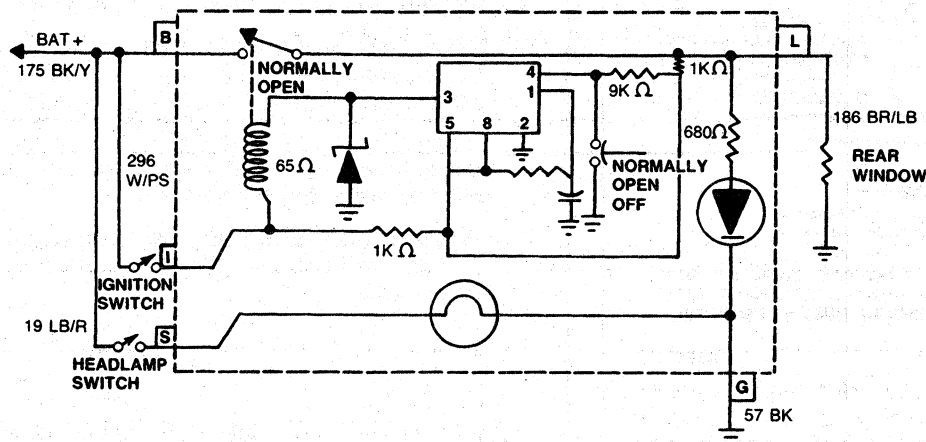
## DESCRIPTION AND OPERATION (Continued)

The rear window defrost grid is fed through the relay contacts from the fuse link wire. The input to the rear defrost control assembly from the ignition switch determines if the relay contacts will stay closed when activated by the ON-OFF rocker or buttons. When the ignition switch is in RUN position, moving the rocker or button to ON closes the relay contacts and also activates the timing circuit. The relay contacts will remain closed until they are

opened by the timing circuit, the rocker or button is depressed to the OFF position, or the ignition is turned to the OFF position.

The circuit is protected by a fuse located in the fuse panel and a fuse link.

The operating rocker (Taurus) or buttons (Sable) are spring-loaded to return from ON or OFF to its center (normal) position.



K9615-A

As soon as the switch is depressed to the ON position, it electrically connects power to energize the timer relay coil, thereby causing the normally open relay load contacts to close and provide power to the ON lamp and the rear window grid wires. The grid wires will continue to receive power for approximately ten minutes.

The control can be deactivated before automatic time out by momentarily depressing it to the OFF position or when the ignition switch is turned to the OFF position.

For individual wiring harness applications refer to Section 34-20.

## MAJOR SERVICE OPERATIONS

## Grid Wire Repair

Any break in the grid longer than 25mm (1 inch) cannot be repaired. The rear window must be replaced. For breaks less than 25mm (1 inch) long, use the following procedure:

## Surface Preparations

1. The vehicle should be brought inside and permitted to come to room temperature of 16°C (60°F) or above.
2. Clean entire grid line repair area with Ford Glass Cleaner E4AZ-19C507-A (ESR-M1495-

A) or equivalent or other suitable cleaning solvent to remove all dirt, wax, grease, oil or other foreign matter. It is important that repair area be clean and dry.

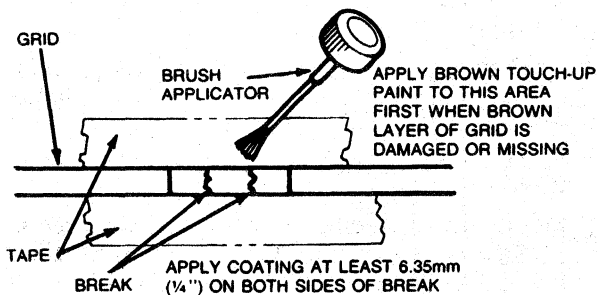
## Mixing

The bottle of Grid Repair Compound D8AZ-19562-A (ESB-M4J58-A) or equivalent and touch-up paint must be at room temperature. Shake bottle for at least one minute for thorough mixing. Shake frequently during use.

## MAJOR SERVICE OPERATIONS (Continued)

## Application

1. Mark location of break on outside of window.
2. Using cellulose tape, mask off area directly above and below grid break. The break area should be at the center of mask and tape gap must be no wider than existing grid line.



USING CELLULOSE TAPE, MASK OFF THE AREA DIRECTLY ABOVE AND BELOW THE GRID BREAK. THE BREAK AREA SHOULD BE AT THE CENTER OF THE MASK AND THE GAP MUST BE NO WIDER THAN THE EXISTING GRID LINE.

K3787-D

3. If both brown and silver layers of grid are broken or missing, apply a coating of the brown touch-up paint across break area first. Two coats may be necessary to obtain proper color. Allow touch-up paint to dry, then apply three coats of silver grid repair compound, allowing three to five minutes drying time between coats. The coating of silver grid repair compound should extend at least 6.35mm (1/4 inch) on both sides of break area.

NOTE: If the brown layer of the grid is not broken or missing, apply only the silver grid repair compound to the break.

4. Allow to dry for five minutes, then remove mask.
5. After removing mask, check outside appearance of grid repair. If silver repair compound is visible above or below grid, this excess should be removed. This can be done by placing a single-edge razor blade on the glass parallel to grid and scrape gently toward grid.

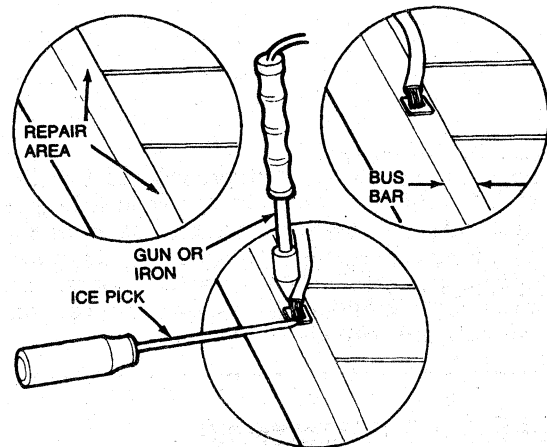
**CAUTION:** Be careful not to damage the grid line with the razor blade.

## Curing

The repair coating will air dry in approximately one minute and can be energized within three to five minutes. Optimum hardness and adhesion occurs after approximately 24 hours. At that time, the repair area may be cleaned with a mild window cleaner.

## Lead Wire Terminal Service

1. Allow rear window to warm up to room temperature for one-half hour to a hour.
2. Clean bus bar in area to be repaired using fine steel wool (3/0 to 4/0 grade).
3. Restore area where bus bar terminal was originally attached by applying three coats of Grid Repair Compound D8AZ-19562-A (ESB-M4J58-A) or equivalent. Allow approximately ten minutes drying time between coats.
4. Work as quickly as possible to avoid overheating glass. Tin bus bar with solder in area where terminal will be reattached.
5. Using a heat gun or heat lamp, preheat glass in the solder area to 67°-83°C (120°-150°F), just prior to soldering terminal on.
6. Position terminal on bus bar in area that was tinned and hold it in place with an ice pick or screwdriver.



L2447-C

7. Apply soldering heat to pad of terminal until solder flows.

**CAUTION:** To avoid damaging bus bar, remove soldering gun or iron as soon as the solder flows.

8. Start the vehicle, turn heater rear window on, and leave it on for five minutes. Inspect terminal and apply Grid Repair Compound D8AZ-19562-A (ESB-M4J58-A) or equivalent to the required area.

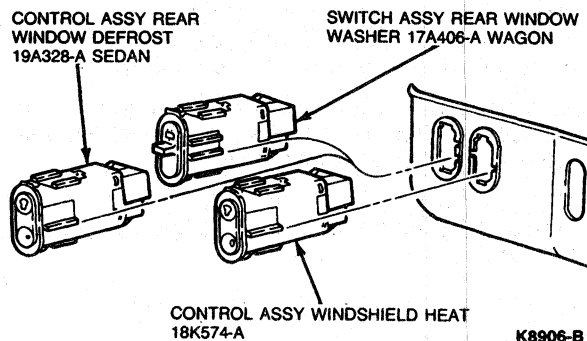
## REMOVAL AND INSTALLATION

### Switch

#### Taurus

#### Removal and Installation

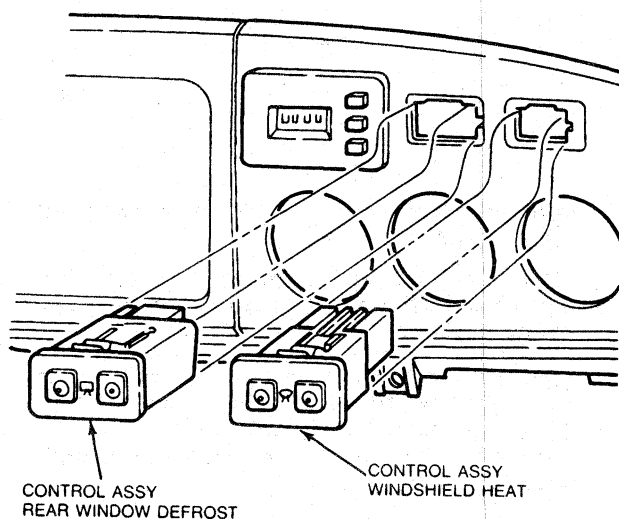
1. Remove lower LH finish panel.
2. Disconnect electrical connector.
3. Depress spring locking tabs on switch and push out of finish panel.
4. To install, reverse Steps 1, 2 and 3.



### Sable

#### Removal and Installation

1. Remove instrument cluster finish panel.
2. Disconnect electrical connector.
3. Depress spring locking tabs on switch and push out of finish panel.
4. To install, reverse Steps 1, 2 and 3.



### Window

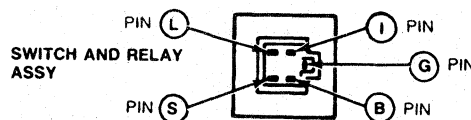
Disconnect the wire leads at each end of the glass. Replace the window. Refer to Section 43-11.

## TESTING

### Relay Tests

#### Timer/Relay

1. Ground pin G and connect a jumper wire between pins I and B. Connect a 12V test lamp between pin L and ground.
2. Apply power to pin B. The test lamp should not light.
3. Momentarily actuate control to the ON position. The test lamp should come on and stay on after the control returns to the normal position.
4. Test lamp should go off under the following conditions:
  - a. If control is depressed to OFF.
  - b. If power to ignition switch accessory terminal is removed or approximately ten minutes have elapsed.
5. Apply 12V power to pin S. The ISO bulb should light.



### Grid Wire Test

1. Using a strong light inside vehicle, visually inspect wire grid from outside. A broken grid wire will appear as a brown spot.
2. Run engine at idle. Set control switch to ON. The indicator lamp should come on.
3. Working inside vehicle with a 12-volt DC voltmeter, contact broad red-brown strips on sides of rear window. The meter should read 10-13 volts. A lower voltage reading indicates a loose ground wire (pigtail) connection at grounded side of glass.
4. Contact a good ground point with negative lead of meter. The voltage reading should not change.
5. With negative lead of the meter grounded, touch each grid line of heated rear window at its midpoint with positive lead. A reading of approximately 6 volts indicates that the line is good. A reading of zero volts indicates that the line is broken between midpoint and the positive side of the grid line. A reading of 12 volts indicates that the circuit is broken between midpoint of grid line and ground.



GROUP

**SPEED  
CONTROL**

**37**  
(19000)

**SECTION 37-05 Speed Control System with Resume**

SUBJECT	PAGE	SUBJECT	PAGE
ADJUSTMENTS		REMOVAL AND INSTALLATION (Cont'd.)	
Clutch Switch .....	37-05-5	Clutch Switch .....	37-05-9
Linkage Actuator Cable .....	37-05-3	Control Switches .....	37-05-8
Vacuum Dump Valve .....	37-05-4	EEC-IV Electronic Control Assembly (ECA) .....	37-05-7
DESCRIPTION		Servo Assembly .....	37-05-5
Vacuum Dump Valve .....	37-05-3	Speed Sensor .....	37-05-7
OPERATION		Vacuum Dump Valve .....	37-05-7
Decreasing Set Speed .....	37-05-3	Vacuum Reservoir .....	37-05-9
Increasing Set Speed .....	37-05-3	SPECIAL SERVICE TOOLS .....	37-05-35
Resume .....	37-05-3	TESTING	
System Activation .....	37-05-3	Pinpoint Tests .....	37-05-18
REMOVAL AND INSTALLATION		Quick Test .....	37-05-12
Actuator Cable .....	37-05-7	VEHICLE APPLICATION .....	37-05-1
Brush Assembly .....	37-05-8		
Check Valve .....	37-05-10		

**VEHICLE APPLICATION**

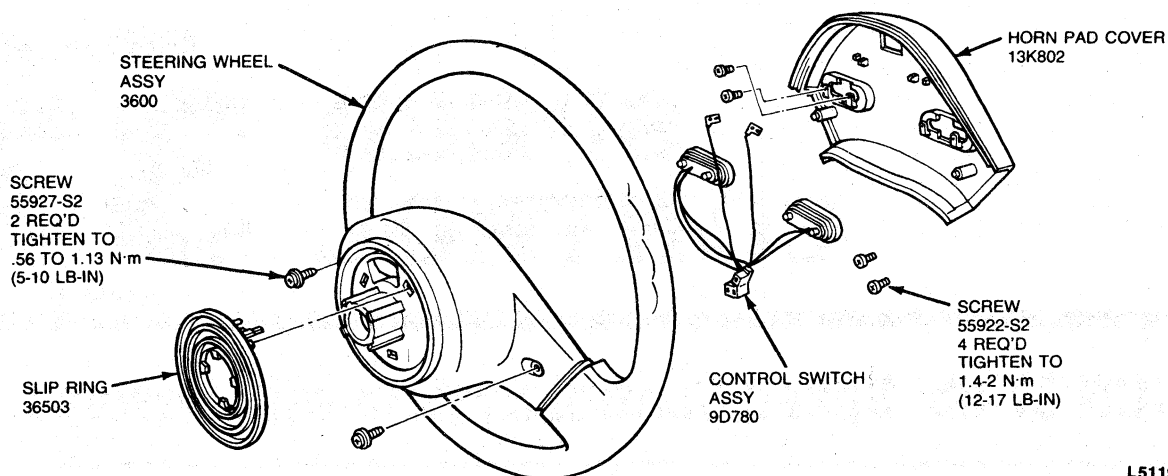
Taurus/Sable.

**DESCRIPTION**

The Integrated Vehicle Speed Control (IVSC) system consists of operator controls, a servo (throttle actuator) assembly, a speed sensor, a clutch switch, a stoplamp switch, a vacuum dump valve, a horn relay, a vacuum reservoir, a check valve and necessary wires and vacuum hoses. In this system, the speed control amplifier assembly function has been integrated into the EEC-IV

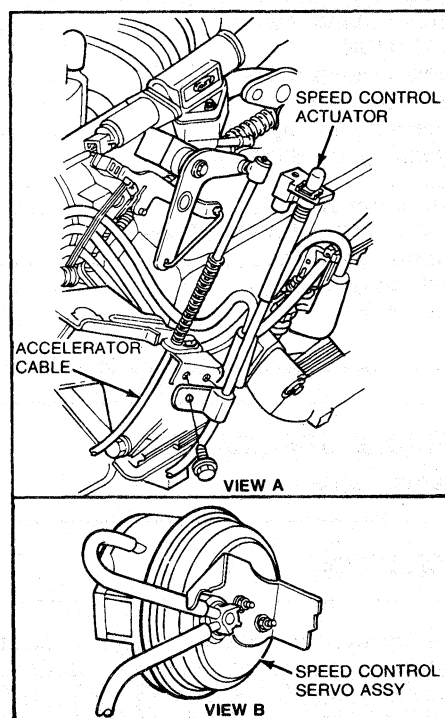
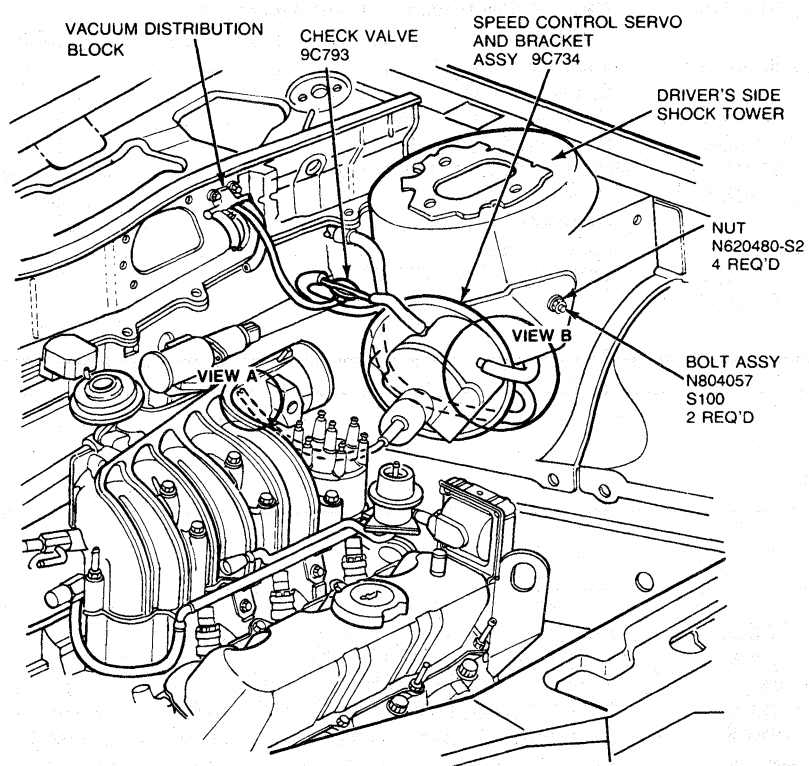
Electronic Control Assembly (ECA). The servo assembly is mounted in the engine compartment as shown in the illustrations, and is connected to the throttle linkage with an actuator cable. The servo is connected to the vacuum reservoir and to manifold vacuum through the check valve as shown in the illustrations. The speed control sensor is located on the transaxle.

## DESCRIPTION (Continued)



L5119-B

## 3.0L Engine

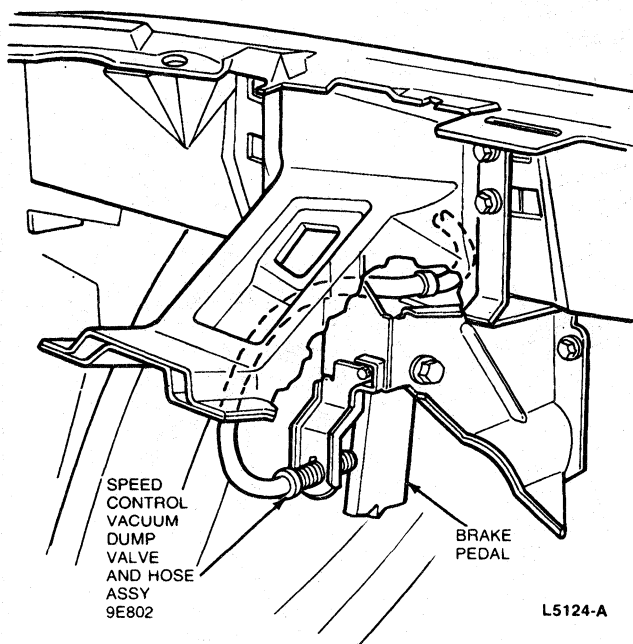


L5123-B



**DESCRIPTION (Continued)****Vacuum Dump Valve**

The vacuum dump valve provides an additional redundant safety feature in the system. Normally, when the brake pedal is depressed, an electrical signal from the stoplamps to the ECA will turn off the system. In addition, the vacuum dump valve will mechanically release the vacuum in the servo when the brake pedal is depressed, thus releasing the throttle independently of the ECA control.

**OPERATION****System Activation**

To operate the speed control system, the engine must be running and the vehicle speed must be greater than 40 km/h (25 mph) for 3.0L (183 CID) applications, or greater than 56 km/h (35 mph) for 2.5L (153 CID) applications. Under these conditions, the system is activated and is ready to accept a set speed signal by pressing the ON switch in the steering wheel. Then, the operator must depress and release the SET ACCEL switch. This will result in the current speed being maintained until a new speed is set by the operator, the brake pedal is depressed, the clutch pedal is depressed or the OFF switch is depressed.

**Decreasing Set Speed**

The vehicle speed may be reduced by applying the brake or clutch pedal and then resetting the speed using the foregoing method or by depressing the COAST switch. When the vehicle has slowed to the desired speed, the COAST switch is released and the new speed is set automatically. If the vehicle speed is reduced below 56 km/h (35 mph) for 2.5L (153 CID) or 40 km/h (25 mph) for 3.0L (183 CID), the operator must manually increase the speed and reset the system.

**Increasing Set Speed**

The vehicle set speed may be manually increased at any time by depressing the accelerator until the higher speed is reached and stabilized, then depressing and releasing the SET ACCEL button.

Speed may also be increased by depressing the SET ACCEL switch button, at speeds over 40 km/h (25 mph) for 3.0L (183 CID) or 56 km/h (35 mph) for 2.5L (153 CID), and holding it in that position. The vehicle will then automatically increase speed. When the desired rate of speed is attained and the button is released, that new set speed will be maintained.

**Resume**

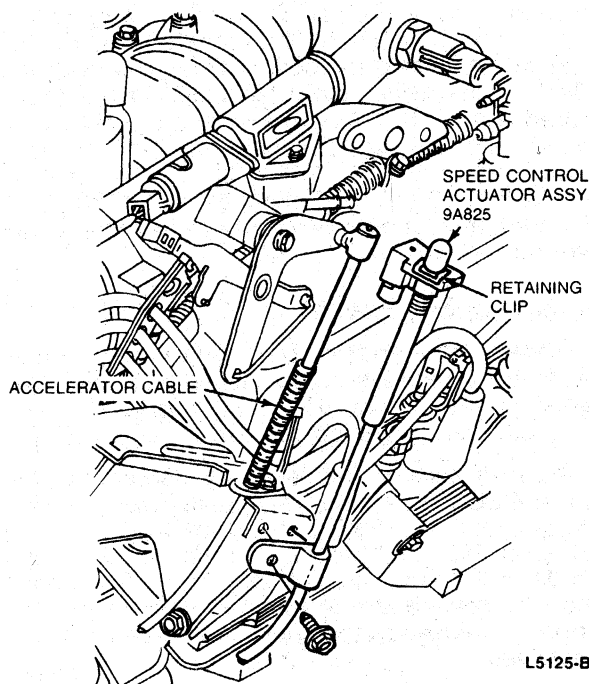
When the speed control system is deactivated by depressing the brake or clutch pedal, the set speed prior to deactivation may be re-established by momentarily depressing the RESUME switch. The RESUME switch is hinged on the side closest to the SET ACCEL switch. Therefore, it should be depressed on the side farthest from the SET ACCEL switch. The resume feature will not function if the system is deactivated with the OFF switch, or if the vehicle speed has been reduced to below 56 km/h (35 mph) for 2.5L (153 CID) 40 km/h (25 mph) for 3.0L (183 CID). In addition, when the ignition switch is turned off, the speed control memory is erased and the resume feature will not function.

**ADJUSTMENTS****Linkage Actuator Cable****3.0L Engine**

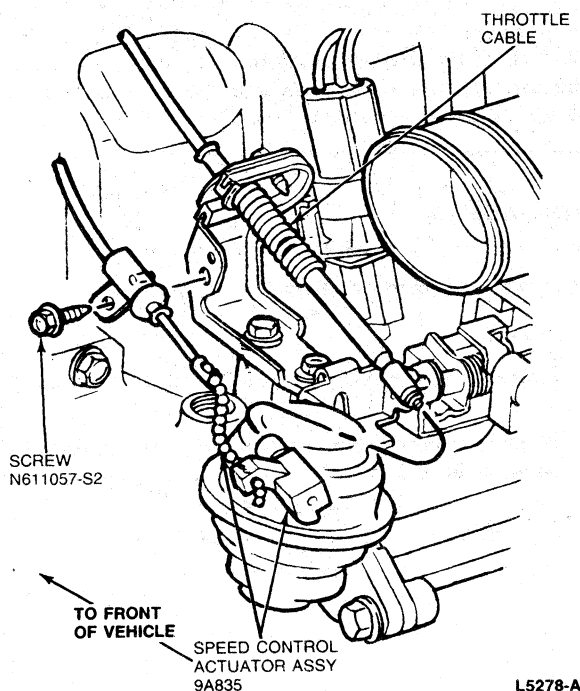
1. Remove speed control actuator cable retaining clip.
2. Push actuator cable through adjuster until slight tension is felt.

**ADJUSTMENTS (Continued)**

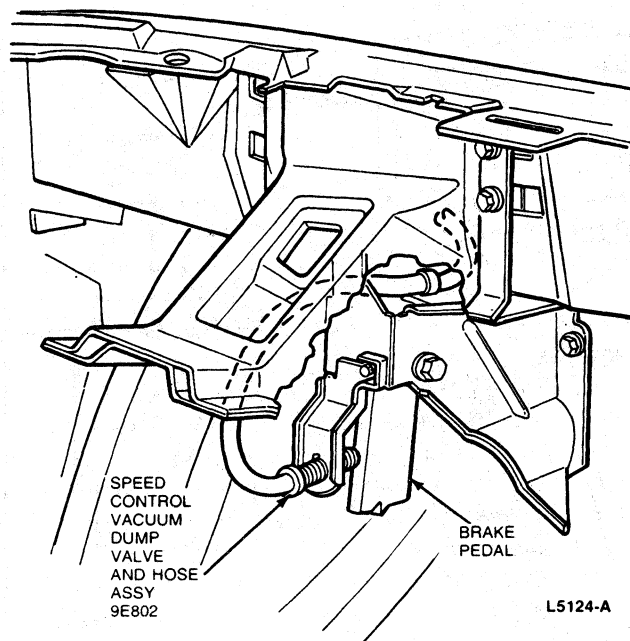
3. Insert cable retaining clip and snap into place.

**2.5L Engine**

1. Remove locking pin.
2. Pull bead chain through adjuster.
3. Insert locking pin in best hole of adjuster for tight bead chain without opening throttle plate.

**Vacuum Dump Valve**

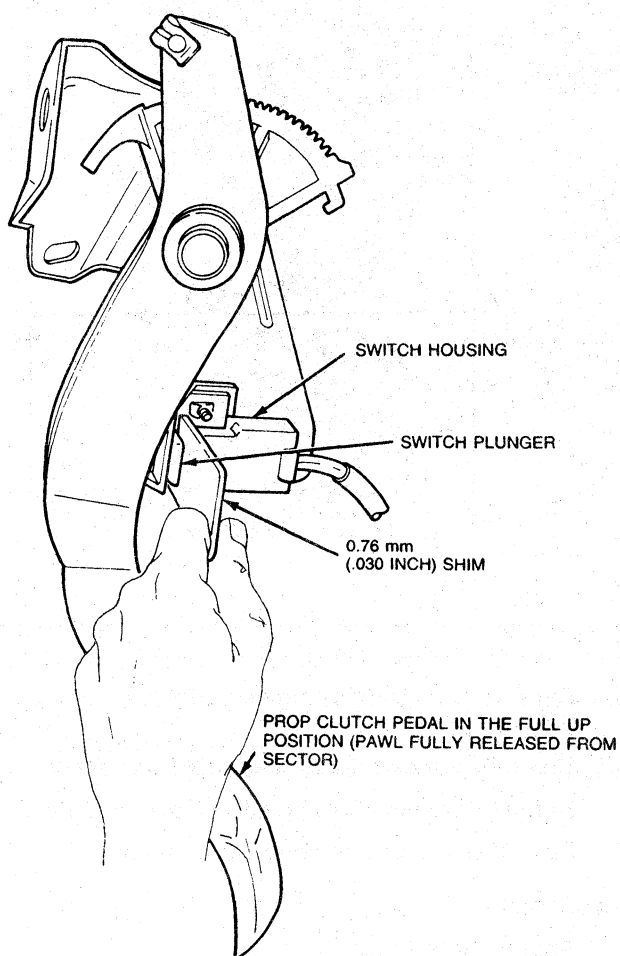
The vacuum dump valve is adjustable in its mounting bracket. It should be adjusted so that it is closed (no vacuum leak) when the brake pedal is in its normal release position (not depressed), and open when the pedal is depressed. Use a hand vacuum pump to make this adjustment.



## ADJUSTMENTS (Continued)

### Clutch Switch

1. Prop clutch pedal in full-up position (pawl fully released from sector).
2. Loosen switch mounting screw.
3. Slide switch forward toward clutch pedal until switch plunger cap is 0.76mm (0.030 inch) from contacting switch housing. Tighten attaching screw.



L4317-B

4. Remove prop from clutch pedal and test drive for clutch switch cancellation of a speed control.

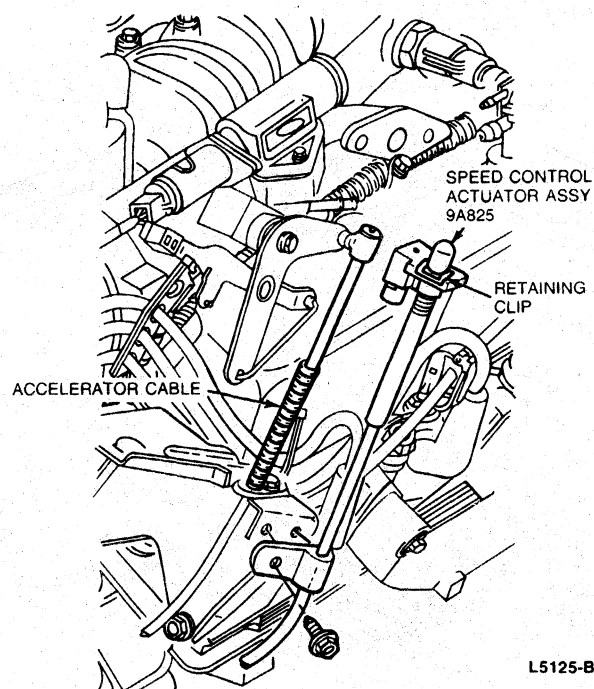
## REMOVAL AND INSTALLATION

### Servo Assembly

#### Removal

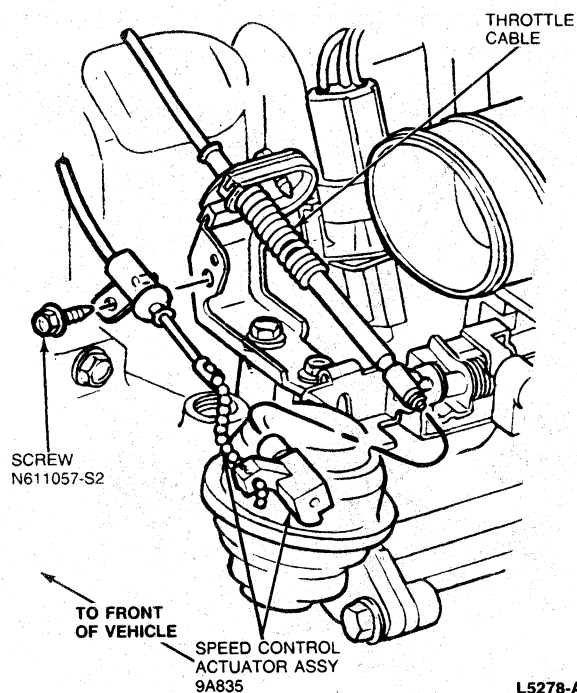
1. Remove screw and disconnect speed control actuator cable from accelerator cable bracket.
2. Disconnect speed control actuator cable with adjuster from accelerator cable.

### 3.0L Engine



L5125-B

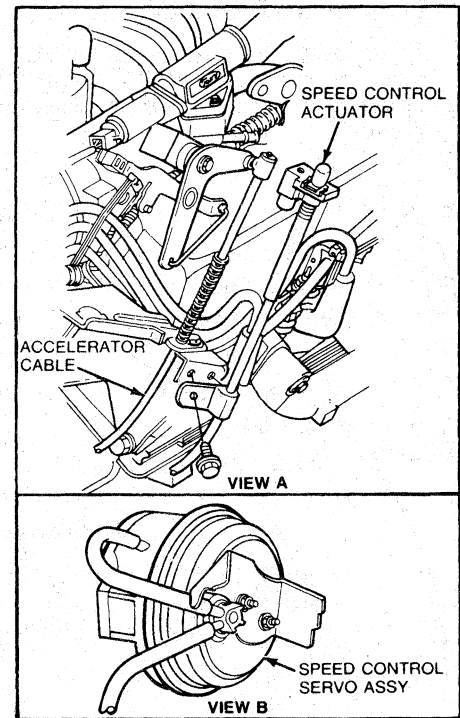
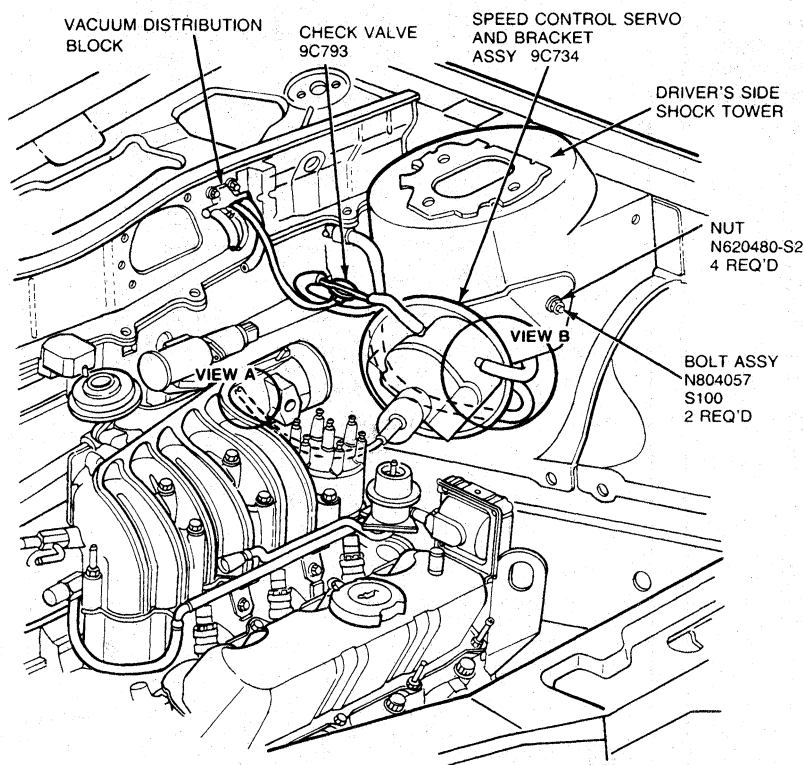
### 2.5L Engine



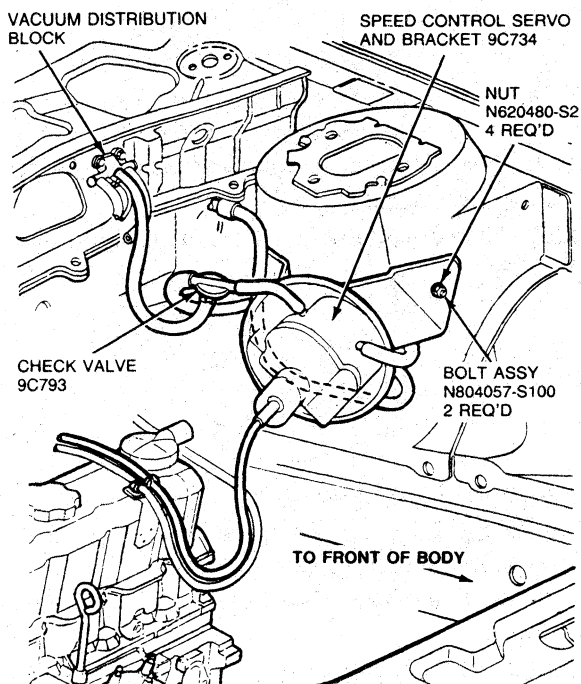
L5278-A

**REMOVAL AND INSTALLATION (Continued)**

3. Remove two vacuum hoses and electrical connector from servo assembly.

**3.0L Engine**

L5123-B

**2.5L Engine**

L5276-A

4. Remove two nuts holding servo to its mounting bracket.
5. Carefully remove servo and cable assembly.
6. Remove two nuts holding cable cover to servo.
7. Pull off cover and remove cable assembly.

**Installation**

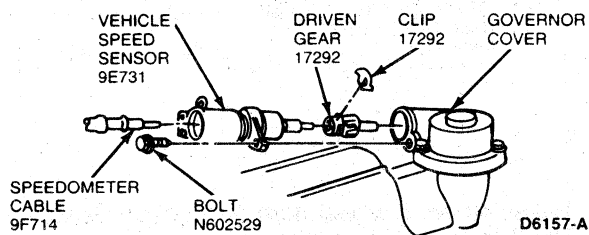
1. Attach cable to servo.
2. Attach cable cover to servo with two nuts.
3. Attach servo to mounting bracket.
4. Feed actuator cable under cleaner air duct.
5. Snap actuator cable with adjuster onto accelerator cable.
6. Connect actuator cable to accelerator cable bracket and install pushpin.
7. Install two vacuum hoses and electrical connector at servo.

**REMOVAL AND INSTALLATION (Continued)****Actuator Cable**

To replace actuator assembly, remove servo assembly, attach new actuator cable assembly to servo and install total assembly.

**Speed Sensor****AXOD Transaxle****Removal**

1. Raise vehicle on a hoist. Remove bolt retaining speed sensor mounting clip to transaxle.
2. Remove sensor and driven gear from transaxle.



D6157-A

3. Disconnect electrical connector and speedometer cable from speed sensor.
4. Disconnect speedometer cable by pulling it out of speed sensor.

NOTE: Do not attempt to remove spring retainer clip with speedometer cable in sensor.

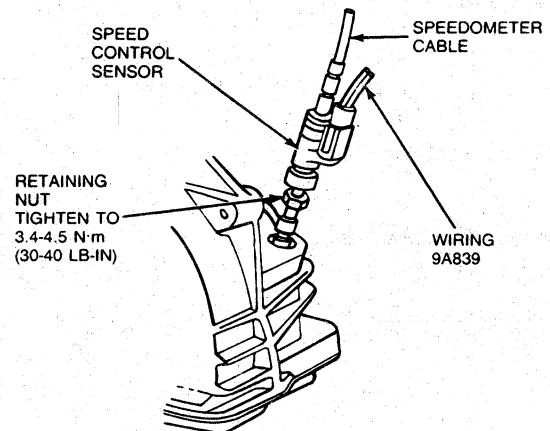
5. Remove driven gear retainer. Remove driven gear from sensor.

**Installation**

1. Position driven gear to speed sensor. Install gear retainer.
2. Connect electrical connector.
3. Ensure internal O-ring is properly seated in sensor housing. Snap speedometer cable into sensor housing.
4. Insert sensor assembly into transaxle housing. Install retaining bolt.
5. Lower vehicle.

**ATX and MTX Transaxles****Removal**

1. Raise vehicle on a hoist. Loosen retaining nut holding sensor in transaxle.
2. Remove sensor from transaxle.



RETAINING NUT  
TIGHTEN TO  
3.4-4.5 N·m  
(30-40 LB-IN)

L4871-A

3. Disconnect electrical connector.
4. Disconnect speedometer cable by pulling it out of speed sensor.

NOTE: Do not attempt to remove spring retaining clip with speedometer cable in sensor.

**Installation**

1. Connect electrical connector.
2. Ensure internal O-ring is properly seated in sensor housing. Snap speedometer cable into sensor housing.
3. Insert sensor assembly into transaxle housing. Tighten retaining nut.
4. Lower vehicle.

**EEC-IV Electronic Control Assembly (ECA)****Removal and Installation**

The ECA is located behind the glove compartment, under the instrument panel.

1. Disconnect electrical connector at ECA.
2. Remove clip attaching ECA to dash panel.
3. Remove ECA.
4. To install, reverse Steps 1, 2 and 3.

**Vacuum Dump Valve****Removal**

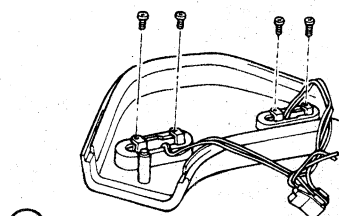
1. Remove vacuum hose from valve.
2. Remove valve from bracket.

**Installation**

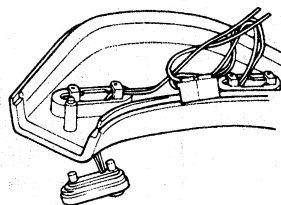
1. Install valve to bracket.
2. Connect vacuum hose.
3. Adjust valve as outlined.

**REMOVAL AND INSTALLATION (Continued)****Control Switches****Removal**

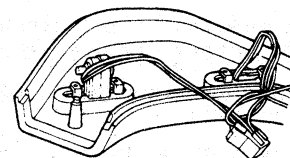
1. Remove steering wheel horn pad cover by removing two screws from back of steering wheel.
2. Disconnect wiring connector from slip ring terminal.
3. Remove speed control switch assembly from horn pad cover by removing two attaching screws from each switch.



- ① TO REMOVE SWITCH ASSY, REMOVE SCREWS AND PUSH ON BACK OF SWITCH



- ② PUSH SWITCH OUT AND ROTATE



- ③ INSERT END OF SWITCH INTO HOLE AND REMOVE SWITCH.

TO INSTALL SWITCH ASSY, REVERSE PROCEDURE

L5120-A

**Installation**

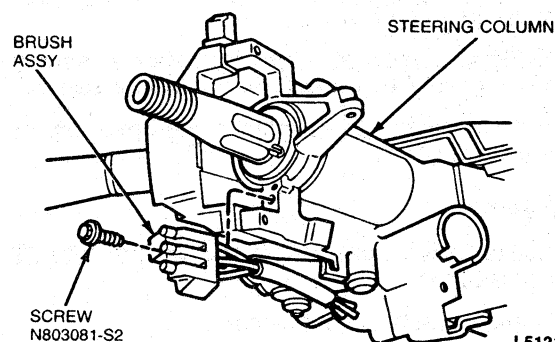
1. Install control switches into horn pad cover. Attach each switch with two screws.
2. Carefully attach control switch connector to terminal on slip ring.
3. Install steering wheel horn pad cover. Snap in latching hook at 12 o'clock position. Attach with two screws.

**Brush Assembly****Removal**

1. Remove steering wheel hub horn pad cover by removing two screws from back of steering wheel.
2. Remove and discard steering wheel attaching nut.
3. Remove steering wheel from upper shaft by grasping rim of steering wheel and pulling off. Do not use steering wheel puller.
4. Remove tilt lever, if so equipped.
5. Remove ignition lock cylinder and steering column lower trim shroud.
6. Separate speed control brush wire harness at connector and remove wire harness retainers from steering column.
7. Remove screw securing brush assembly to upper steering column.

**Installation**

1. Position brush assembly wire on upper steering column and secure with one screw.
2. Install wire harness into steering column with attached retainers. Connect harness to main wiring.



L5121-B

3. Attach lower trim shroud to upper shroud with three retaining screws.
4. Install ignition lock cylinder.
5. Position steering wheel on end of steering wheel shaft. Align index mark on wheel with index mark on shaft.
6. Install a new steering wheel nut. Tighten to 68-84 N·m (50-62 lb-ft).
7. Install steering wheel horn pad.

**REMOVAL AND INSTALLATION (Continued)****Clutch Switch****Removal**

1. Remove screw attaching switch to bracket.
2. Disconnect electrical connector.
3. Remove switch assembly.
4. Remove switch from bracket.

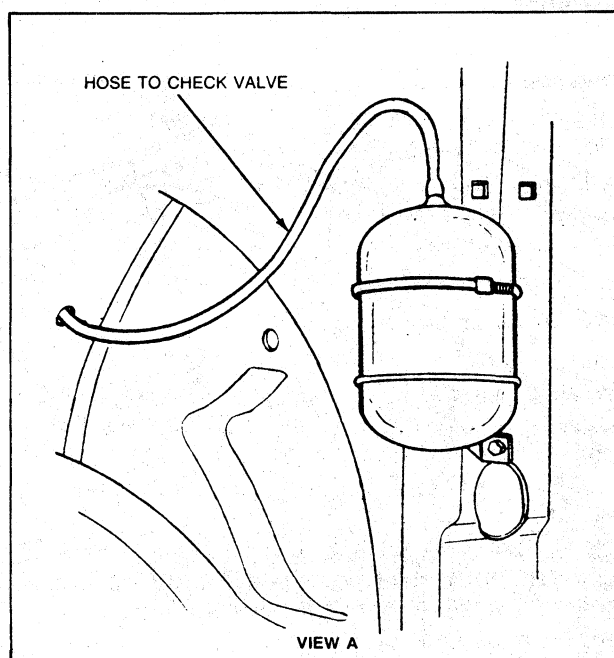
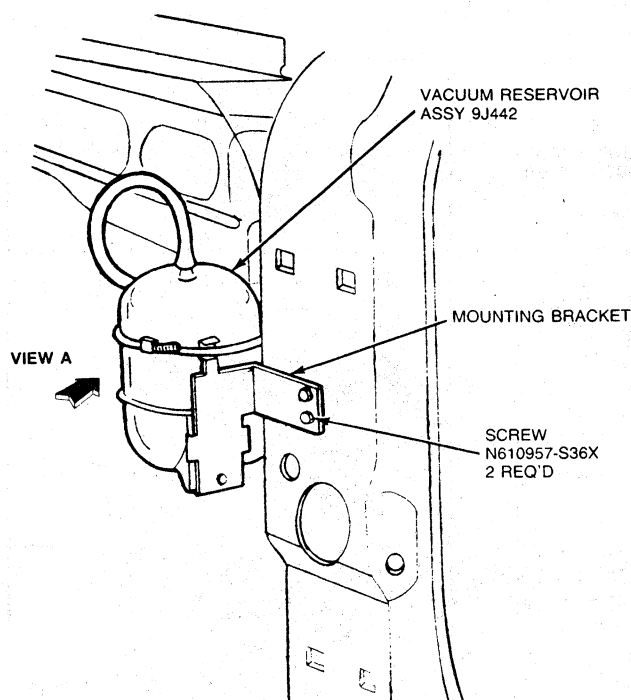
**Installation**

1. Install switch on bracket.
2. Connect electrical connector.
3. Install attaching switch to bracket.
4. Adjust clutch switch as outlined.

**Vacuum Reservoir****Removal**

1. Raise vehicle and remove LH front wheel and tire assembly. Refer to Pre-Delivery manual, Section 50-04.
2. Remove inner fender splash shield.
3. Remove hose connection at check valve in engine compartment.

4. Remove two screws retaining vacuum reservoir assembly to A-pillar.
5. Remove vacuum reservoir assembly by pulling hose through cowl side panel.



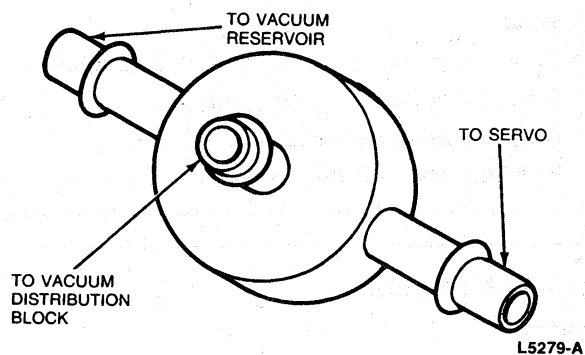
L5277-A

**Installation**

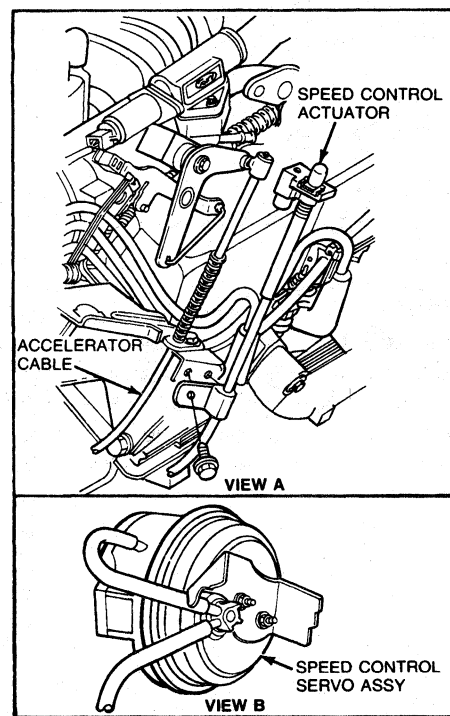
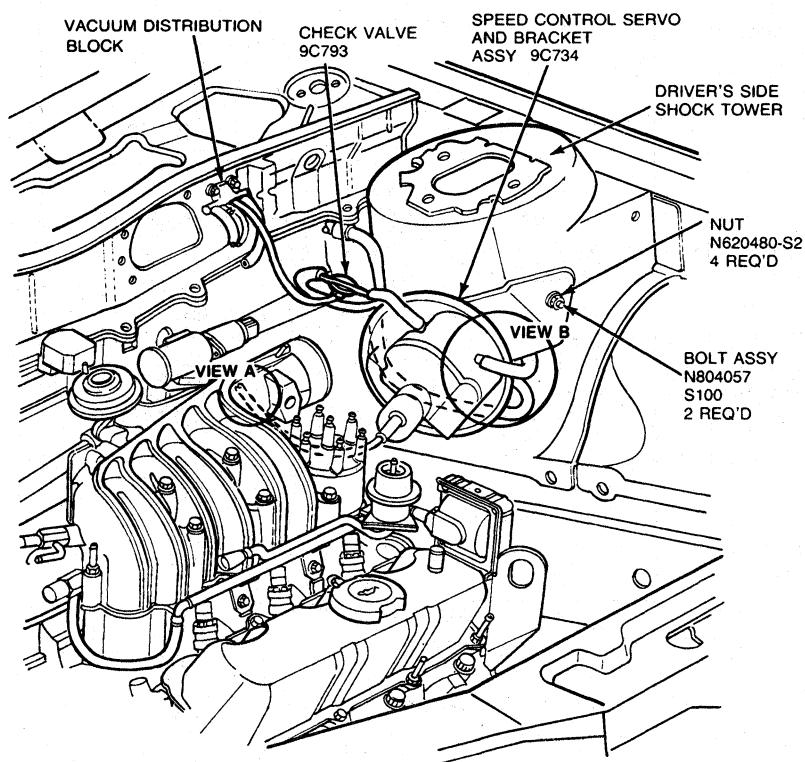
1. Attach vacuum reservoir assembly to A-pillar with two retaining screws.
2. Route vacuum hose from reservoir through cowl side panel.
3. Replace inner fender splash shield.
4. Connect hose to check valve in engine compartment.
5. Replace LH front wheel and tire assembly.
6. Lower vehicle.

**REMOVAL AND INSTALLATION (Continued)****Check Valve****Removal**

1. Disconnect hose to vacuum distribution block.
2. Disconnect hose to servo.
3. Disconnect hose to vacuum reservoir.

**Installation**

1. Connect hose from vacuum distribution block to "VAC" port on check valve.
2. Connect hose from servo.
3. Connect hose from vacuum reservoir.

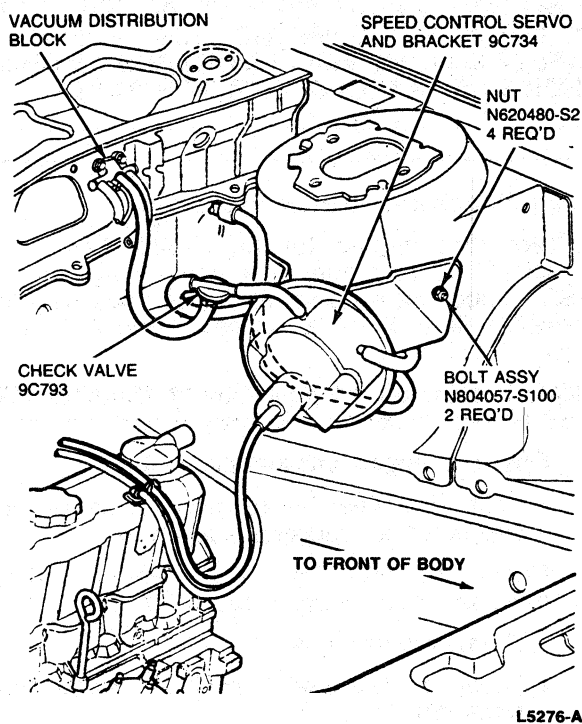
**3.0L Engine**

L5123-B



## REMOVAL AND INSTALLATION (Continued)

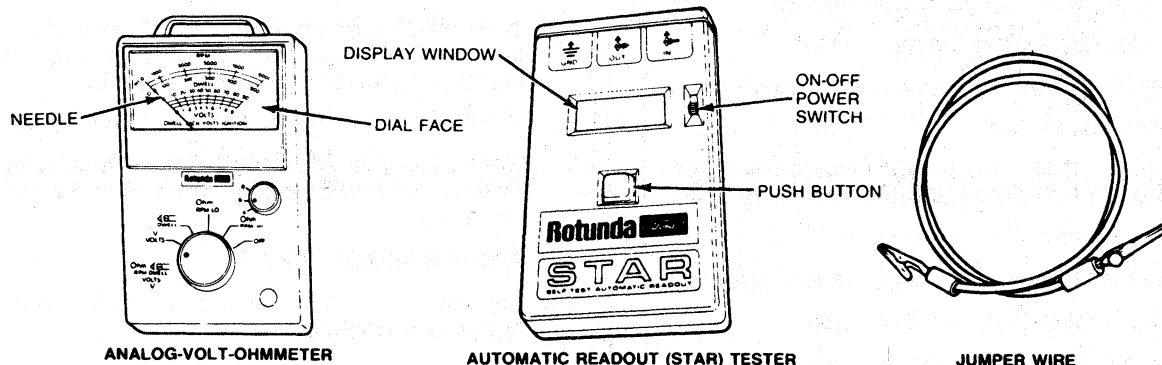
## 2.5L Engine



## TESTING

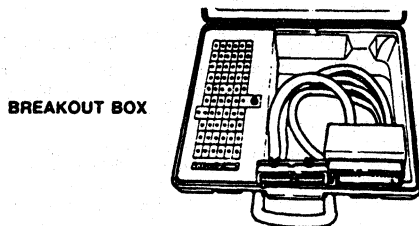
The Integrated Vehicle Speed Control (IVSC) contains a self-test capability. Key On, Engine Off (KOEO) and Key On, Engine Running (KOER) routines output error codes in a manner similar to EEC-IV subsystem "Quick Tests", which then refer to Pinpoint Tests for specific component diagnosis. The self-test capability applies only to the Taurus/Sable IVSC. The Rotunda Speed Control Automatic

System Tester 007-00013 or equivalent cannot be used for IVSC diagnosis. The Rotunda Self-Test Automatic Readout (STAR) Tester 007-00017, Super STAR Tester 007-00019, or Analog volt-ohmmeter (VOM) 059-00010 or equivalent, 0 to 20 VDC (alternate to STAR) is required to perform the IVSC Quick Test and display error codes.



**TESTING (Continued)**

A Rotunda Breakout Box 014-00322 or equivalent can also be used for convenience during Pinpoint Testing.



BREAKOUT BOX

L5130-A

Testing for the IVSC is divided into two formats: the Quick Test and Pinpoint Tests. The Quick Test is a functional IVSC system test. The Pinpoint Tests are specific component test.

The Quick Test checks all IVSC components except the speed sensor, which must be tested separately. To test and service the IVSC system, perform the Quick Test first. If the system passes, check the speed sensor. If failure codes are generated, perform only the Pinpoint Test specified by that particular failure code.

After all test and services have been completed, repeat the entire Quick Test to verify that the IVSC system operates properly.

**Quick Test****Description**

The Quick Test is a functional test of the IVSC system consisting of basic Test Steps (described below). These Steps must be carefully followed in sequence. Otherwise, mis-diagnosis or the replacement of non-faulty components may result.

**Quick Test Steps**

1. Visual Check and Vehicle Preparation:
  - Checks for obvious faults.
  - Properly prepares the vehicle for testing.
2. Equipment Hookup:
  - Ensures that the proper equipment for gathering test data is ready, prior to testing.
3. Key On, Engine Off Self-Test:
  - Is a static check of IVSC inputs and outputs.
4. Key On, Engine Running Self-Test:
  - Is a dynamic check of the IVSC with the engine in operation.

**WARNING: ANYONE WHO DEPARTS FROM THE INSTRUCTION PROVIDED IN THIS PUBLICATION MUST FIRST ESTABLISH THAT HE COMPROMISES NEITHER HIS PERSONAL SAFETY NOR THE VEHICLE INTEGRITY BY HIS CHOICE OF METHODS, TOOLS OR PARTS.**

**Visual Check and Vehicle Preparation**

Correct test results for the Quick Test are dependent on the proper operation of related non-IVSC component systems. It may be necessary to correct faults in these areas before the IVSC will pass the Quick Test.

Before hooking up any equipment to diagnose the IVSC system, make the following checks:

1. Check all engine vacuum hoses for:
  - Leaks or pinched hoses (servo to dump valve and servo to manifold vacuum).
2. Check the IVSC and EEC system wiring harness electrical connections for:
  - Proper connections.
  - Loose or detached connectors, wires and terminals.
  - Corrosion.
  - Proper routing of harness.

It may be necessary to disconnect or disassemble the connector assembly to perform some of the inspections. (Note the location of each pin before disassembly.)

3. Check the EEC-IV ECA and IVSC sensors and actuators for physical damage.
4. Perform all safety steps required to start and run operation vehicle tests.
5. Apply the emergency brake. Place the shift lever in PARK (NEUTRAL for manual transmission).
6. Turn off all electrical loads such as the radio, lamps, air conditioner, etc. Ensure doors are closed whenever readings are made.
7. Verify engine coolant is at the specified level.
8. Start the engine and idle until the upper radiator hose is hot and pressurized and the throttle is off fast idle.
9. Turn the ignition key off.
10. Service items as required, and proceed to equipment hookup.

**TESTING (Continued)****Equipment Hookup****Using the STAR tester:**

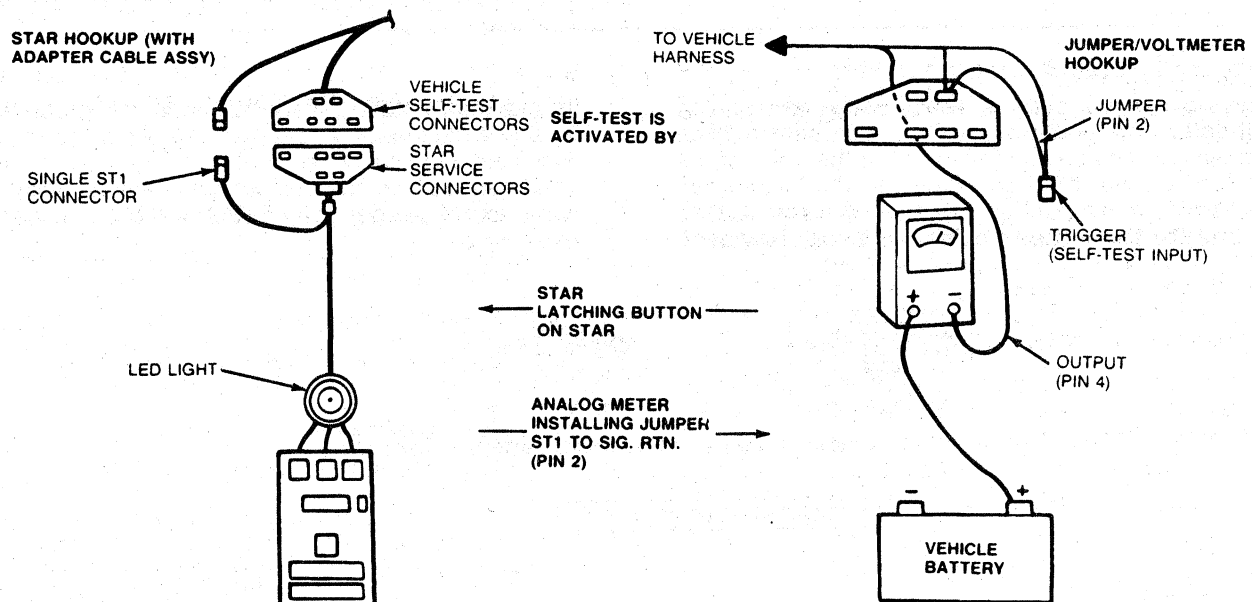
- Turn the ignition key off.
- Connect the color-coded adapter cable leads to the STAR tester.
- Connect the adapter cable's two service connectors to the vehicle's appropriate Self-Test connectors.

After equipment hookup, go on to Self Testing.

**Using analog voltmeter:**

- Turn ignition key off.
- Connect a jumper wire from Self-Test input (STI) to Pin 2, Signal Return on the Self-Test connector (refer to the diagram below).
- Set analog VOM on a DC voltage range to read from 0 to 15 volts DC. Connect VOM from battery (+) to Pin 4 Self-Test Output (STO), in the Self-Test connector.

After equipment hookup go on to Self Testing.



L5131-A

**Quick Test Self-Test**

Quick Test Self-Testing is divided into two specialized test: Key On, Engine Off, and Key On, Engine Running. The Self-Test is not a conclusive test by itself, but is used as a part of the functional Quick Test diagnostic procedure. The processor stores the Self-Test program in its permanent memory. When activated, it checks the IVSC system by testing its functional capability and verifies that various sensors and actuators are connected and operating properly.

The Key On, Engine Off and Engine Running tests are functional tests which only detect faults present at the time of the Self Test.

**Key On, Engine Off Test**

At this time, a test of the IVSC system is conducted with power applied and engine at rest.

The fault must be present at the time of testing for errors to be detected in this test.

**Key On, Engine Running Test**

At this time, a test of the IVSC system is conducted with the engine running. The system is checked under actual operating conditions and at normal operating temperatures. The actuators are exercised and checked for corresponding results.

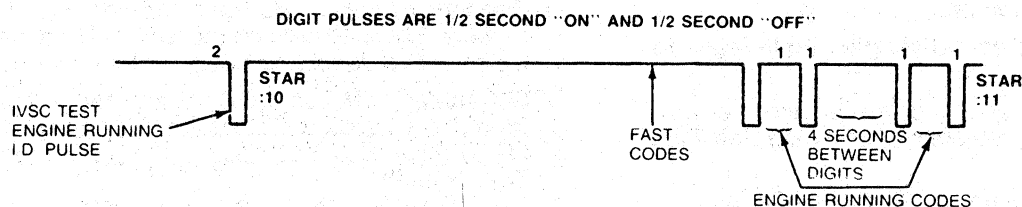
**Service Codes**

The EEC-IV system communicates service information to the outside world by way of the Self-Test service codes. These service codes are two-digit numbers representing the results of the Self Test.

The service codes are transmitted on the Self-Test output (found in the Self-Test connector) in the form of timed pulses, and read by the technician on a voltmeter or on the STAR tester.

## TESTING (Continued)

## Self-Test Output Code Format

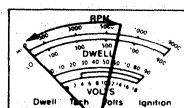
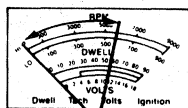


L5132-A

## Reading Codes—Analog Voltmeter

When a service code is reported on the analog voltmeter for a function test, it will represent itself as a pulsing or sweeping movement of the voltmeter's needle across the dial face of the voltmeter. Therefore, a single-digit number of three will be reported by three needle pulses (sweeps). However,

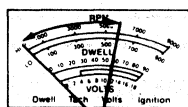
as previously stated, a service code is represented by a two-digit number, such as 2-3. As a result, the Self-Test service code of 2-3 will appear on the voltmeter as two needle pulses (sweeps). After a two-second pause, the needle will pulse (sweep) three times.



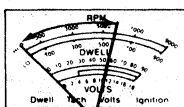
1 NEEDLE PULSE (SWEEP) + 1 NEEDLE PULSE (SWEEP) = 2 NEEDLE PULSES (SWEEPS) FOR 1ST DIGIT

2-SECOND PAUSE BETWEEN DIGITS

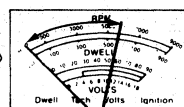
:23



1 NEEDLE PULSE (SWEEP) FOR 1/2 SECOND



1 NEEDLE PULSE (SWEEP) FOR 1/2 SECOND



1 NEEDLE PULSE (SWEEP) FOR 1/2 SECOND

3 NEEDLE PULSES (SWEEPS) FOR 2ND DIGIT

4-SECOND PAUSE BETWEEN SERVICE CODES, WHEN MORE THAN ONE CODE IS INDICATED

A8205-B

**TESTING (Continued)****Reading Codes—Rotunda Self-Test Automatic Readout (STAR) Tester 007-00017, or Super STAR Tester 007-00019 or Equivalent**

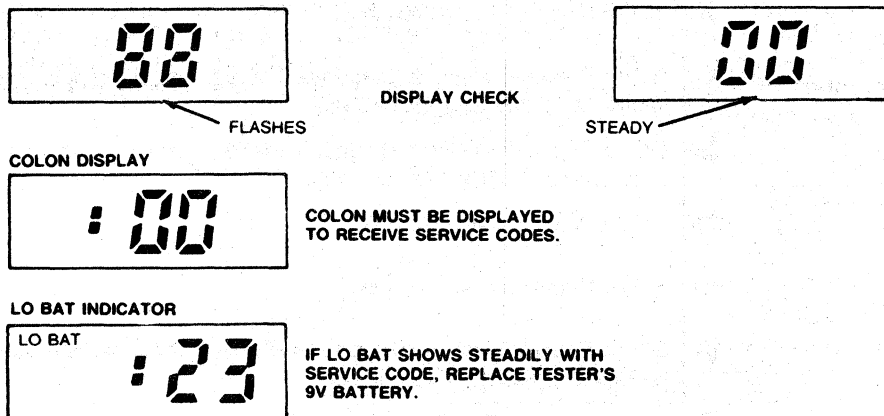
After hooking up the STAR tester and turning on its power switch, the tester will run a display check and the numerals 88 will begin to flash in the display window. A steady 00 will then appear to signify that the STAR tester is ready to start the Self-Test and receive the test's service codes.

To receive the service codes, press the push button at the front of the STAR tester. The button will latch down, and a colon will appear in the display window in front of the 00 numerals. The colon must be displayed to receive the service codes.

If for any reason the technician wishes to clear the display window during the Self Test, he must turn off

the vehicle's engine, press the tester's push buttons once to unlatch it (colon will disappear), then press the button again to latch down the button (colon will appear again). Every time the STAR tester is turned off, the low battery indicator (LO BAT) should show briefly at the upper LH corner to the tester's display window. If the LO BAT indicator shows steadily at any other time during the operation of the STAR tester with any service code, turn its power switch to OFF and replace the 9-volt battery in the tester.

The STAR tester will display the last service code received, even after it has been disconnected from the vehicle. It will hold the service code on the display until the power is turned off or the push button is unlatched and relatched.



A8186-A

**QUICK TEST: KEY ON, ENGINE OFF (KOEO) SELF-TEST****A CODE OUTPUT**

To activate the KOEO IVSC test, do the following:

- Place transaxle shift lever in PARK (AXOD or ATX) or NEUTRAL (MTX).
- Leave single STI connector unplugged; plug in multipin self-test connector.
- Turn on STAR tester by moving slide switch to ON position.
- Press STAR pushbutton.
- Turn ignition key to RUN position.
- Within 10 seconds, press speed control ON switch.
- Observe code 10 on STAR display (indicates IVSC test in progress).
- Press speed control OFF, COAST, ACCEL, RESUME buttons; tap brake pedal once; depress clutch pedal once (if so equipped).

NOTE: Do not depress throttle during KOEO self-test.

- Observe and record all Service Codes indicated. One of the following outputs will occur.

RESULTS	ACTION TO TAKE
Code Displayed	
11	KEY ON ENGINE OFF TEST indicates a pass. GO To KEY ON ENGINE RUNNING (KOER) SELF-TEST.
Any other code(s)	KEY ON ENGINE OFF TEST indicates a fault. Record codes and GO To Step B.
NO CODES OUTPUTTED	Repeat SELF-TEST and verify that no service codes are present. GO To Pinpoint Test Step Q1.

CL5133-B

## TESTING (Continued)

## QUICK TEST: KEY ON, ENGINE OFF (KOEO) SELF-TEST — Continued

B	RESULTS AND ACTION TO TAKE	
<ul style="list-style-type: none"><li>● Using the KEY ON ENGINE OFF service codes from Step A, follow the instructions in the ACTION TO TAKE column in this step.</li><li>● When more than one service code is received always start with the first code received.</li><li>● Whenever a service is made, REPEAT QUICK TEST.</li></ul> <p>NOTE: Before proceeding to the specified Pinpoint Test, read the instructions on how to use the Pinpoint Tests at the beginning of the Pinpoint Test section.</p>		
RESULT		ACTION TO TAKE
ON DEMAND SERVICE CODES		
23	▶	GO to Engine/Emissions Diagnosis Manual*. After service, return to this section and REPEAT Quick Test.
47	▶	GO to Pinpoint Test Step <b>A1</b> .
48	▶	GO to Pinpoint Test Step <b>A3</b> .
49	▶	GO to Pinpoint Test Step <b>A5</b> .
53	▶	GO to Engine/Emissions Diagnosis Manual*. After service, return to this section and REPEAT Quick Test.
63	▶	GO to Engine/Emissions Diagnosis Manual*. After service, return to this section and REPEAT Quick Test.
74	▶	GO to Pinpoint Test Step <b>B1</b> .
75	▶	GO to Pinpoint Test Step <b>B4</b> .
67	▶	GO to Engine/Emissions Diagnosis Manual*. After service, return to this section and REPEAT Quick Test.
81	▶	GO to Pinpoint Test Step <b>C1</b> .
82	▶	GO to Pinpoint Test Step <b>C5</b> .
<p>NOTE: Service codes 23, 53, 63 and 67 are common with EEC-IV Diagnostics. These service codes must be diagnosed using the Engine/Emissions Diagnosis Manual.</p>		

\*Can be purchased as a separate item.

CL5134-B

**TESTING (Continued)****QUICK TEST: KEY ON, ENGINE RUNNING (KOER) SELF-TEST**

<b>A CODE OUTPUT</b>	
<p>Before running KOER Self-Test, start the engine and idle until the upper radiator hose is hot and pressurized, with the throttle off fast idle and the idle stabilized, then shut engine off.</p> <p>To activate the KOER self-test, do the following:</p> <ul style="list-style-type: none"> <li>● Connect STAR self-test and STI connectors.</li> <li>● Start engine, turn on STAR tester by moving slide switch to ON position.</li> <li>● Within 30 seconds of starting engine, press speed control ON switch.</li> <li>● Within 15 seconds, press STAR pushbutton.</li> <li>● Observe code 10 on STAR display (indicates IVSC test in progress).</li> <li>● Observe and record all Service Codes indicated. One of the following outputs will occur.</li> </ul> <p>NOTE: Do not depress throttle or brake pedal during the KOER Self-Test. This procedure must be followed exactly to obtain IVSC KOER Self-Test.</p> <p>NOTE: The engine may stall at test exit. Turn off the ignition to prevent entry into EEC-IV Key On, Engine Off Self-Test.</p>	
<b>RESULTS</b>	<b>ACTION TO TAKE</b>
Code Displayed	
11	ENGINE RUNNING SELF-TEST indicates a pass. If the drive symptom is currently present, GO To DIAGNOSTIC BY SYMPTOM. Otherwise testing is complete, IVSC system is OK.
ANY OTHER CODE(S)	ENGINE RUNNING SELF-TEST indicates a fault. GO To STEP B.
NO CODES OUTPUTTED	Repeat SELF-TEST and verify that no service codes are present, then GO To Pinpoint Test Step Q1.

CL5135-B

**QUICK TEST: KEY ON, ENGINE RUNNING (KOER) SELF-TEST**

<b>B RESULTS AND ACTION TO TAKE</b>	
<ul style="list-style-type: none"> <li>● Using the ENGINE RUNNING service codes from Step A, follow the instructions in the ACTION TO TAKE column in this step.</li> <li>● When more than one service code is received, always start service with the first code received.</li> <li>● Whenever a service is made, REPEAT QUICK TEST.</li> </ul>	
<b>RESULT</b>	<b>ACTION TO TAKE</b>
ENGINE RUNNING SERVICE CODES	
27	Go to Pinpoint Test Step <b>E1</b> .
28	GO to Pinpoint Test Step <b>E4</b> .
36	GO to Pinpoint Test Step <b>D1</b> .
37	GO to Pinpoint Test Step <b>F1</b> .

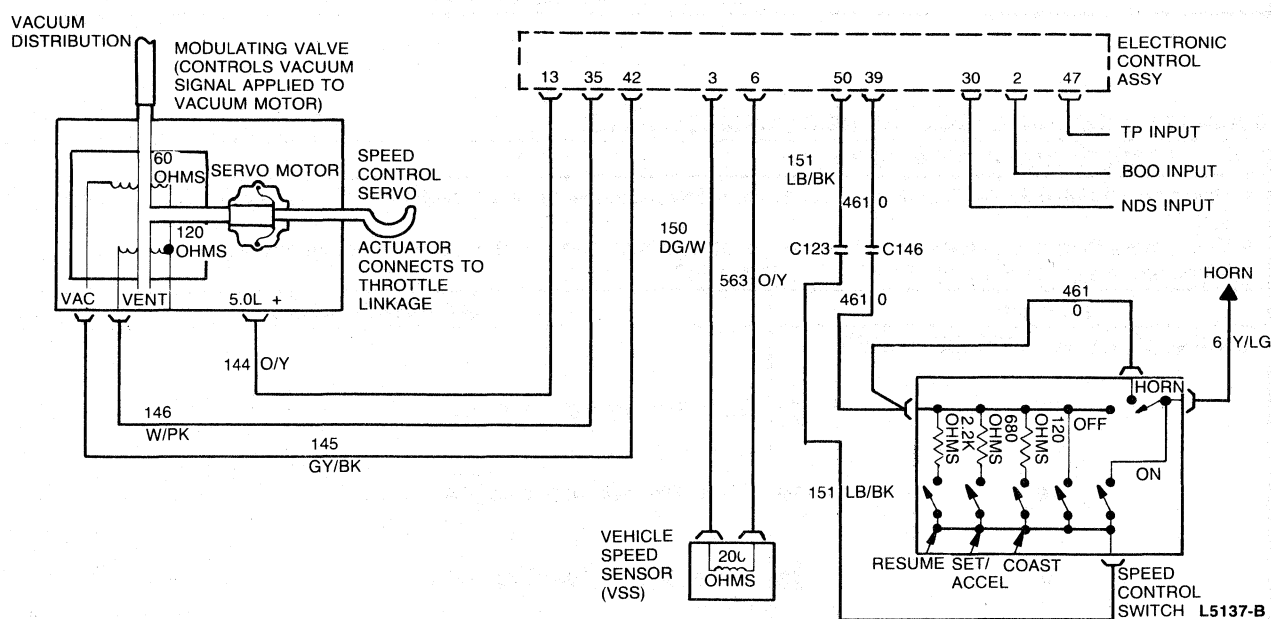
CL5136-B

## TESTING (Continued)

## Pinpoint Tests

## Instructions for Using the Pinpoint Tests

- Do not run any of the following Pinpoint Tests unless instructed by the Quick Test. Each Pinpoint Test assumes that a fault has been detected in the system with direction to enter a specific service routine. Performing any Pinpoint Test without direction from the Quick Test may produce incorrect results and cause replacement of undamaged components.
- Do not replace any parts unless the test result indicates that they should be replaced.
- When more than one service code is received, always start service with the first code received.
- Do not measure voltage or resistance at the ECA or connect any test lights to it, unless otherwise specified.
- Isolate both ends of a circuit, and turn the ignition key off whenever checking for shorts or continuity, unless otherwise specified.
- Disconnect solenoids and switches from the harness before measuring for continuity, resistance or energizing by way of 12-volt source, unless otherwise instructed.
- In using the Pinpoint Tests, follow each Step in order, starting from the first Step in the appropriate test. Follow each Step until the fault is found.
- After completing any service to the IVSC system, verify that all components are properly reconnected and repeat the Quick Test.
- An open is defined as any resistance reading greater than 5 ohms unless otherwise specified.
- A short is defined as any resistance reading less than 10,000 ohms to ground, unless otherwise specified.
- Refer to the following wiring diagram as necessary during Pinpoint testing.



## DIAGNOSTIC BY SYMPTOM

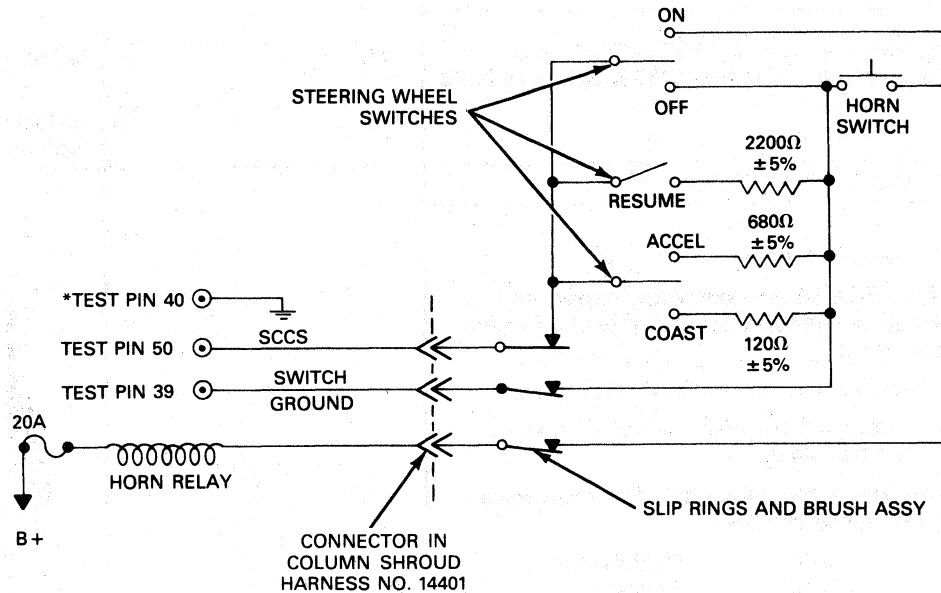
SYMPTOM	RESULT	ACTION TO TAKE
<ul style="list-style-type: none"> <li>Speed control does not work.</li> <li>Code "11" displayed on QUICK TESTS.</li> </ul>		GO to G.

CL5151-A



## TESTING (Continued)

## SPEED CONTROL SWITCHES — PINPOINT TEST A



\*TEST PINS LOCATED ON BREAKOUT BOX

## STOP-WARNING

You should enter this Pinpoint Test only when a Service Code 47, 48 or 49 is received in the KOEO Self-Test.

To prevent the replacement of good components, be aware that the following non-IVSC areas may be at fault:

- Horn relay
- Fuse

This Pinpoint Test is intended to diagnose only the following:

- Speed control switches
- Brush assembly
- Slip ring assembly
- Wiring harness
- ECA

## TESTING (Continued)

## SPEED CONTROL SWITCHES — PIN POINT TEST A — Continued

TEST STEP		RESULT	ACTION TO TAKE
A1	SERVICE CODE 47		
● Did you press the OFF, COAST, ACCEL, and RESUME buttons during the IVSC KOEO Self-Test?		Yes	GO to A2.
		No	RERUN IVSC KOEO Self-Test.
A2	SWITCH DOES NOT FUNCTION		
● Key Off, wait 10 seconds.			
● Disconnect ECA 60 Pin connector. Inspect for damaged pins, corrosion, loose wires, etc. Service as necessary.			
● Install Breakout box, leave ECA disconnected.			
● Measure resistance between test Pin 50 and test Pin 39 per table below.			
● Rotate steering wheel through its full range while making resistance checks.			
DVOM Range	Button Pressed	Resistance Range	
200 ohm	OFF	0-4 ohms	
200 ohm	COAST	114-126 ohms	
2000 ohm	ACCEL	646-714 ohms	
5000 ohm	RESUME	2090-2310 ohms	
● Are resistances within range?		No	REPLACE switches.
		Yes	REPLACE ECA.
● Do resistance values fluctuate within the ranges, or go above the ranges, as steering wheel is rotated?		No	Switches OK.
		Yes	CLEAN brushes and slip rings, relubricate slip rings.

CL5139-A

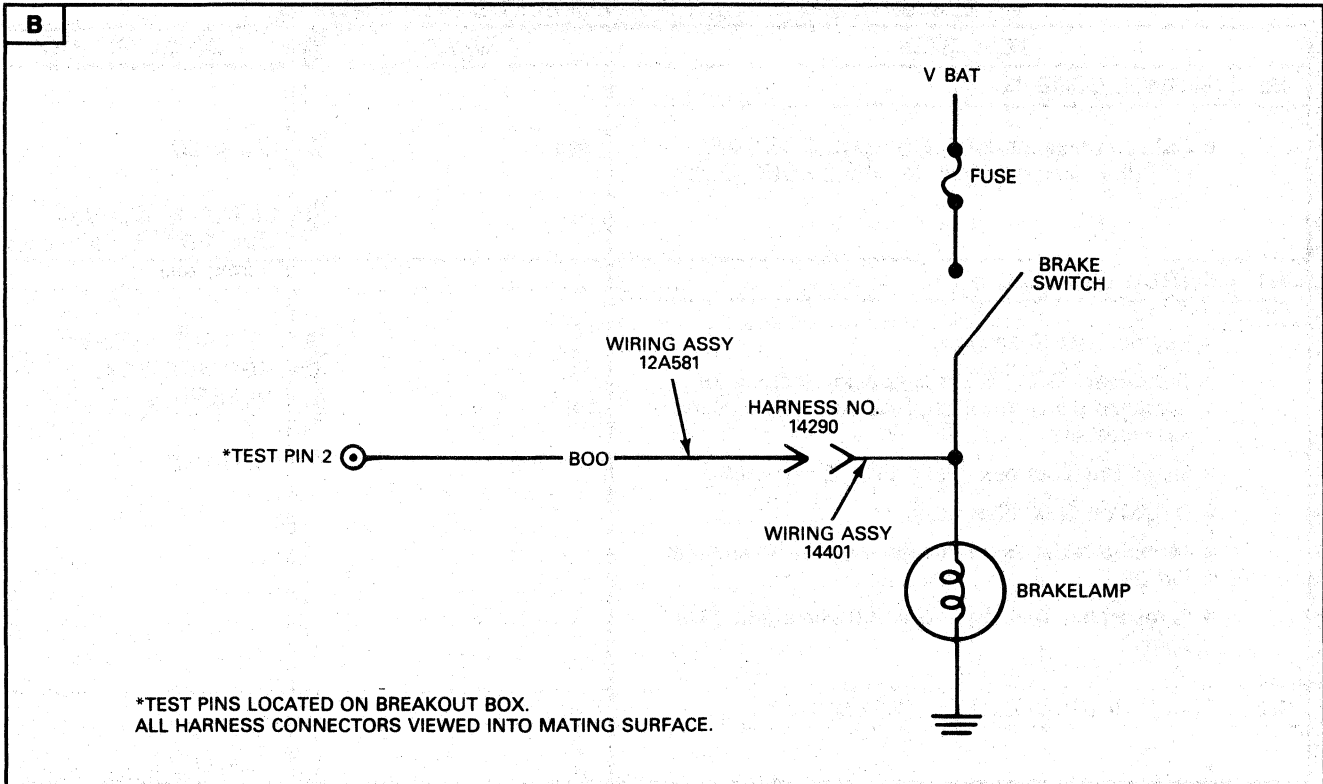
## TESTING (Continued)

## SPEED CONTROL SWITCHES — PINPOINT TEST A — Continued

TEST STEP		RESULT	ACTION TO TAKE
<b>A3</b>	<b>SERVICE CODE 48</b>		
	<ul style="list-style-type: none"> <li>Did you press the OFF, COAST, ACCEL, and RESUME buttons during the IVSC KOEO Quick Test?</li> </ul>	Yes  No	GO to A4.  RERUN IVSC KOEO QUICK TEST.
<b>A4</b>	<b>SWITCH IS STUCK</b>		
	<ul style="list-style-type: none"> <li>Key off, wait 10 seconds.</li> <li>Disconnect ECA 60 Pin connector. Inspect for damaged pins, corrosion, loose wires, etc. Service as necessary.</li> <li>Install Breakout box, leave ECA disconnected.</li> <li>DVOM on 5000 ohm scale.</li> <li>Measure resistance between test Pin 50 and test Pin 39.</li> <li>Is resistance reading between 0 ohms and 2310 ohms?</li> </ul>	Yes  No	REPLACE switches.  REPLACE ECA.
<b>A5</b>	<b>SERVICE CODE 49</b>		
	<ul style="list-style-type: none"> <li>Did you press the OFF, COAST, ACCEL, and RESUME buttons during the IVSC KOEO QUICK TEST?</li> </ul>	Yes  No	GO to A6.  RERUN IVSC KOEO QUICK TEST.
<b>A6</b>	<b>GROUND CIRCUIT TO SWITCHES OPEN</b>		
	<ul style="list-style-type: none"> <li>Key off, wait 10 seconds.</li> <li>Disconnect ECA 60 Pin connector. Inspect for damaged pins, corrosion, loose wires, etc. Service as necessary.</li> <li>Install Breakout box, leave ECA disconnected.</li> <li>Disconnect speed control switch plug in steering column shroud.</li> <li>DVOM on 200 ohm scale.</li> <li>Measure resistance between test Pin 39 and ground terminal in 14290 half of disconnected switch plug.</li> <li>Is resistance reading greater than 5 ohms?</li> </ul>	Yes  No	SERVICE open circuit between EEC-IV connector Pin 39 and switch plug ground terminal.  REPLACE ECA.

## TESTING (Continued)

## BRAKE ON/OFF (BOO) — PINPOINT TEST B

**STOP-WARNING**

You should enter this Pinpoint Test only when a Service Code 74 or 75 is received in the KOEO Self-Test.

To prevent the replacement of good components, be aware that the following non-IVSC areas may be at fault:

- Brakelamp, brake switch, and fuse

This pinpoint test is intended to diagnose only the following:

- BOO circuit
- ECA

CL5141-B

## TESTING (Continued)

## BRAKE ON/OFF (BOO) — PINPOINT TEST B — Continued

TEST STEP		RESULT	ACTION TO TAKE
<b>B1</b>	<b>SERVICE CODE 74</b>		
	<ul style="list-style-type: none"> <li>Did you press brake during the KOEO Self-Test?</li> </ul>	Yes  No	GO to B2.  RERUN KOEO Self-Test, PRESS brake once during test.
<b>B2</b>	<b>BOO CIRCUIT CYCLING</b>		
	<ul style="list-style-type: none"> <li>Key off, wait 10 seconds.</li> <li>Disconnect ECA 60 Pin connector. Inspect for damaged pins, corrosion, loose wires, etc. Service as necessary.</li> <li>Install Breakout box, leave ECA disconnected.</li> <li>DVOM on 20V scale.</li> <li>Measure voltage between test Pin 2 and test Pin 40 at the Breakout box while depressing and releasing brake.</li> <li>Does the voltage cycle?</li> </ul>	Yes  No	REPLACE ECA. RETEST.  GO to B3.
<b>B3</b>	<b>BOO CIRCUIT SHORT TO GROUND</b>		
	<ul style="list-style-type: none"> <li>Key off.</li> <li>Breakout box installed.</li> <li>ECA disconnected.</li> <li>DVOM on 200 Ohm scale.</li> <li>Disconnect BOO circuit from 14290 harness (12 pin connector).</li> <li>Measure resistance between test Pin 2 at the Breakout box and ground.</li> <li>Is resistance reading greater than 5 ohms?</li> </ul>	No  Yes	SERVICE BOO circuit short to ground.  GO to Shop Manual Section 32-20 to SERVICE stoplamp circuit.

CL5142-A

## TESTING (Continued)

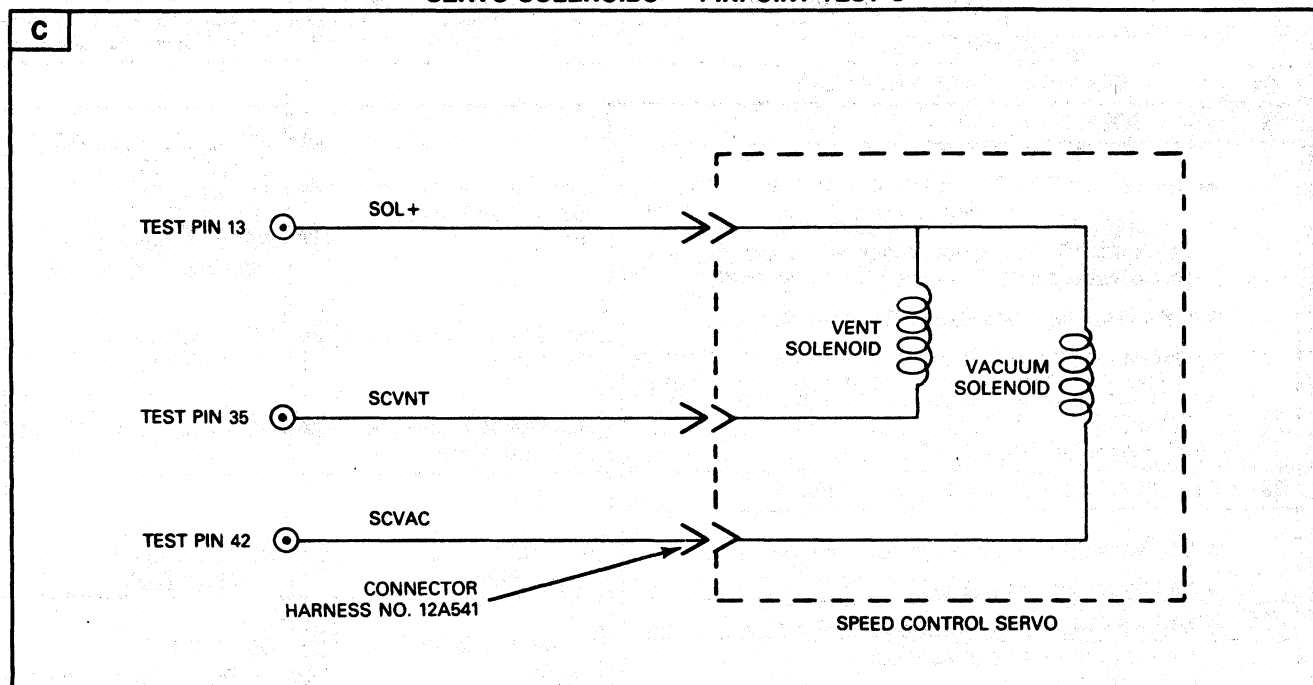
## BRAKE ON/OFF (BOO) — PINPOINT TEST B — Continued

TEST STEP		RESULT	ACTION TO TAKE
<b>B4</b>	<b>BOO CIRCUIT CYCLING CODE 75</b>		
<ul style="list-style-type: none"> <li>● Key off, wait 10 seconds.</li> <li>● Disconnect ECA 60 Pin connector. Inspect for damaged pins, corrosion, loose wires, etc. Service as necessary.</li> <li>● Install Breakout box, leave ECA disconnected.</li> <li>● DVOM on 20V scale.</li> <li>● Measure voltage between test Pin 2 and test Pin 40 at the Breakout box while depressing and releasing brake.</li> <li>● Does the voltage cycle?</li> </ul>		Yes	REPLACE ECA. RERUN QUICK TEST.
		No	GO to B5.
<b>B5</b>	<b>BOO CIRCUIT SHORT TO POWER</b>		
<ul style="list-style-type: none"> <li>● Key off.</li> <li>● Breakout box installed.</li> <li>● ECA disconnected.</li> <li>● DVOM on 20V scale.</li> <li>● Disconnect BOO circuit from 14290 harness (12 pin connector).</li> <li>● Measure voltage between test Pin 2 at the Breakout box and Engine Block Ground.</li> <li>● Is voltage reading greater than 10.5V?</li> </ul>		Yes	SERVICE BOO circuit short to power.
		No	BOO circuit OK. GO to Shop Manual Section 32-20 to SERVICE stoplamp circuit.

CL5143-A

## TESTING (Continued)

## SERVO SOLENOIDS — PINPOINT TEST C

**STOP-WARNING**

You should enter this Pinpoint Test only when a Service Code 81 or 82 is received in the KOEO Self-Test.

This Pinpoint Test is intended to diagnose only the following:

- Servo vent solenoid
- Servo vacuum solenoid
- Circuits SOL + , SCVNT, and SCVAC
- ECA

CL5144-B

## TESTING (Continued)

## SERVO SOLENOIDS — PINPOINT TEST C — Continued

TEST STEP		RESULT	ACTION TO TAKE
<b>SERVICE CODE 81 OR SERVICE CODES 81 AND 82</b>			
<b>C1</b>	<b>VENT SOLENOID TEST</b>		
<ul style="list-style-type: none"> <li>• Key off.</li> <li>• Disconnect ECA 60 Pin connector. Inspect for damaged pins, corrosion, loose wires, etc. Service as necessary.</li> <li>• Install Breakout box, leave ECA disconnected.</li> <li>• DVOM on 200 ohm scale.</li> <li>• Measure resistance between test Pin 13 and test Pin 35.</li> </ul>		Resistance is between 100 and 150 ohms	▶ If code 81 only, REPLACE ECA and REPEAT quick test. Otherwise GO to <b>C2</b> .
		Resistance is less than 100 ohms	▶ REPLACE servo. REPEAT QUICK TEST.
		Resistance is greater than 150 ohms	▶ GO to <b>C2</b> .
<b>C2</b>	<b>CHECK CONTINUITY OF SOL + CIRCUIT</b>		
<ul style="list-style-type: none"> <li>• Disconnect harness connector from the servo.</li> <li>• DVOM on 200 ohm scale.</li> <li>• Measure resistance between test Pin 13 and SOL + Circuit at the harness connector.</li> </ul>		Resistance is greater than 5 ohms	▶ SERVICE open circuit. REPEAT QUICK TEST.
		Resistance is less than 5 ohms	▶ GO to <b>C3</b> .
<b>C3</b>	<b>CHECK CONTINUITY OF SCVNT CIRCUIT</b>		
<ul style="list-style-type: none"> <li>• Disconnect harness connector from the servo.</li> <li>• DVOM on 200 ohm scale.</li> <li>• Measure resistance between test Pin 35 and SCVNT Circuit at the harness connector.</li> </ul>		Resistance is greater than 5 ohms	▶ SERVICE open circuit. REPEAT QUICK TEST.
		Resistance is less than 5 ohms	▶ GO to <b>C4</b> .

## SERVO SOLENOIDS — PINPOINT TEST C — Continued

CL5145-B

TEST STEP		RESULT	ACTION TO TAKE
<b>C4</b>	<b>MEASURE SCVNT SOLENOID RESISTANCE</b>		
<ul style="list-style-type: none"> <li>• Disconnect harness connector from the servo.</li> <li>• DVOM on 200 ohm scale.</li> <li>• Measure resistance between SOL + and SCVNT circuit pins on the servo connector.</li> </ul>		Resistance is greater than 150 ohms	▶ REPLACE servo. REPEAT QUICK TEST.
<b>SERVICE CODE 82</b>			
<b>C5</b>	<b>VACUUM SOLENOID TEST</b>		
<ul style="list-style-type: none"> <li>• Key off.</li> <li>• Disconnect ECA 60 Pin connector. Inspect for damaged pins, corrosion, loose wires, etc. Service as necessary.</li> <li>• Install Breakout box, leave ECA disconnected.</li> <li>• DVOM on 200 ohm scale.</li> <li>• Measure resistance between test Pin 13 and test Pin 42.</li> </ul>		Resistance is between 40 and 75 ohms	▶ REPLACE ECA. REPEAT QUICK TEST.
		Resistance is less than 40 ohms	▶ REPLACE servo. REPEAT QUICK TEST.
		Resistance is greater than 75 ohms	▶ GO to <b>C6</b> .

CL5146-A



## TESTING (Continued)

## SERVO SOLENOIDS — PINPOINT TEST C — Continued

TEST STEP		RESULT	ACTION TO TAKE
<b>C6</b>	CHECK CONTINUITY OF SOL+ CIRCUIT		
<ul style="list-style-type: none"> <li>• Disconnect harness connector from the servo.</li> <li>• DVOM on 200 ohm scale.</li> <li>• Measure resistance between test Pin 13 and SOL+ circuit at the harness connector.</li> </ul>		Resistance is greater than 5 ohms	SERVICE open circuit. REPEAT QUICK TEST.
		Resistance is less than 5 ohms	GO to C7.
<b>C7</b>	CHECK CONTINUITY OF SCVAC CIRCUIT		
<ul style="list-style-type: none"> <li>• Disconnect harness connector from the servo.</li> <li>• DVOM on 200 ohm scale.</li> <li>• Measure resistance between test Pin 42 and SCVAC circuit at the harness connector.</li> </ul>		Resistance is greater than 5 ohms	SERVICE open circuit. REPEAT QUICK TEST.
		Resistance is less than 5 ohms	GO to C8.
<b>C8</b>	MEASURE SCVAC SOLENOID RESISTANCE		
<ul style="list-style-type: none"> <li>• Disconnect harness connector from the servo.</li> <li>• DVOM on 200 ohm scale.</li> <li>• Measure resistance between SOL+ and SCVAC circuit pins at the servo connector.</li> </ul>		Resistance is greater than 75 ohms	REPLACE servo. REPEAT QUICK TEST.

CL5147-B

## TESTING (Continued)

## SPEED DOES NOT INCREASE DURING DYNAMIC TEST — PINPOINT TEST D

D		STOP-WARNING	
You should enter this Pinpoint Test only when Service Code 36 is received in the KOER Self-Test.			
This Pinpoint Test is intended to diagnose only the following:			
• Actuator cable		• ECA	
• Vacuum hose connections		• Vacuum reservoir	
• Dump valve adjustment		• Check valve	
TEST STEP		RESULT	ACTION TO TAKE
D1	SERVICE CODE 36		
• Repeat KOER Self-Test of QUICK TEST. Be sure that the speed control ON button is pressed before pressing the STAR push button.		Code 36 still present	GO to D2.
		No Code 36	Increase vehicle speed test passed. SERVICE any other service code(s) as necessary.
D2	CHECK ACTUATOR CABLE CONNECTION TO THROTTLE BODY		
• Is actuator cable attached to throttle body accelerator linkage?		Yes	GO to D3.
		No	CONNECT servo cable to throttle body accelerator linkage. REPEAT QUICK TEST.
D3	CHECK VACUUM HOSES		
• Is servo vacuum supply hose tightly connected to VAC port on check valve and to the vacuum manifold, and free of cuts, cracks and kinks?		Yes	GO to D4.
• Is vacuum hose tightly connected between check valve and servo, and free of cuts, cracks and kinks?		No	SERVICE hoses. REPEAT QUICK TEST.
• Is vacuum hose tightly connected between check valve and reservoir, and free of cuts, cracks and kinks?			
• Is the dump valve hose tightly connected to the servo and to the dump valve, and free of cuts, cracks and kinks?			
D4	CHECK VACUUM RESERVOIR		
• Disconnect hose between the check valve and vacuum reservoir, at check valve end.		Yes	GO to D5.
• Install vacuum pump to open end of hose to reservoir.		No	REPLACE vacuum reservoir. REPEAT QUICK TEST.
• Apply 60.6 kPa (18 in. Hg) vacuum to the reservoir.			
• Does reservoir hold vacuum?			

## TESTING (Continued)

## SPEED DOES NOT INCREASE DURING DYNAMIC TEST — PINPOINT TEST D (Continued)

TEST STEP		RESULT	ACTION TO TAKE
<b>D5</b>	<b>CHECK THE CHECK VALVE</b>		
	<ul style="list-style-type: none"> <li>● Disconnect the hose between check valve and servo, at the servo end.</li> <li>● Apply 60.6 kPa (18 in. Hg) vacuum to open end of hose.</li> <li>● Can vacuum be pumped to, and held at, 60.6 kPa (18 in. Hg) vacuum?</li> </ul>	Yes  No	GO to D6.  REPLACE check valve. REPEAT QUICK TEST.
<b>D6</b>	<b>CHECK DUMP VALVE ADJUSTMENT</b>		
	<ul style="list-style-type: none"> <li>● Is the dump valve adjusted properly so that the valve is closed when the brake pedal is not depressed?</li> </ul>	Yes  No	REPLACE ECA. REPEAT QUICK TEST.  ADJUST dump valve. REPEAT QUICK TEST.

CL4938-A

## TESTING (Continued)

## DOES NOT HOLD SPEED DURING DYNAMIC TEST — PINPOINT TEST E

E		STOP-WARNING	
You should enter this Pinpoint Test only when Service Codes 27 and/or 28 are received in the KOER Self-Test.			
This Pinpoint Test is intended to diagnose only the following:			
● Speed control servo		● Vacuum reservoir	
● Vacuum hose connections		● Check valve	
TEST STEP		RESULT	ACTION TO TAKE
E1	SERVICE CODE 27		
● Repeat Engine Running Self-Test of QUICK TEST. Be sure that the speed control ON button is pressed before pressing the STAR push button.		Code 27 still present?	GO to E2.
		No Code 27	Servo leaks down test passed. SERVICE any other service code(s) as necessary.
E2	CHECK VACUUM HOSES		
● Is vacuum supply hose tightly connected to VAC port on check valve and to vacuum manifold, and free of cuts, cracks and kinks?		Yes	GO to E3.
● Is vacuum hose tightly connected between check valve and servo, and free of cuts, cracks and kinks?		No	SERVICE vacuum hoses. REPEAT QUICK TEST.
● Is vacuum hose tightly connected between check valve and reservoir, and free of cuts, cracks and kinks?			
● Is dump valve hose tightly connected to the servo and dump valve, and free of cuts, cracks and kinks?			
E3	CHECK VACUUM RESERVOIR		
● Disconnect hose between the check valve and vacuum reservoir, at check valve end.		Yes	GO to E4.
● Install vacuum pump to open end of hose to reservoir.		No	REPLACE vacuum reservoir. REPEAT QUICK TEST.
● Apply 60.6 kPa (18 in. Hg) vacuum to the reservoir.			
● Does reservoir hold vacuum?			
E4	CHECK THE CHECK VALVE		
● Disconnect the hose between check valve and servo, at the servo end.		Yes	REPLACE servo. REPEAT QUICK TEST.
● Apply 60.6 kPa (18 in. Hg) vacuum to open end of hose.		No	REPLACE check valve. REPEAT QUICK TEST.
● Can vacuum be pumped to, and held at, 60.6 kPa (18 in. Hg) vacuum?			
E5	SERVICE CODE 28		
● REPEAT engine running SELF-TEST of QUICK TEST. Be sure that the speed control ON button is pressed before pressing the STAR push button.		Code 28 still present?	REPLACE servo. REPEAT QUICK TEST.
		No Code 27	Servo leaks up test passed. SERVICE any other service code(s) as necessary.

## TESTING (Continued)

## SPEED DOES NOT DECREASE DURING DYNAMIC TEST — PINPOINT TEST F

F

STOP-WARNING

You should enter this Pinpoint Test only when a Service Code 37 is received in the KOER Self-Test.

This Pinpoint Test is intended to diagnose only the following:

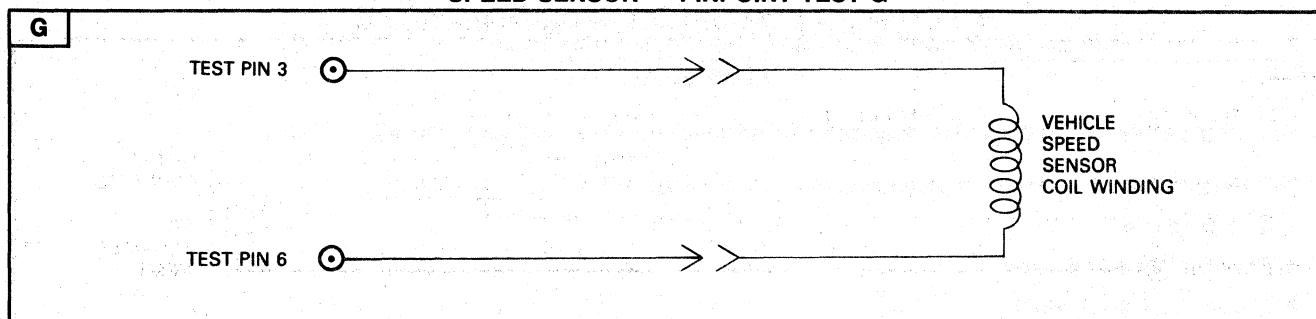
- Actuator cable
- Throttle shaft and linkage
- Throttle position sensor
- ECA

TEST STEP		RESULT	ACTION TO TAKE
F1	SERVICE CODE 37		
	<ul style="list-style-type: none"> <li>● Repeat KOER Self-Test of QUICK TEST. Be sure that the speed control ON button is pressed before pressing the STAR push button.</li> </ul>	Code 37 still present? <div></div> No Code 37 <div></div>	GO to F2.  Decrease vehicle speed test passed. SERVICE any other service code(s) as necessary.
F2	CHECK FOR THROTTLE SHAFT/LINKAGE BINDING		
	<ul style="list-style-type: none"> <li>● Is the throttle shaft or throttle linkage binding, maintaining a part throttle opening?</li> </ul>	Yes <div></div> No <div></div>	SERVICE to eliminate binding. REPEAT QUICK TEST.  GO to F3.
F3	CHECK FOR SPEED CONTROL LINKAGE BINDING		
	<ul style="list-style-type: none"> <li>● Is the actuator cable binding?</li> </ul>	Yes <div></div> No <div></div>	REPLACE the actuator cable. REPEAT QUICK TEST.  GO to F4.
F4	CHECK FOR THROTTLE POSITION SENSOR BINDING		
	<ul style="list-style-type: none"> <li>● Is throttle position sensor binding at a part throttle opening?</li> </ul>	Yes <div></div> No <div></div>	REPLACE the throttle position sensor. REPEAT QUICK TEST.  REPLACE the ECA. REPEAT QUICK TEST.

CL5150-A

## TESTING (Continued)

## SPEED SENSOR — PINPOINT TEST G



## STOP-WARNING

You should enter this Pinpoint Test only when directed here from the KOER Self-Test and the Diagnostic by Symptom chart.

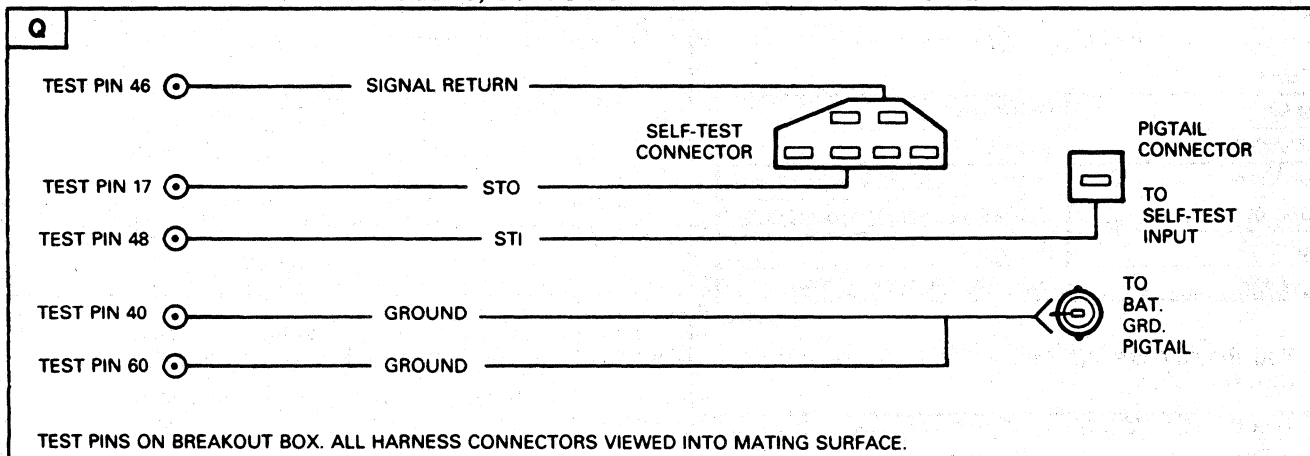
This Pinpoint Test is intended to diagnose only the following:

- Speed sensor resistance check
- Short in sensor input circuit
- Open in sensor input circuit

TEST STEP		RESULT	ACTION TO TAKE
<b>G1</b>	<b>SPEED SENSOR RESISTANCE CHECK</b>		
<ul style="list-style-type: none"> <li>• Key off, wait 10 seconds.</li> <li>• Disconnect ECA 60 Pin connector. Inspect for damaged pins, corrosion, loose wires, etc. Service as necessary.</li> <li>• Install Breakout box, leave ECA disconnected.</li> <li>• DVOM to 2000 ohm scale.</li> <li>• Measure resistance between test Pin 3 and test Pin 6.</li> </ul>		DVOM reading less than 180 ohms	GO to G2.
		DVOM reading greater than 240 ohms	GO to G3.
		DVOM reading between 180 and 240 ohms	GO to AXOD electrical system diagnosis in Section 17-15. PERFORM drive cycle and monitor for continuous codes 57, 59, 62 and 69. PERFORM diagnostics as required.
<b>G2</b>	<b>CHECK FOR SHORT IN SENSOR INPUT CIRCUIT</b>		
<ul style="list-style-type: none"> <li>• Key off.</li> <li>• Disconnect harness connector from vehicle speed sensor.</li> <li>• DVOM on 2000 ohm scale.</li> <li>• Measure resistance between the two connector pins on the speed sensor.</li> </ul>		DVOM reading less than 180 ohms	REPLACE speed sensor. REPEAT QUICK TEST.
		DVOM reading between 180 and 240 ohms	REPAIR short in wire harness between sensor and EEC-IV Pins 3 and 6. REPEAT QUICK TEST.
<b>G3</b>	<b>CHECK FOR OPEN IN SENSOR INPUT CIRCUIT</b>		
<ul style="list-style-type: none"> <li>• Key off.</li> <li>• Disconnect harness connector from vehicle speed sensor.</li> <li>• DVOM on 2000 ohm scale.</li> <li>• Measure resistance between the two connector pins on the speed sensor.</li> </ul>		DVOM reading greater than 240 ohms	REPLACE speed sensor. REPEAT QUICK TEST.
		DVOM reading between 180 and 240 ohms	REPAIR open in wire harness between sensor and EEC-IV Pins 3 and 6. REPEAT QUICK TEST.

## TESTING (Continued)

## NO CODES, CODES NOT LISTED — PINPOINT TEST Q

**STOP-WARNING**

You should enter this Pinpoint Test only when directed here from the KOER or KOEO Self-Test.

This Pinpoint Test is intended to diagnose only the following:

- ECA
- Harness circuits: signal return, STO, STI, Ground

TEST STEP		RESULT	ACTION TO TAKE
<b>Q1</b>	<b>SELF-TEST INPUT CONTINUITY CHECK</b>		
<ul style="list-style-type: none"> <li>• Key off, wait 10 seconds.</li> <li>• Disconnect ECA 60 Pin connector and inspect for damaged pins, corrosion, loose wires. Service as necessary.</li> <li>• Install Breakout box, leave ECA disconnected.</li> <li>• Set DVOM to 200 ohm scale.</li> <li>• Measure resistance between Self-Test input at the Self-Test single pin connector and test Pin 48 at the Breakout box.</li> </ul>		Less than 5 ohms 5 ohms or greater	GO to <b>Q2</b> . CORRECT open in circuit.
<b>Q2</b>	<b>SELF-TEST OUTPUT CIRCUIT CONTINUITY CHECK</b>		
<ul style="list-style-type: none"> <li>• Breakout box installed.</li> <li>• DVOM to 200 ohm scale.</li> <li>• Measure resistance between Self-Test output at the Self-Test connector and test Pin 17 at the Breakout box.</li> </ul>		5 ohms or greater Less than 5 ohms	CORRECT open in circuit. GO to <b>Q3</b> .
<b>Q3</b>	<b>EGO SENSOR GROUND CONTINUITY CHECK</b>		
<ul style="list-style-type: none"> <li>• Breakout box installed.</li> <li>• Key off.</li> <li>• Measure resistance between EGO ground on engine and test Pin 49 at the Breakout box.</li> </ul>		Less than 5 ohms 5 ohms or greater	GO to <b>Q4</b> . CHECK and SERVICE EGO sensor ground wire or open circuit bad connection.
<b>Q4</b>	<b>STO SHORT TO GROUND</b>		
<ul style="list-style-type: none"> <li>• Breakout box installed.</li> <li>• DVOM on 200,000 ohm scale.</li> <li>• Measure resistance between Self-Test output at Self-Test connector and engine block ground.</li> <li>• Is resistance greater than 10,000 ohms?</li> </ul>		Yes No	REPLACE ECA. REPEAT QUICK TEST. SERVICE shorts to ground. REPEAT QUICK TEST.

**SPECIAL SERVICE TOOLS****ROTUNDA**

Model	Description
007-00019	Super STAR Tester
059-00010	Inductive Dwell-Tach-Volt-Ohm Tester
007-00017	Self-Test Automatic Readout (STAR)
014-00322	Breakout Box
014-00407	Digital Volt-Ohmmeter (DVOM)

**CL5122-B**



# SEATS

# GROUP 41

(70000)

SECTION TITLE	PAGE	SECTION TITLE	PAGE
HEAD RESTRAINTS .....	41-40-1	SEAT BACK—FRONT .....	41-30-1
SEAT, CHILD RESTRAINT—TETHER ATTACHMENT .....	41-52-1	SEAT TRACKS—MANUAL .....	41-01-1
SEAT—6-WAY POWER .....	41-08-1	SEAT TRIM .....	41-60-1
SEAT AND SHOULDER BELTS .....	41-50-1	SEATS, REAR—CONVENTIONAL .....	41-14-1
		SEATS, REAR—FOLD DOWN .....	41-20-1

## SECTION 41-01 Seat Tracks—Manual

SUBJECT	PAGE	SUBJECT	PAGE
DESCRIPTION AND OPERATION .....	41-01-1	VEHICLE APPLICATION .....	41-01-1
REMOVAL AND INSTALLATION .....	41-01-2		

### VEHICLE APPLICATION

Taurus/Sable.

### DESCRIPTION AND OPERATION

The seat release handle is located at the front of the seat. Pulling the seat release handle upward allows forward or rearward movement of the seat assembly.

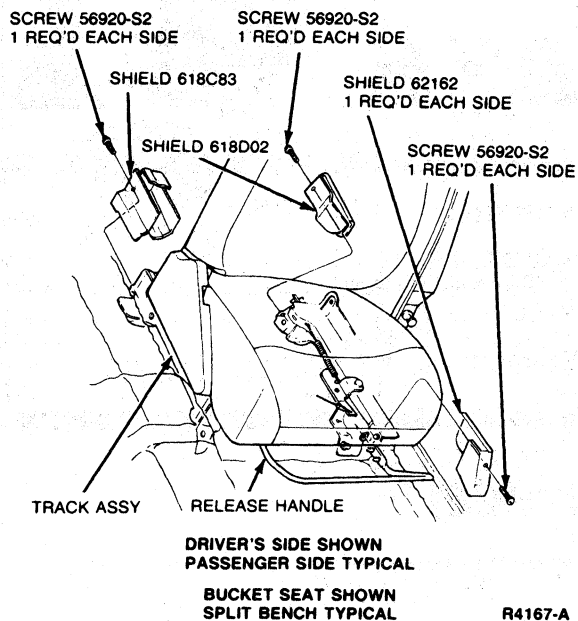
Manual seat tracks are retained to the floorpan by studs with nut and washer assemblies or screws (washer head type). Nuts and screws retaining the seat tracks are removed from inside the vehicle.

## REMOVAL AND INSTALLATION

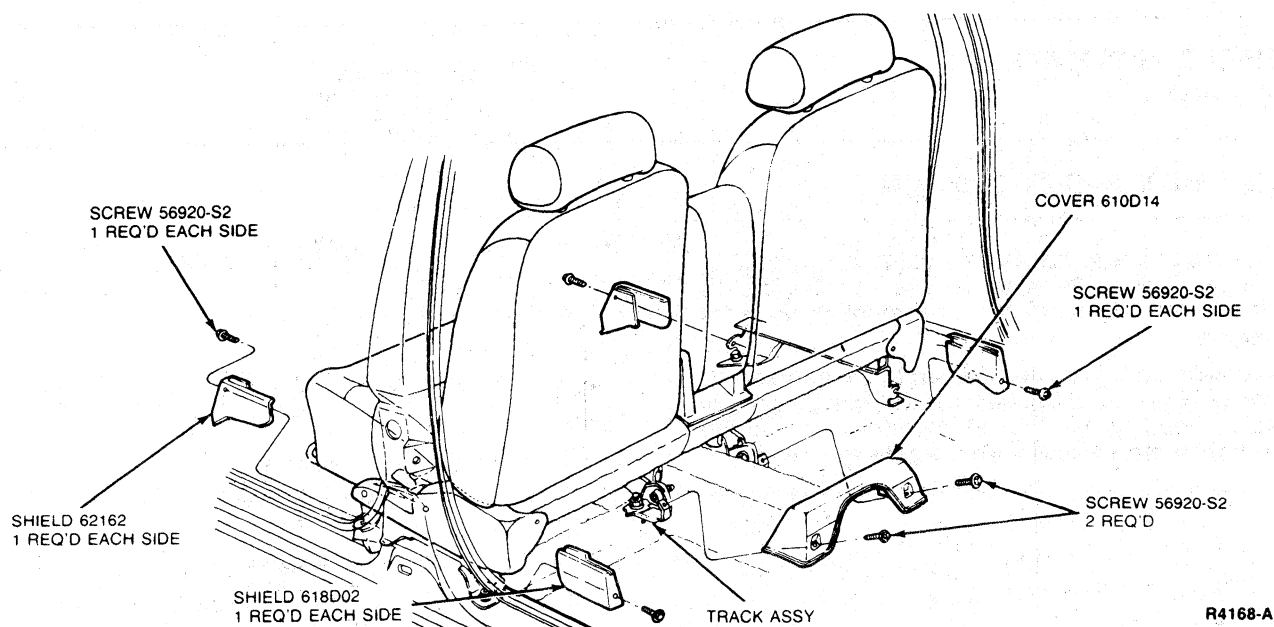
### Removal

1. Remove plastic shield retaining screws and remove shield.

### Seats—Bucket and Split Bench



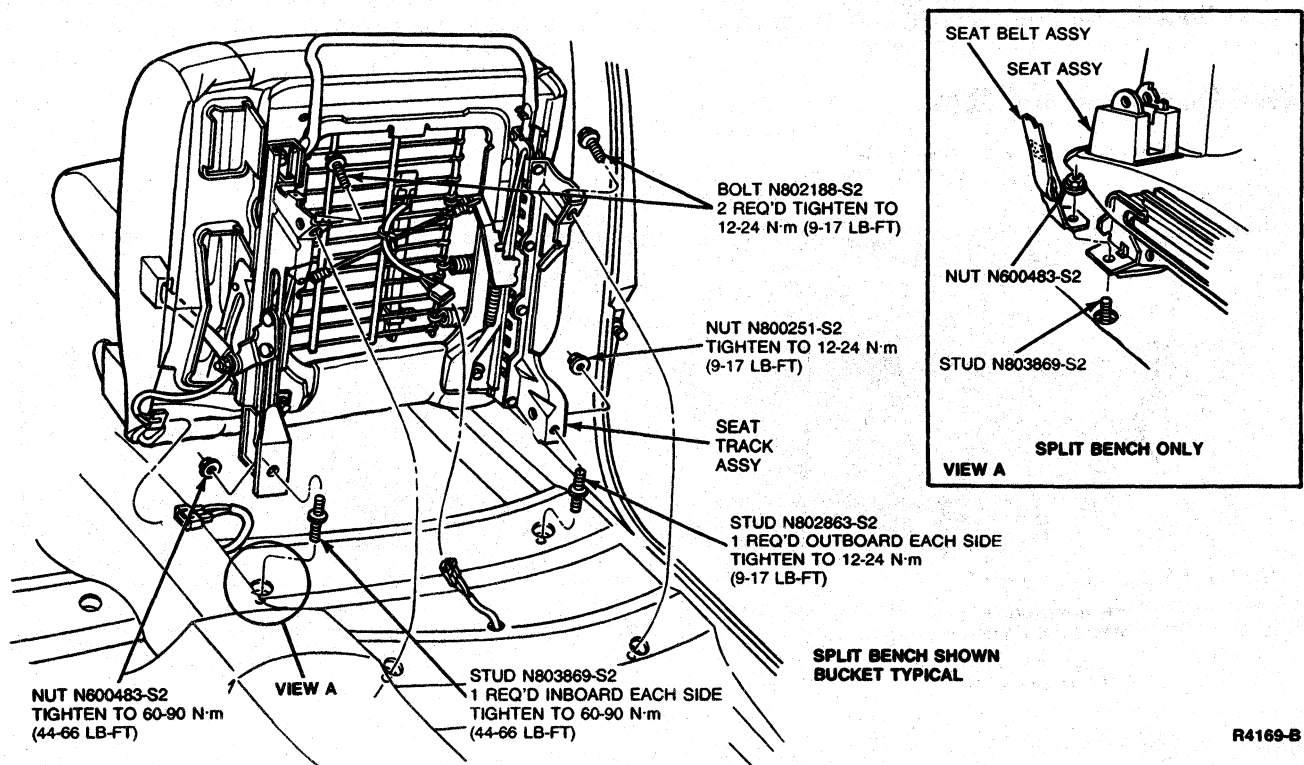
### Seats—Full Bench



## REMOVAL AND INSTALLATION (Continued)

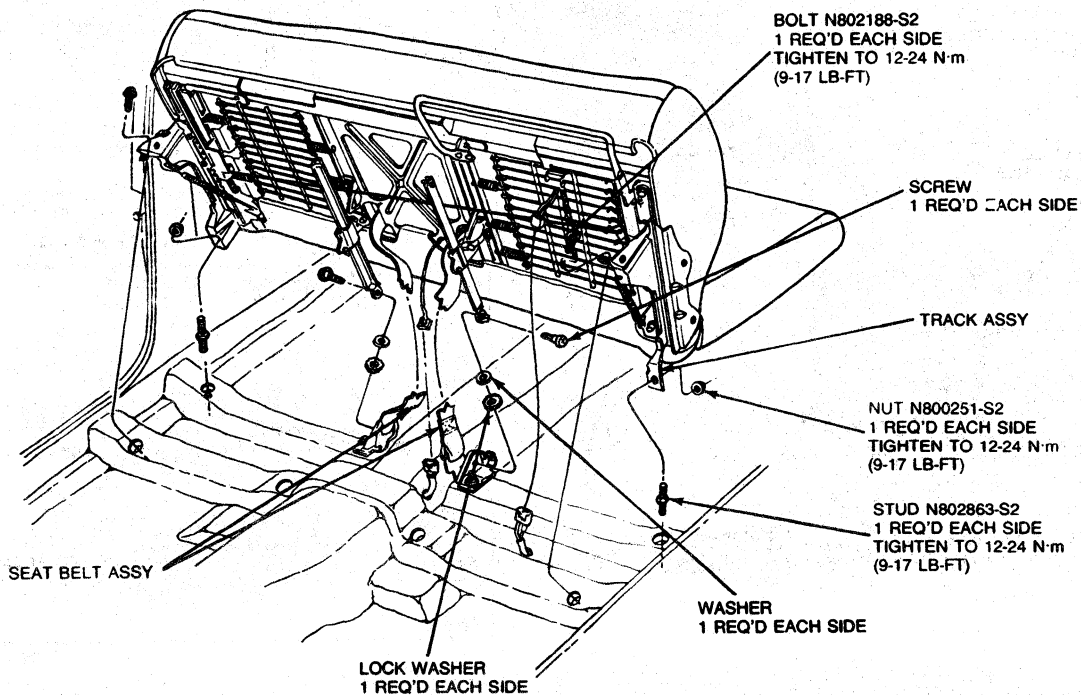
2. Remove bolts and nut and washer assemblies retaining seat tracks to floor.

## Seats—Bucket and Split Bench



R4169-B

## Seats—Full Bench



R4170-B

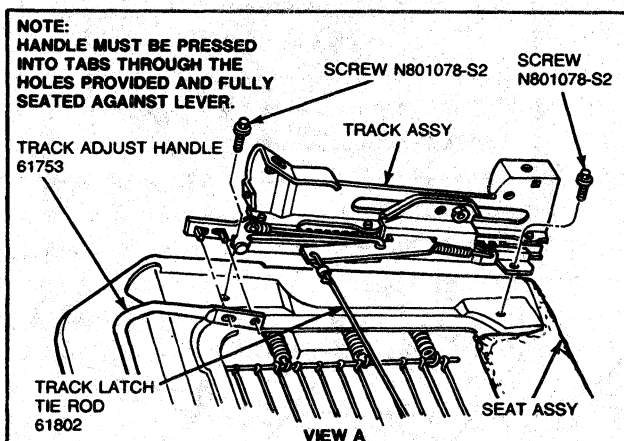
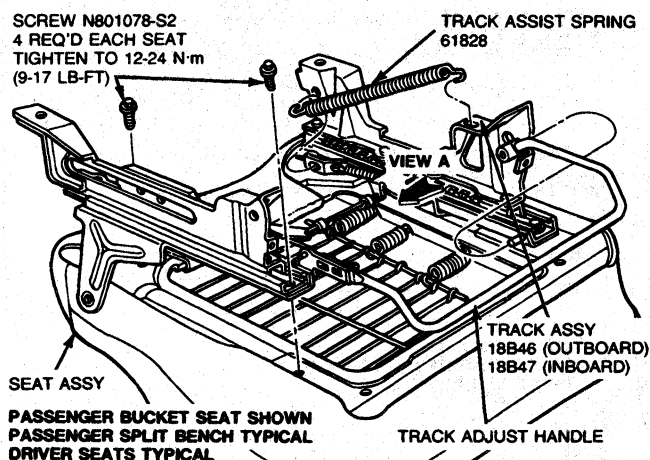
## REMOVAL AND INSTALLATION (Continued)

3. Remove seat and track assembly from vehicle and place on a clean working area.

**CAUTION:** Use care when handling seat and track assembly. Dropping assembly or sitting on seat not secured in vehicle may result in damaged components.

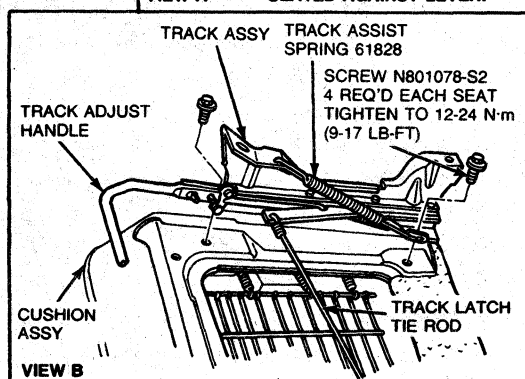
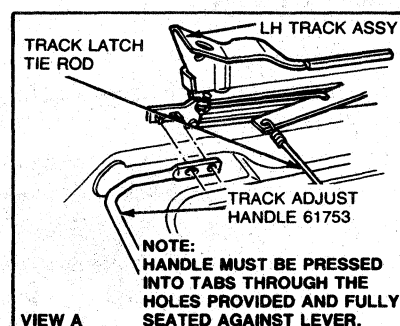
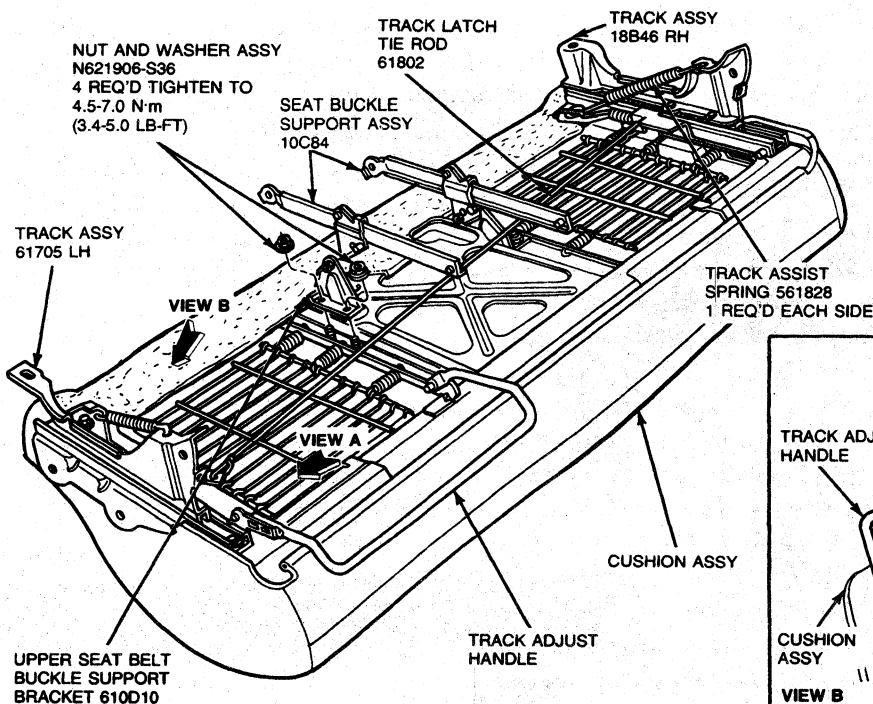
4. Remove seat track-to-seat cushion attaching screws. Remove seat cushion and assist spring from tracks.
5. If seat tracks are being replaced, transfer assist springs and spacers, if so equipped, to new track assembly.

## Seats—Bucket and Split Bench



R4171-B

## Seats—Full Bench



R4172-B

**REMOVAL AND INSTALLATION (Continued)****Installation**

1. Mount seat tracks to seat cushion.
2. Install seat track-to-seat cushion retaining screws. Tighten to specification.
3. Place seat assembly into vehicle and ensure proper alignment.
4. Install screws, studs, plastic shields, and nut and washer assemblies. Tighten to specification.

## SECTION 41-08 Seat—6-Way Power

SUBJECT	PAGE	SUBJECT	PAGE
DESCRIPTION AND OPERATION .....	41-08-1	REMOVAL AND INSTALLATION (Cont'd.)	
DIAGNOSIS .....	41-08-9	Seat Track .....	41-08-2
REMOVAL AND INSTALLATION		Upper Support Assembly .....	41-08-7
Motor and Drive Cables .....	41-08-7	TESTING	
Right or Left Track .....	41-08-7	Switch Test .....	41-08-8
Seat Control Switch .....	41-08-8	VEHICLE APPLICATION .....	41-08-1

### VEHICLE APPLICATION

Taurus/Sable.

### DESCRIPTION AND OPERATION

The optional 6-way power seat system uses a screw-type drive for seat adjustment.

The 6-way power seat provides horizontal, vertical and tilt adjustments. It consists of a reversible armature motor, switch and housing assembly, vertical screw, and horizontal screw drives.

The mechanical portion of the seat track in the horizontal drive consists of a transmission and lead screw on each track. The transmission, lead screw and motor are attached to the movable section of the track. When the switch is actuated, the front armature is energized and the horizontal drive units are activated. The seat is then moved forward or rearward by the lead screw traveling in a plastic drive block attached to each lower track section.

In the vertical drive, a transmission and screw drive are used. The drive units are located on the LH side of the movable track.

When the switch is actuated, the center and rear armatures are energized simultaneously and the vertical drive units are activated. The seat is then moved up or down by the lead screws traveling in the drive nuts.

When the front tilt switch is actuated, the center armature drives the front vertical lead screw and moves the seat to the desired position. When the rear tilt switch is actuated, the rear armature drives the rear vertical lead screw and moves the seat to the desired position.

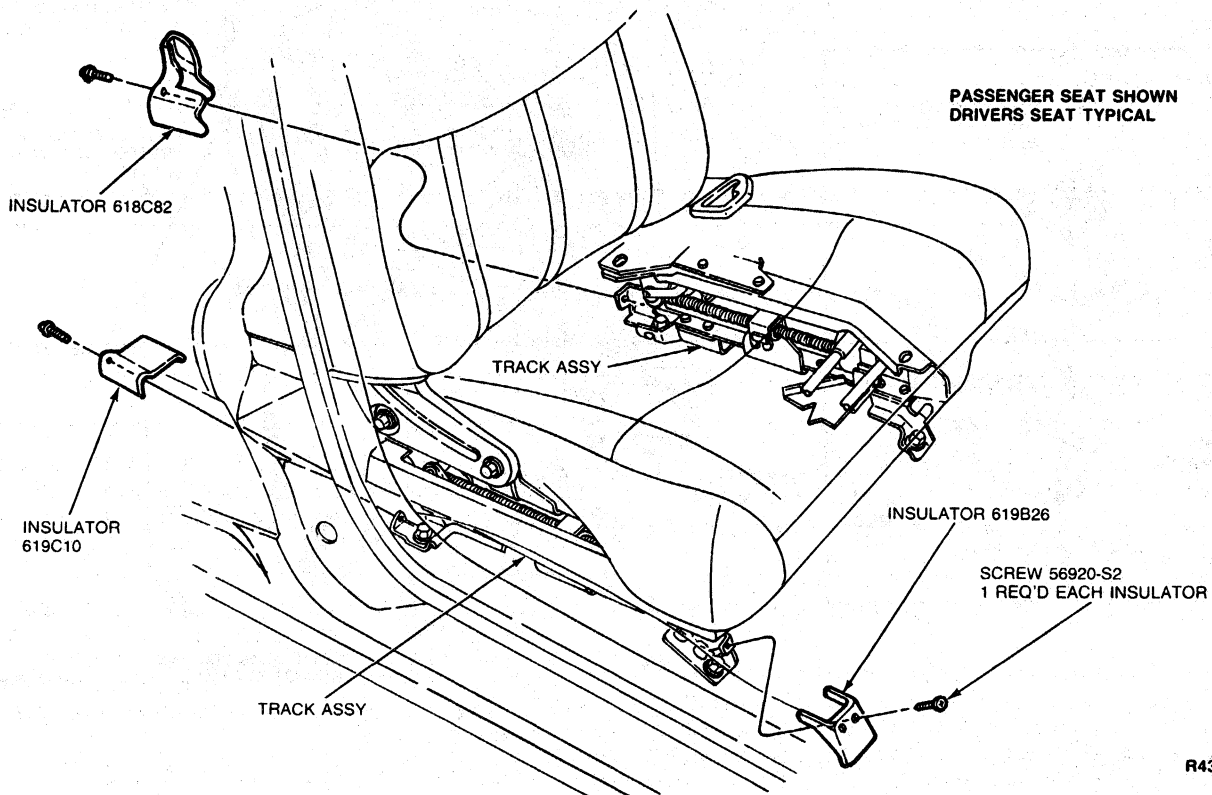
The power seat circuit is protected by a circuit breaker mounted in the fuse panel.

The motor assembly, which contains three armatures, is serviced only as an assembly. The flexible shafts are serviced individually and can be removed by deflecting the cables.

The switch and housing assembly is serviced separately.

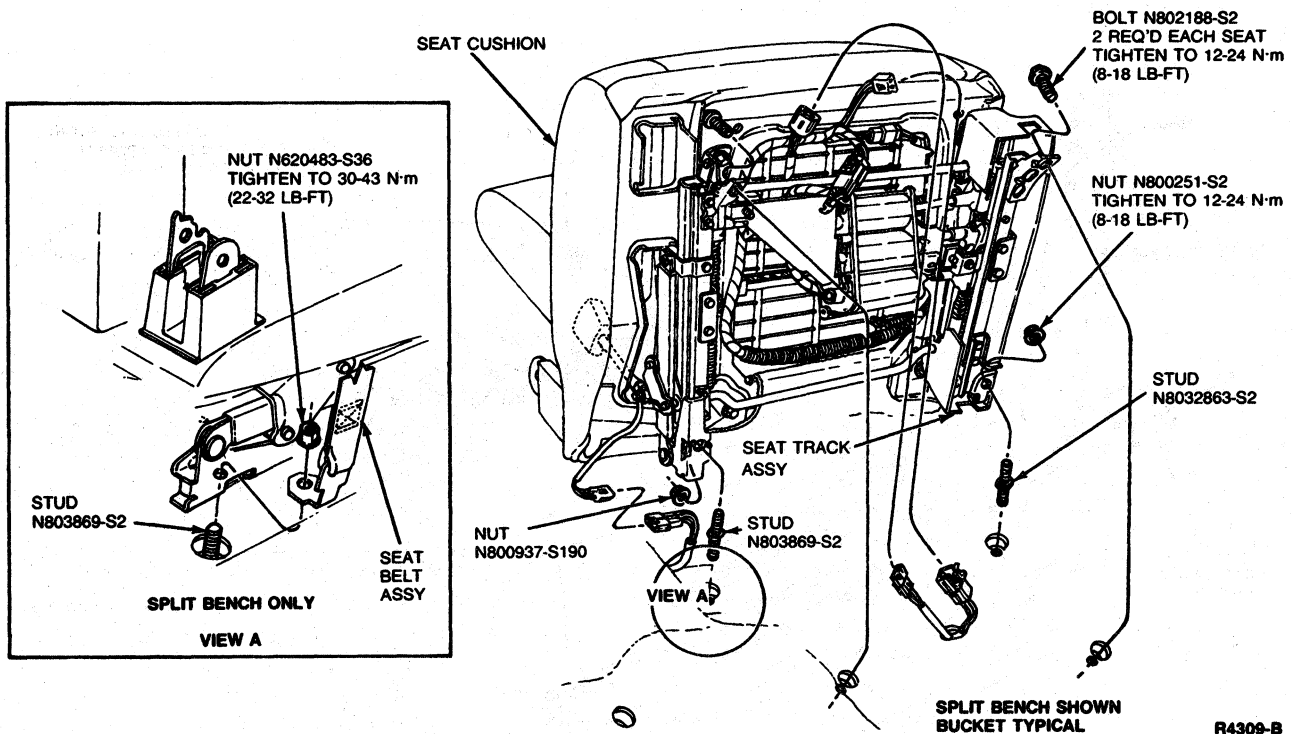
**REMOVAL AND INSTALLATION****Seat Track****Removal**

1. Remove heat shield covers to expose nuts and washers and/or bolts.



**REMOVAL AND INSTALLATION (Continued)**

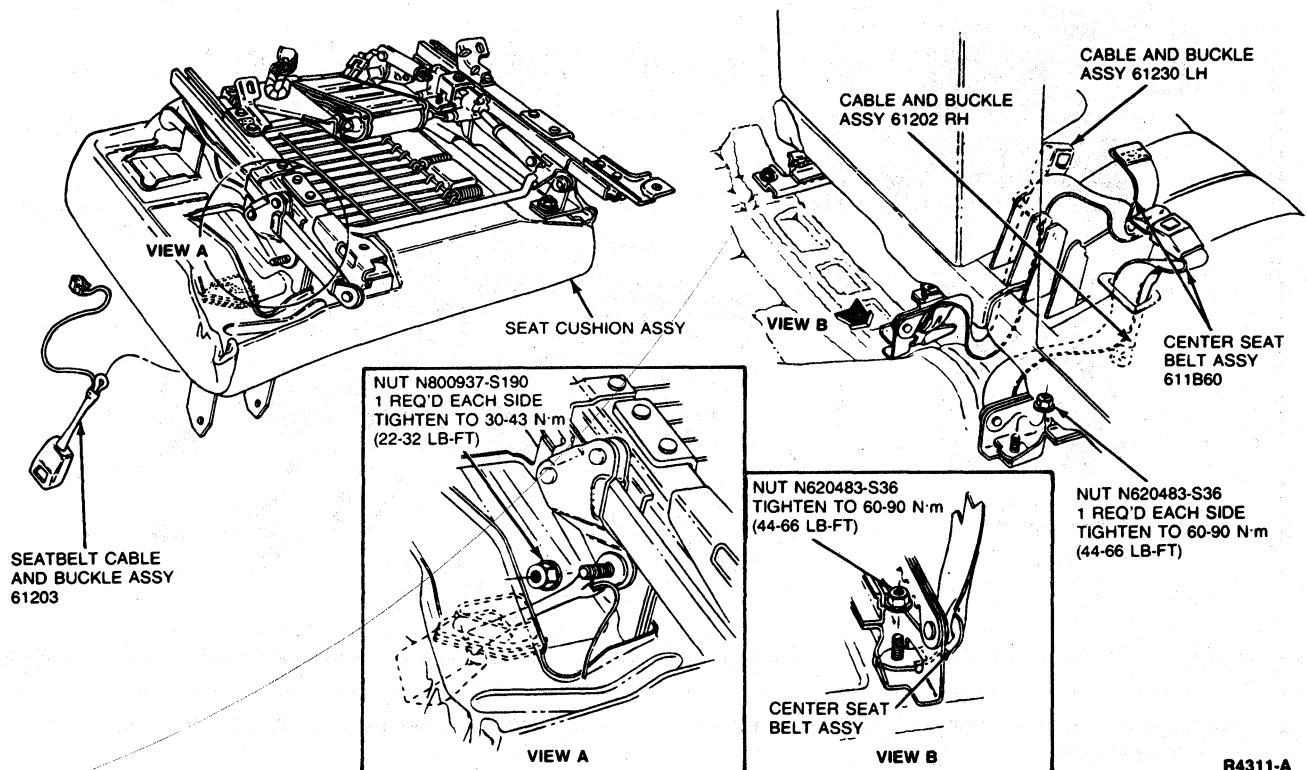
2. Remove the nuts and washers, and bolts retaining the seat and track assembly to the floorpan.





## REMOVAL AND INSTALLATION (Continued)

3. Lift the seat and track assembly high enough to disconnect the wire harness. Remove the seat and track assembly from the vehicle.
4. Place the seat upside down on a clean bench. Remove center occupant seat belt, if so equipped.

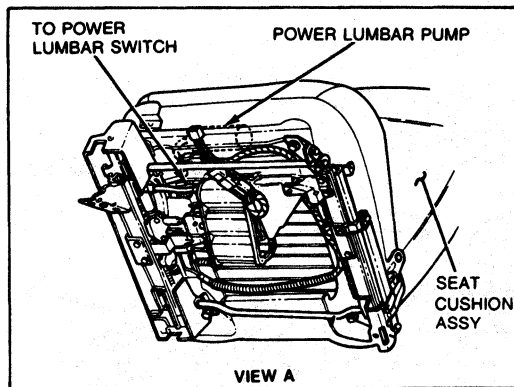


R4311-A

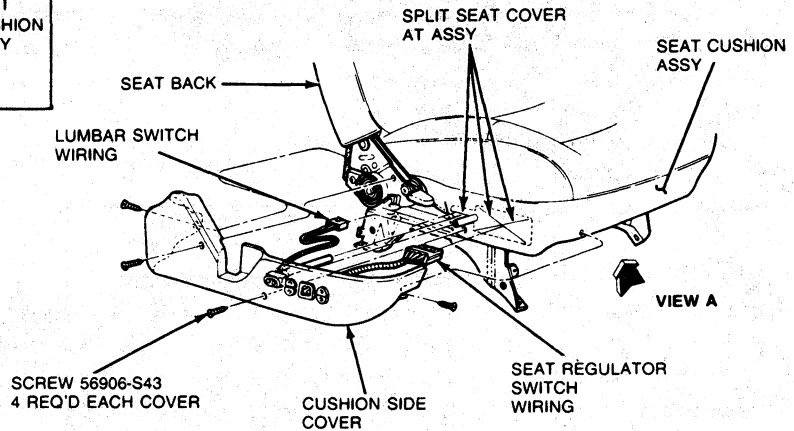
## REMOVAL AND INSTALLATION (Continued)

5. Disconnect the power seat switch-to-motor wire harness, if so equipped.

6. Remove cushion side cover from seat track assembly.



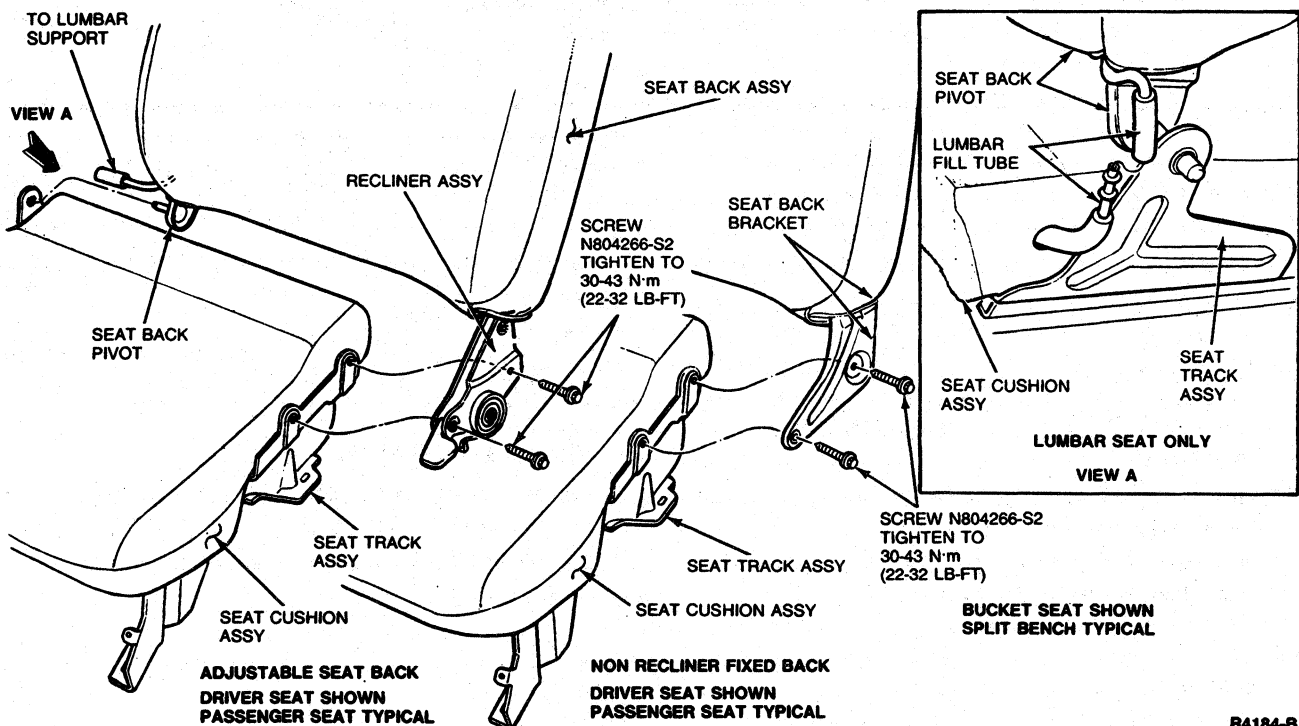
PASSENGER SEAT SHOWN  
DRIVER SEAT TYPICAL



R4310-A

7. Remove two bolts retaining recliner mechanism to the seat track.

8. Remove seat back from seat track.

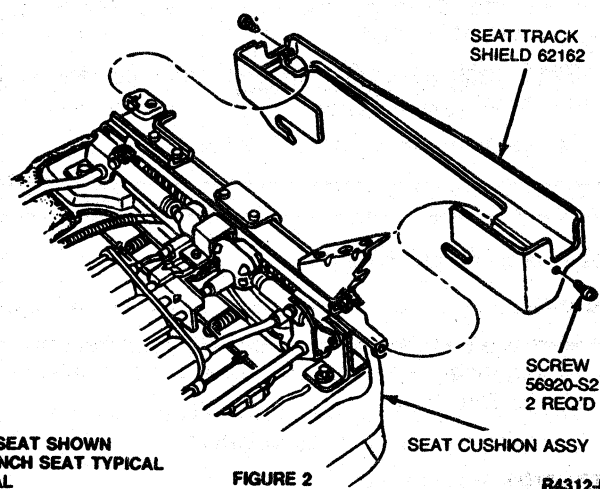
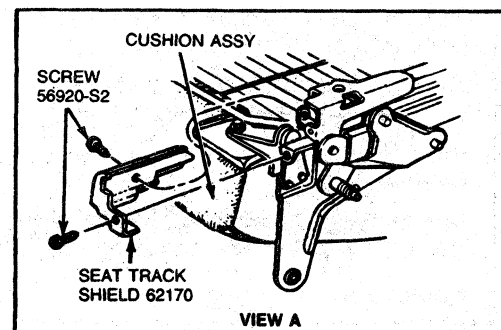
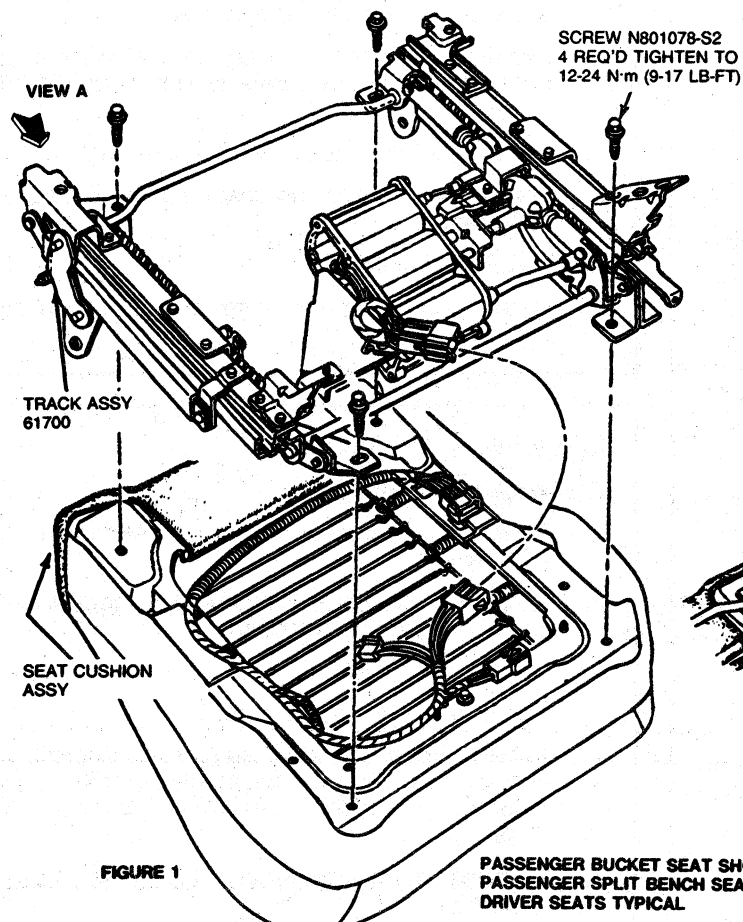


R4184-B

**REMOVAL AND INSTALLATION (Continued)**

9. Remove outboard occupant seat belt.
10. Remove the four bolts retaining the seat track to the seat cushion. Remove the track assembly.

**CAUTION:** Use care when handling seat and track assembly. Dropping the assembly or sitting on seat not secured in vehicle may result in damaged components.



R4312-B

**Installation**

1. Position the track assembly to the seat cushion.
2. Install seat recliner-to-seat track retaining bolts.
3. Secure the outboard occupant seat belt to seat track.
4. Secure the seat track assembly to the seat cushion using the four previously removed attaching bolts. Tighten the bolts to specification.
5. Install cushion side cover to the seat track assembly.
6. Connect the power seat switch to motor wire harness, if so equipped.
7. Install center occupant seat belt to seat track.
8. Position the seat and track assembly in vehicle.
9. Lift seat and track assembly high enough to permit the connection of the wire harness, then, connect wires.
10. Install the seat track-to-floorpan attaching nuts and washers and/or bolts. Tighten the bolts to specification.
11. Install heat shield covers.
12. Install the seat belt-to-floorpan attaching bolt. Tighten the bolt as specified in Section 41-50.
13. Check seat tracks for proper operation.

**REMOVAL AND INSTALLATION (Continued)****Right or Left Track****Removal and Installation**

1. Remove seat and track assembly as outlined.
2. Remove seat belts.
3. Remove seat recliner-to-seat track attaching bolts and remove seat back.
4. Remove seat track from cushion.
5. Identify assist spring(s) (clock) spring(s) and their respective locations. Then, carefully remove springs.

**WARNING: MAKE SURE PRESCRIBED SAFETY PRECAUTIONS ARE FOLLOWED.**

6. Remove two retaining rings.
7. Remove motor assembly.
8. Remove two E-rings, two clevis pins, and screw from vertical drive transmission bracket (LH subassembly only).
9. Slide track assembly off of upper seat track assembly.
10. To install, reverse Steps 1 through 7.

**Motor and Drive Cables****Removal**

1. Remove seat and track assembly from vehicle as outlined.
2. Remove seat recliner mechanism and seat back from seat track as outlined.
3. Remove seat belt.
4. Remove the seat track from seat cushion.
5. Identify cables and their respective locations.
6. Remove the motor bracket screw.
7. Lift motor and deflect three left cables toward left track assembly. Then, remove three LH cable assemblies from motor.
8. Remove two locknuts retaining motor to mounting bracket.

**Installation**

1. Secure motor to mounting bracket using two previously removed locknuts. Tighten nuts to .91-1.12 N·m (8-10 lb-in).
2. Lower the motor into place.
3. Position three LH drive cables to motor, being sure to fully engage square ends of cables into motor armature.

4. Align RH drive cable ends with motor armatures.
5. With three LH cables engaged in motor, lift motor. Insert RH cable into motor being sure to fully engage square end of cable into motor armature. Lower motor into place.
6. Install screw used to retain motor bracket to seat track. Tighten screw to 6-8 N·m (54-70 lb-ft).
7. Install seat track assembly to seat cushion.
8. Install seat recliner and seat back to seat track as outlined.
9. Install seat belts.
10. Install seat and track assembly in vehicle as outlined.

**Upper Support Assembly****Removal and Installation**

1. Remove seat and track assembly from vehicle as outlined.
2. Remove seat back and recliner mechanism from seat track as outlined.
3. Remove seat belt.
4. Remove seat track from seat cushion.

**NOTE:** When servicing seat track assembly, position seat and track assembly approximately 6.35mm (1/4-inch) from full-up position (if possible).

5. Remove motor assembly. Refer to motor removal.
6. Remove screw from vertical transmission bracket.
7. Remove four retaining clips.
8. Slide RH track assembly off upper support assembly. Rotate RH track assembly to allow disengagement of stabilizer rod.
9. Remove E-ring and clevis pin used to retain vertical transmission drive nuts to upper support assembly.
10. Slide LH track assembly off the upper support assembly.
11. Remove the upper support assembly.
12. To install, reverse Steps 1 through 11.

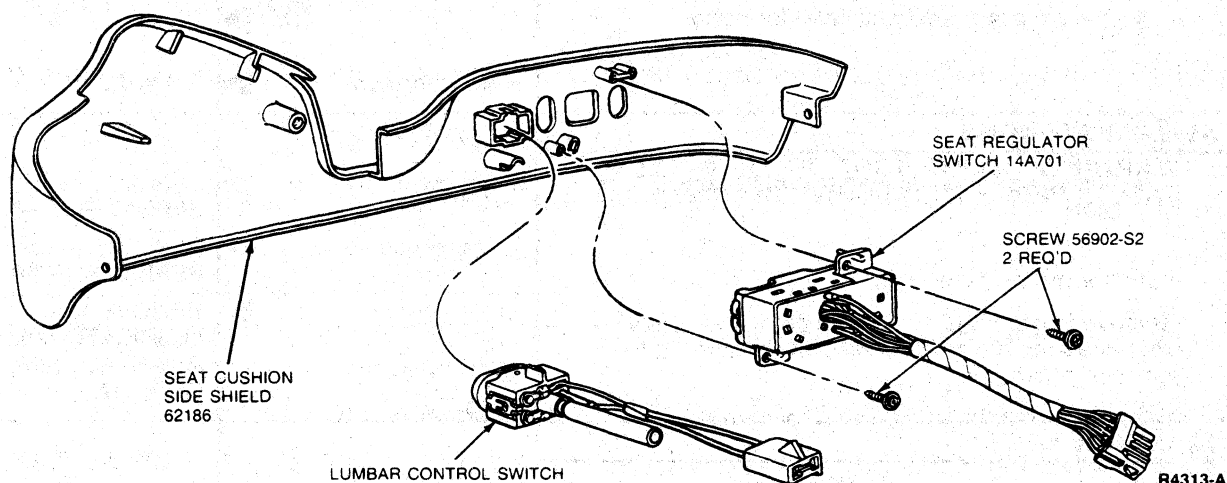
**NOTE:** To ensure efficient operation of seat track assembly, do not remove lubricant from components of seat track assembly.

## REMOVAL AND INSTALLATION (Continued)

### Seat Control Switch

#### Removal and Installation

1. Disconnect battery ground cable.
2. Remove four screws retaining seat cushion side shield and remove shield as outlined.
3. Remove two screws securing switch.
4. Remove switch and housing assembly and disconnect electrical connector. Remove assembly.
5. To install, reverse Steps 1 through 4.



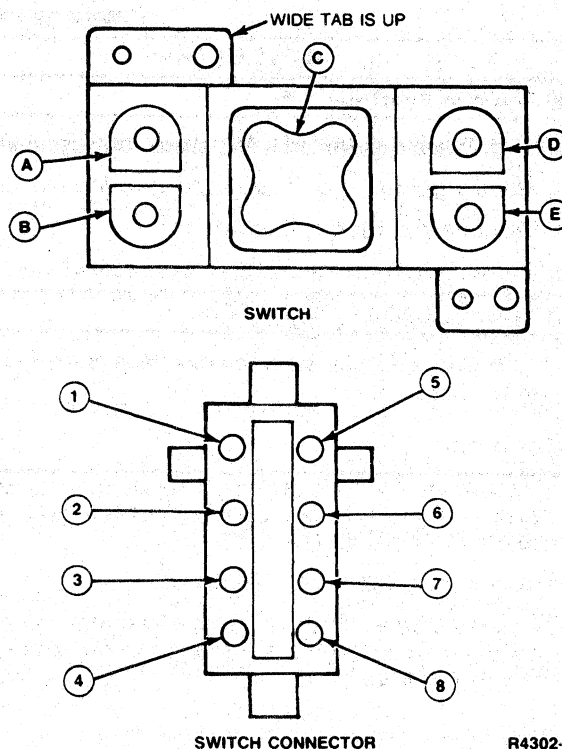
## TESTING

### Switch Test

Test switch with a self-powered test lamp or ohmmeter when the switch is disconnected from the wiring.

1. With all switch knobs in the NEUTRAL position, there should be continuity between terminals 1, 3, 4, 5, 6, 7 and 8. Terminal 2 should be disconnected from all others.
2. With stud knob A depressed, there should be continuity between terminals 1, 3, 4, 6, 7 and 8 and terminals 2 and 7.
3. With switch knob B depressed there should be continuity between terminals 1, 3, 4, 6, 7 and 8 and terminals 2 and 5.
4. With switch knob C pushed up there should be continuity between terminals 1, 2 and 7 and terminals 3, 4, 5, 6 and 8.
5. With switch knob C pushed down there should be continuity between terminals 1, 3, 4, 7 and 8 and terminals 2, 5 and 6.
6. With switch knob C pushed down there should be continuity between terminals 1, 4, 5, 6, 7 and 8 and terminals 2 and 3.
7. With switch knob C pushed to the left there should be continuity between terminals 1, 3, 4, 5, 6 and 7 and terminals 2 and 8.
8. With switch knob D depressed there should be continuity between terminals 1 and 2 and terminals 3, 4, 5, 6, 7 and 8.
9. With switch knob E depressed there should be continuity between terminals 1, 3, 4, 5, 7 and 8 and terminals 2 and 6.

10. If any part of the switch fails to test as stated, replace the entire switch assembly.



**DIAGNOSIS**

Consult the following diagnosis charts for conditions encountered in the power seat system.

**POWER SEAT MOVES — NOISY OPERATION**

TEST STEP		RESULT	ACTION TO TAKE
<b>A0</b>	<b>VERIFY CONDITION</b>		
	<ul style="list-style-type: none"> <li>Operate power seat and listen for noise.</li> </ul>	<p>(OK) ► Power seat OK.</p> <p>Noisy operation ► GO to A1.</p>	
<b>A1</b>	<b>ISOLATE NOISE</b>		
	<ul style="list-style-type: none"> <li>Determine if noise is from motor, transmission or cable.</li> </ul>	<p>Motor noise ► REPLACE motor. REPEAT Step A0.</p> <p>Transmission noise ► REPLACE transmission. REPEAT Step A0.</p> <p>Cable noise ► REMOVE and LUBRICATE cables. REINSTALL cables and GO to A2.</p>	
<b>A2</b>	<b>CABLE NOISE</b>		
	<ul style="list-style-type: none"> <li>Operate seat to verify that noisy condition has been corrected.</li> </ul>	<p>(OK) ► Power seat OK.</p> <p>(X) ► REPLACE cables. REPEAT Step A0.</p>	

**CR3538-B****POWER SEAT MOVES BUT IS LOOSE**

TEST STEP		RESULT	ACTION TO TAKE
<b>B0</b>	<b>VERIFY CONDITION</b>		
	<ul style="list-style-type: none"> <li>Operate power seat and check for looseness.</li> </ul>	<p>(OK) ► Power seat OK.</p> <p>(X) ► RETIGHTEN all attachment hardware. GO to B1.</p>	
<b>B1</b>	<b>CHECK SEAT OPERATION</b>		
	<ul style="list-style-type: none"> <li>Check if loose condition has been corrected.</li> </ul>	<p>(OK) ► Power seat OK.</p> <p>(X) ► REPLACE track assembly.</p>	

**CR3539-B**

## DIAGNOSIS (Continued)

## POWER SEAT DOES NOT MAKE FULL TRAVEL

TEST STEP		RESULT	ACTION TO TAKE
<b>C0</b>	<b>VERIFY CONDITION</b>		
	<ul style="list-style-type: none"> <li>• Operate power seat and verify that seat mechanism does not make full travel.</li> </ul>	<div> <div>OK</div> <div>▶</div> </div> <div> <div><del>OK</del></div> <div>▶</div> </div>	<div>Power seat OK.</div> <div>GO to <b>C1</b>.</div>
<b>C1</b>	<b>TRACK OBSTRUCTION</b>		
	<ul style="list-style-type: none"> <li>• Check for an obstruction in track mechanism.</li> </ul>	<div> <div>OK</div> <div>▶</div> </div> <div> <div><del>OK</del></div> <div>▶</div> </div>	<div>Power seat OK.</div> <div>GO to <b>D0</b> diagnosis chart.</div>

CR3540-D

## DIAGNOSIS (Continued)

## TRACK DOES NOT MOVE HORIZONTALLY AND/OR VERTICALLY

TEST STEP		RESULT	ACTION TO TAKE
<b>D0</b>	<b>VERIFY CONDITION</b>		
	<ul style="list-style-type: none"> <li>Operate power seat and verify condition.</li> </ul>	(OK) ► Power seat OK. (X) ► GO to D1.	
<b>D1</b>	<b>CHECK CABLE DEFLECTION</b>		
	<ul style="list-style-type: none"> <li>Check power seat track drive cables for deflection when the switch is activated.</li> </ul>	Cables deflect ► GO to D2. Cables do not deflect ► GO to D3.	
<b>D2</b>	<b>CABLE ROTATION CHECK</b>		
	<ul style="list-style-type: none"> <li>Remove cable attachments from transmission and check that flex cables in the tubes are free to rotate and slide.</li> </ul>	(OK) ► REMOVE and REPLACE transmission and bar assembly. REPEAT Step D0. (X) ► REMOVE and REPLACE flex cable and tube assembly. REPEAT Step D0.	
<b>D3</b>	<b>POWER CHECK</b>		
	<ul style="list-style-type: none"> <li>Disconnect motor leads from harness. Check for voltage at power seat harness when switch is activated.</li> </ul>	Voltage present ► REMOVE and REPLACE motor assembly. REPEAT Step D0. No voltage present ► GO to D4.	
<b>D4</b>	<b>TEST POWER SEAT SWITCH</b>		
	<ul style="list-style-type: none"> <li>Test power seat switch.</li> </ul>	Switch OK ► GO to D5. Switch Not OK ► REPLACE switch assembly. REPEAT Step D0.	
<b>D5</b>	<b>CHECK MOTOR GROUND CONNECTIONS</b>		
	<ul style="list-style-type: none"> <li>Check power seat motor for tight ground connections.</li> </ul>	(OK) ► CHECK for damaged connectors, shorts or open circuit. SERVICE as necessary. REPEAT Step D0. (X) ► TIGHTEN ground connection. REPEAT Step D0.	

CR3541-B



## DIAGNOSIS (Continued)

## POWER SEAT MOTOR DIAGNOSIS

TEST STEP		RESULT	ACTION TO TAKE
<b>E1</b>	<b>CHECK MOTOR OPERATION</b>		
	<ul style="list-style-type: none"> <li>• Disconnect leads from motor.</li> <li>• Connect jumper wires from battery positive and negative to motor terminals.</li> <li>• Motor should operate in one direction.</li> </ul>	<p>⓪ →</p> <p>ⓧ →</p>	<p>GO to <b>E2</b>.</p> <p>REPLACE motor.</p>
<b>E2</b>	<b>REVERSE JUMPER WIRES</b>		
	<ul style="list-style-type: none"> <li>• Reverse jumper wires to motor.</li> <li>• Motor should operate in opposite direction.</li> </ul>	<p>⓪ →</p> <p>ⓧ →</p>	<p>Motor OK. Problem is elsewhere in systems.</p> <p>REPLACE motor.</p>

CR3576-A

# SECTION 41-14 Seats, Rear—Conventional

SUBJECT	PAGE	SUBJECT	PAGE
REMOVAL AND INSTALLATION		VEHICLE APPLICATION .....	41-14-1
Seat Back Rest .....	41-14-2		
Seat Cushion .....	41-14-1		

## VEHICLE APPLICATION

Taurus/Sable.

## REMOVAL AND INSTALLATION

### Seat Cushion

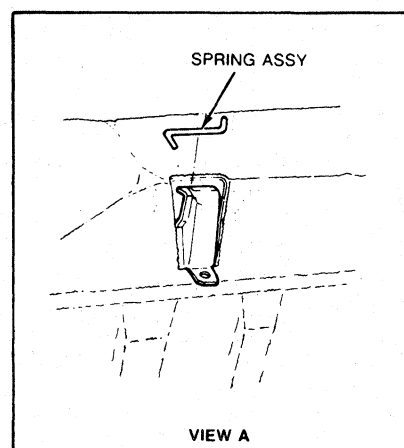
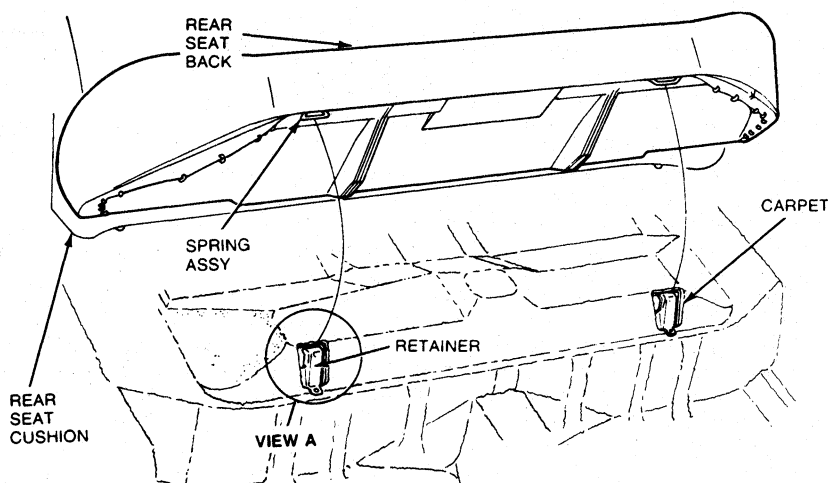
#### Removal

Apply knee pressure to lower portion of the rear seat cushion. Push rearward to disengage seat cushion from retainer brackets.

NOTE: The armrest is an integral part of the quarter trim panel. Its removal is not required to remove rear seat cushion or back.

#### Installation

1. Position seat cushion assembly into the vehicle.
2. Place seat belts on top of cushion.
3. Apply knee pressure to lower portion of seat cushion assembly. Push rearward and down to lock the seat cushion into position.
4. Pull rear seat cushion forward to be certain it is secured into its floor retainer.



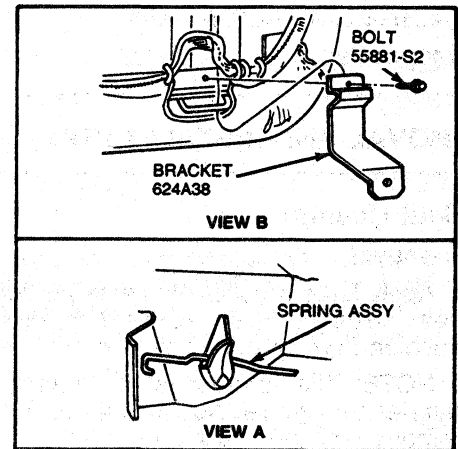
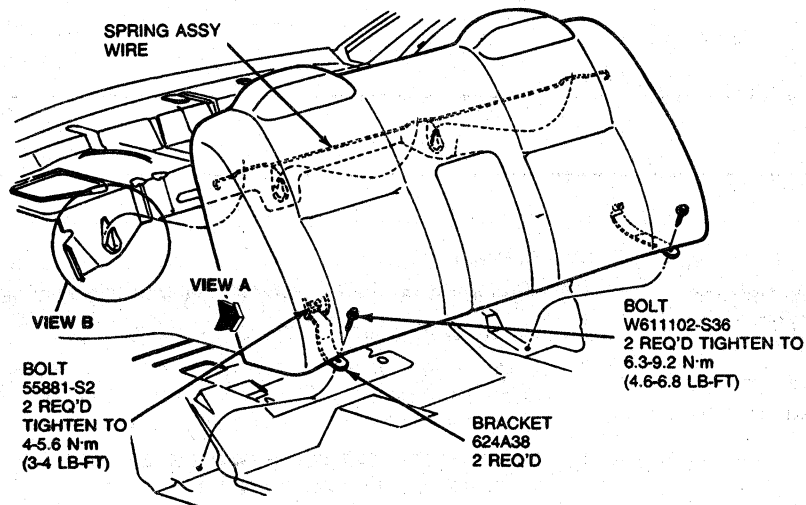
R4164-A

**REMOVAL AND INSTALLATION (Continued)****Seat Back Rest****Removal**

1. Remove rear seat cushion as outlined.
2. Remove seat back bracket attaching bolts.  
NOTE: Seat belt bolts do not secure seat back to vehicle.
3. Grasp seat back assembly at the bottom and lift up to disengage the hanger wire from the retainer brackets.

**Installation**

1. Position seat back in vehicle so that the hanger wires are engaged with the retaining brackets.
2. Install seat back bolts and tighten to 6.3-9.2 N·m (4.6-6.8 lb-ft). Refer to Section 41-50.
3. Install rear seat cushion as outlined.



R4165-B

# SECTION 41-20 Seats, Rear—Fold Down

SUBJECT	PAGE	SUBJECT	PAGE
DESCRIPTION AND OPERATION .....	41-20-1	REMOVAL AND INSTALLATION (Cont'd.)	
REMOVAL AND INSTALLATION		Seat Cushion, Auxiliary .....	41-20-3
Seat Back, Auxiliary .....	41-20-4	Seat Cushion, Rear .....	41-20-1
Seat Back, Rear—Split Folding .....	41-20-2	VEHICLE APPLICATION .....	41-20-1
Seat Back Latch, Rear .....	41-20-3		

## VEHICLE APPLICATION

Taurus/Sable.

## DESCRIPTION AND OPERATION

Optional split folding rear seats are available on station wagon applications to allow folding down of one or both sides of the rear seat backs. This allows hauling of cargo too long for the rear load floor area.

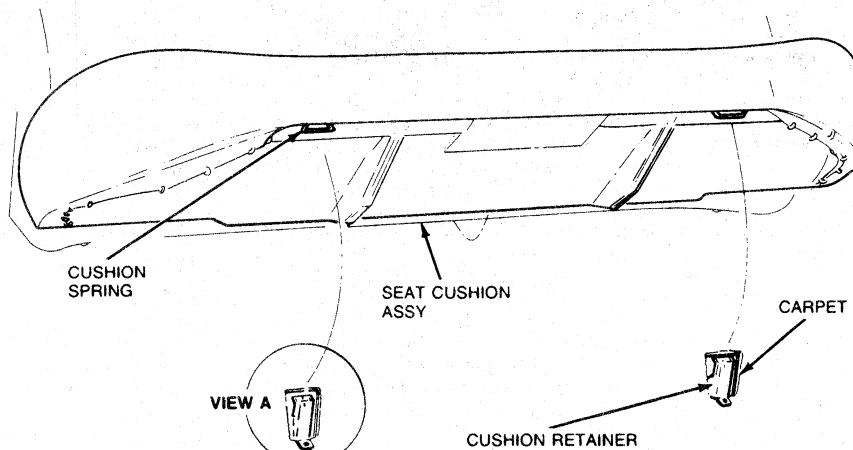
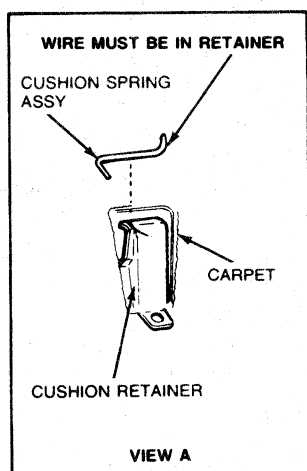
Depressing the latch release on the top of the seat back will allow the respective seat back to be folded down. The seat back will automatically latch on returning the seat back to its full-up position.

## REMOVAL AND INSTALLATION

### Seat Cushion, Rear

#### Removal and Installation

1. To remove rear seat cushion, apply knee pressure to lower portion of rear seat cushion. Push rearward to disengage seat cushion from retainer brackets.
2. To install rear seat cushion, apply knee pressure to lower portion of seat cushion assembly. Push rearward and down to engage cushion in retainer brackets.



R4393-A

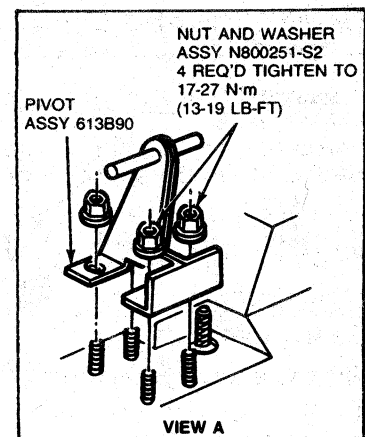
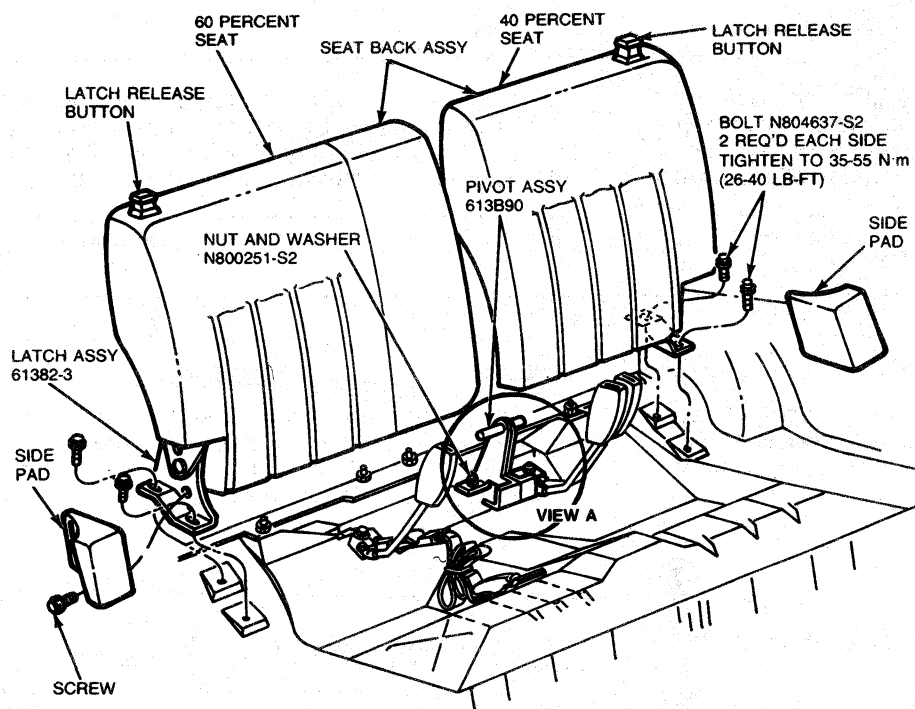
**REMOVAL AND INSTALLATION (Continued)****Seat Back, Rear—Split Folding****Removal**

1. Remove rear seat cushion as outlined.
2. Remove seat back side pads by removing attaching screws (one each) and sliding pad upward.
3. Remove four bolts (two each seat back) retaining seat back assembly to floorpan.
4. Remove seat back from inboard pivot pin by sliding seat back toward outboard side of vehicle.

**Installation**

1. Position seat back onto inboard pivot pin in the full-up position.
2. Install seat back-to-floorpan retaining bolts (two each side).
3. Check seat back latch for proper operation.
4. Install seat back side pads and attaching screws.

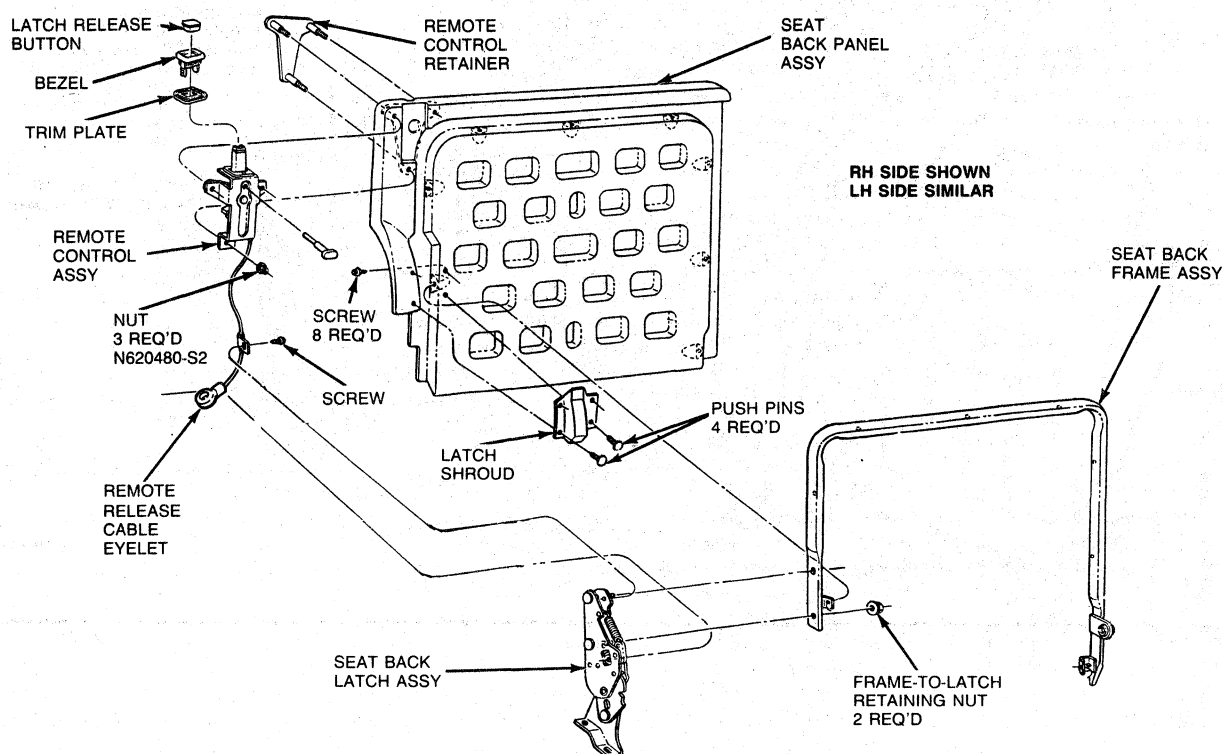
NOTE: A nut and bolt have been provided on the LH (40 percent) seat back latch only, to align the RH seat back to the fixed position ( $\pm 2$  degrees adjustment). To align the RH seat back, loosen the nut and bolt and reposition the bolt in its slot. Tighten the bolt and nut to 41-55 N·m (30-40 lb-ft). Check the seat backs for proper operation after alignment.



R4394-B

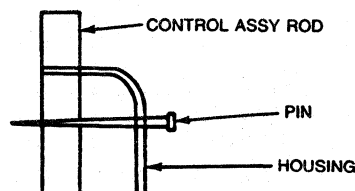
**REMOVAL AND INSTALLATION (Continued)****Seat Back Latch, Rear****Removal and Installation**

1. Remove rear seat back as outlined.
2. Remove and discard seat back latch release knob (snaps off). Remove bezel and retain.
3. Remove rear seat back trim cover and pad. Refer to Section 41-60.
4. Remove seat back latch shroud and discard the four push pins.
- NOTE: Do not cut off push pins. Cutoff push pins will rattle inside the load floor.
5. Remove three nuts attaching the remote control assembly to the remote control retainer and remove from seat back.
6. Remove screw securing cable flag to latch plate.
7. Detach remote release cable eyelet from latch.
8. Remove eight screws attaching seat back panel to frame.
9. Remove two nuts retaining latch to seat back frame.
10. To install, reverse the removal procedures using a new latch release knob.



R4395-B

NOTE: Before reinstalling pad and cover, function latch to ensure the remote control cable tension will allow the latch to release and lock. To ensure proper height of the control assembly rod, insert an approximately 3mm pin through the housing and rod before beginning installation procedure of the remote control assembly. Remove pin after installation is completed.



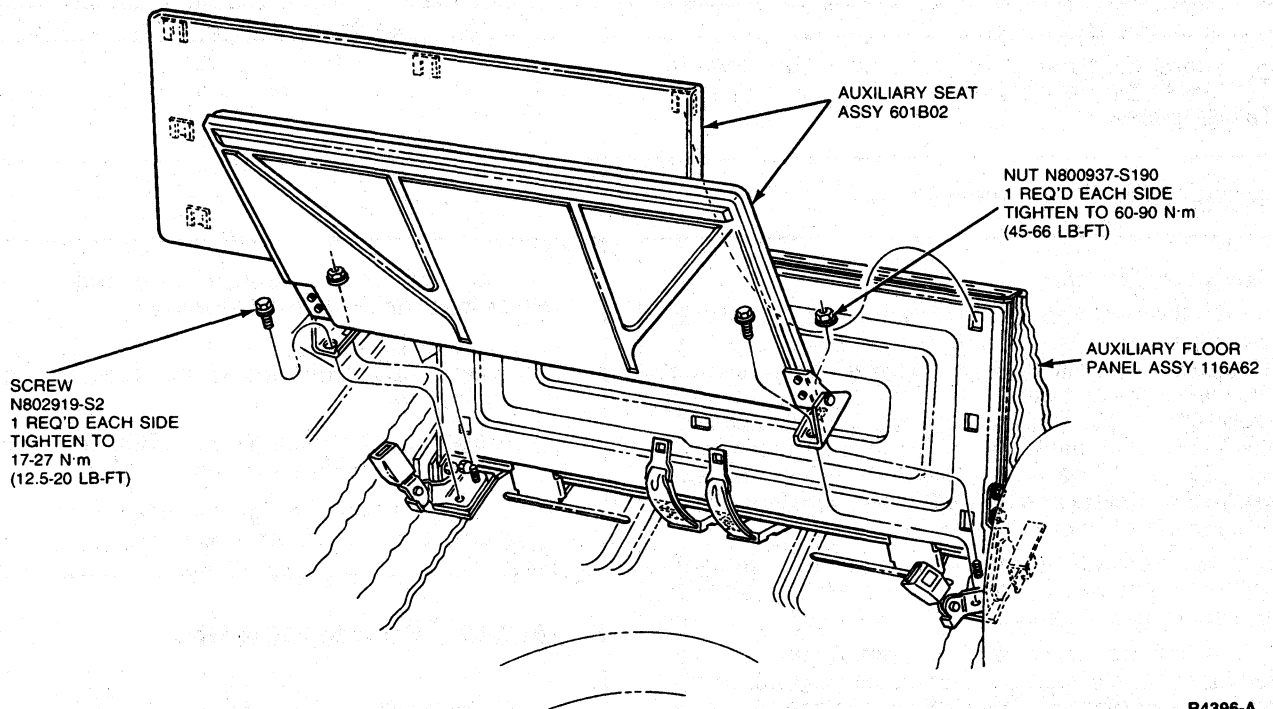
R4575-A

**Seat Cushion, Auxiliary****Removal and Installation**

1. Open liftgate.
2. Position auxiliary seat back into locking position.
3. Remove RH and LH auxiliary seat belt retaining nuts. Lift cushion assembly out of vehicle.
4. To install, reverse the removal procedures.

**REMOVAL AND INSTALLATION (Continued)****Seat Back, Auxiliary****Removal and Installation**

1. Remove auxiliary seat cushion as outlined.
2. Disengage retainers at top of back panel between load floor and seat back assembly.
3. Pull seat back assembly up to remove.
4. To install, reverse the removal procedures.



R4396-A

## SECTION 41-30 Seat Back—Front

SUBJECT	PAGE	SUBJECT	PAGE
ADJUSTMENTS .....	41-30-1	REMOVAL AND INSTALLATION .....	41-30-1
CLEANING AND MAINTENANCE .....	41-30-1	VEHICLE APPLICATION .....	41-30-1
DESCRIPTION AND OPERATION			
Recliner, Manual .....	41-30-1		

### VEHICLE APPLICATION

Taurus/Sable.

### DESCRIPTION AND OPERATION

#### Recliner, Manual

With the seat back recliner system, the seat back is reclined rearward for optimum occupant comfort. The reclining seat back is adjusted by a release handle on the outboard side of the seat cushion. To recline the seat back, rotate the handle upward, push the seat back to the desired position and release the handle. Spring action will return the seat back to its full-up position when the handle is lifted and occupant back pressure is removed.

If the recliner assembly is removed for any reason, it must be reinstalled. Tighten all attaching screws to specification.

If a recliner assembly or component is non-functional or damaged, the entire recliner assembly must be replaced. The recliner assembly is a modular design and the individual components cannot be serviced or replaced independently.

The only authorized service permitted on the recliner mechanism is the following:

1. Tightening of all attaching screws to specification indicated in Removal and Installation.
2. Replacement (in entirety) of a damaged or non-functional recliner assembly.
3. Removal of any foreign material, such as tie straps, pieces of foam and trim.

### CLEANING AND MAINTENANCE

The manual recliner assembly requires no cleaning or maintenance.

### ADJUSTMENTS

The manual recliner system is modular and does not require adjustments. However, proper lubrication of a hesitant seat back recliner assembly is permitted using Ford Polyethylene Grease D0AZ-19584-A or equivalent.

### REMOVAL AND INSTALLATION

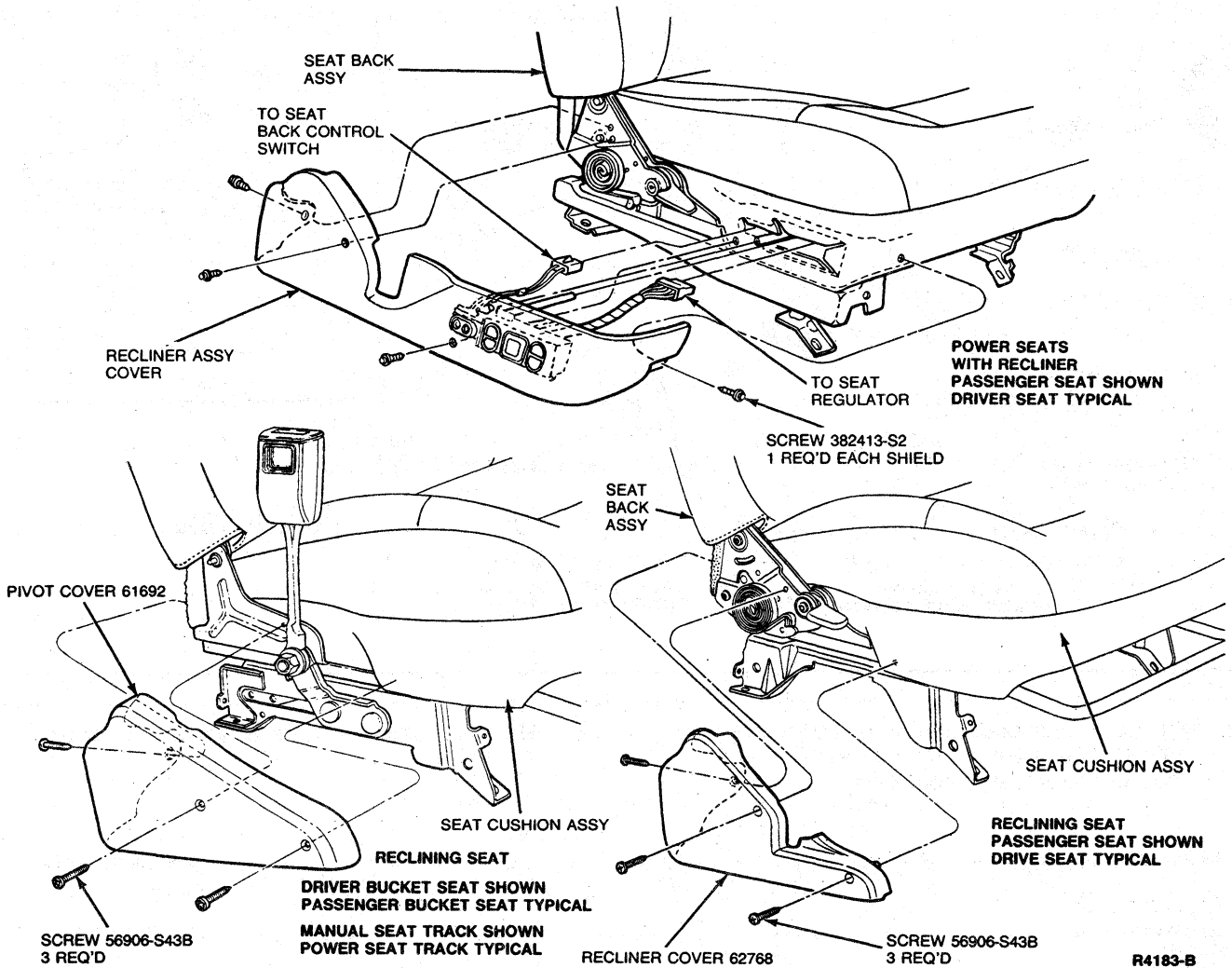
The recliner assembly must be replaced as a unit. Service of the recliner components **is not acceptable** and should not be attempted.



## REMOVAL AND INSTALLATION (Continued)

## Removal

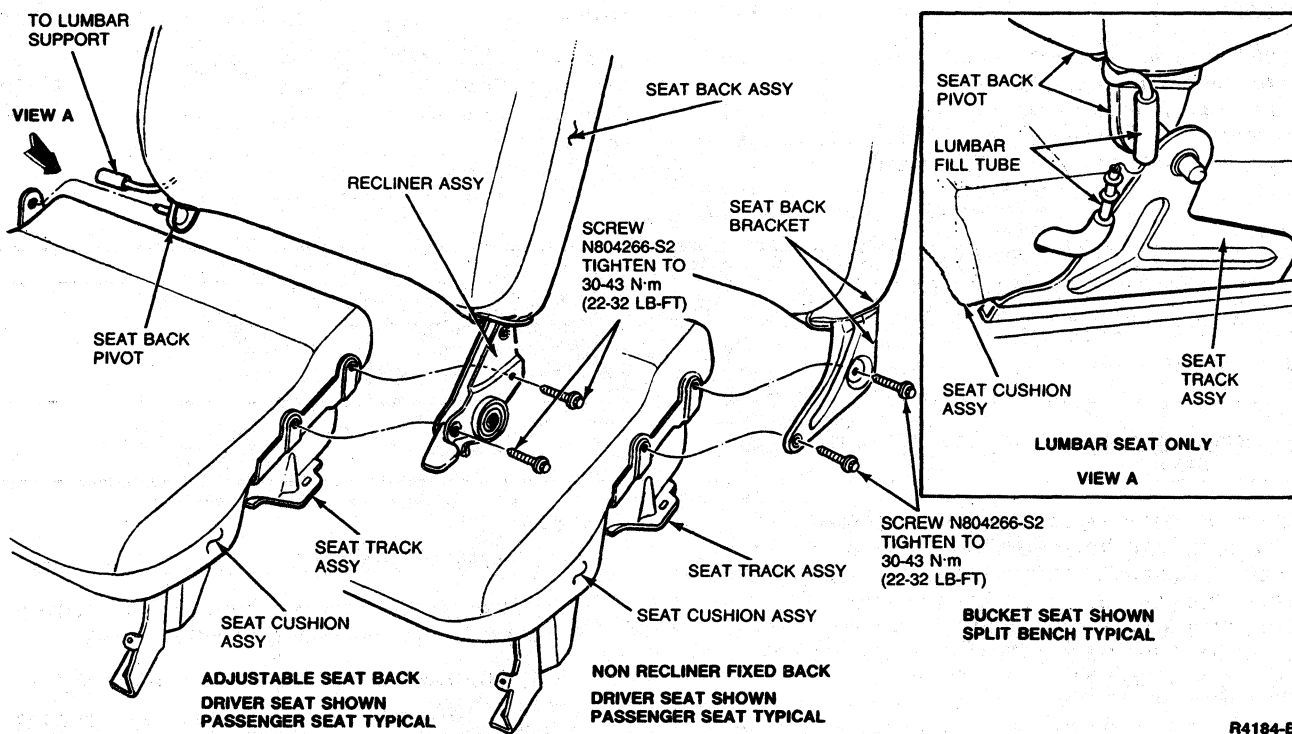
1. Remove seat cushion side cover retaining screws. Disconnect electrical connectors, if necessary (power seats), and remove side cover.



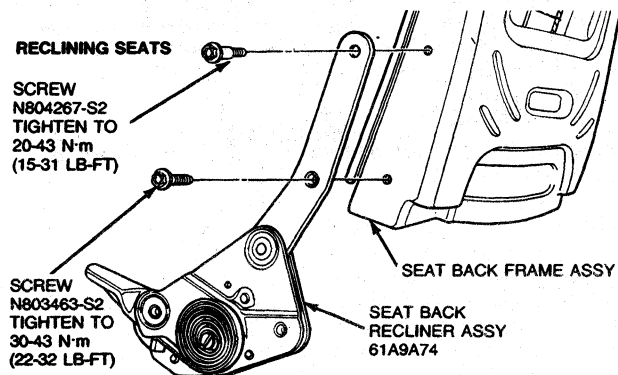
R4183-B

## REMOVAL AND INSTALLATION (Continued)

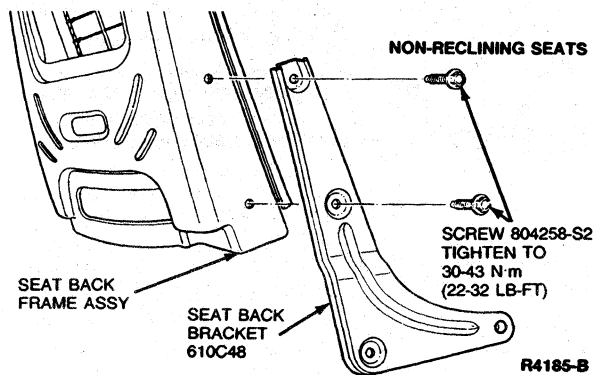
2. Remove screws retaining seat back bracket (fixed back seats) or recliner assembly (reclining seats) to seat track assembly.



3. Pull back a small portion of seat back cover to expose two screws retaining seat bracket or recliner assembly to seat back.



4. Remove screws and bracket or recliner assembly.



## Installation

1. Position seat back bracket (fixed back seats) or recliner assembly (reclining seats) to seat back frame. Install attaching screws and tighten to 30-43 N·m (22-32 lb-ft). Refer to the illustration under Removal, Step 2.
2. Position seat back bracket or recliner assembly to seat track assembly. Install attaching screws

and tighten to 30-43 N·m (22-32 lb-ft). Refer to the illustration under Removal, Step 2.

3. Position seat cushion side cover to seat and install cover screws. Connect any disconnected wires. Refer to the illustration under Removal, Step 1.

# SECTION 41-40 Head Restraints

SUBJECT	PAGE	SUBJECT	PAGE
DESCRIPTION AND OPERATION .....	41-40-1	REMOVAL AND INSTALLATION (Cont'd.)	
REMOVAL AND INSTALLATION		Head Restraint-to-Guide Rod, Rear .....	41-40-2
Head Restraint, Front Seat .....	41-40-1	VEHICLE APPLICATION .....	41-40-1
Head Restraint, Rear Seat .....	41-40-2		
Head Restraint Retaining Bracket, Rear Seat .....	41-40-2		

## VEHICLE APPLICATION

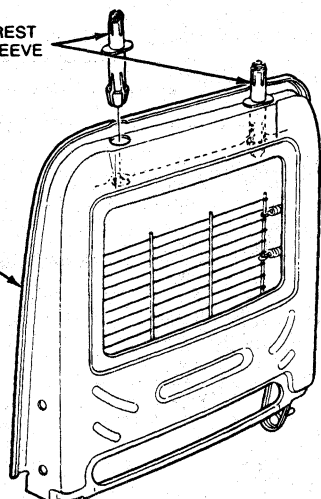
Taurus/Sable.

## DESCRIPTION AND OPERATION

Each front seat is equipped with a dual post design, 2-way or 4-way head restraint. The 4-way head restraint is capable of a 60 degree rotation from normal position by grasping head restraint and pulling forward on top surface. The guide sleeves are retained in the seat back by self-contained, integrally moulded ribs.

FRONT HEAD REST  
GUIDE ROD SLEEVE  
610A16

SEAT BACK  
SPRING ASSY



R4198-A

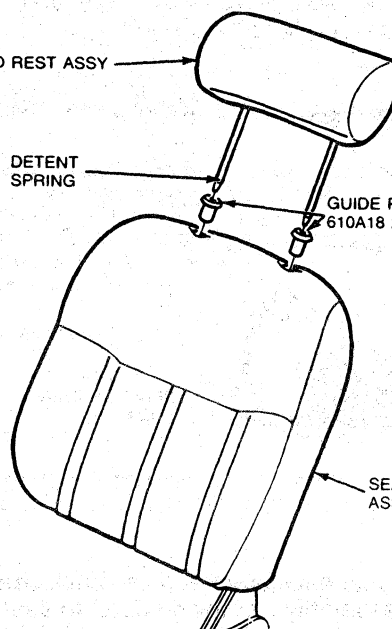
## Installation

1. Slide retainer caps onto head restraint posts.
2. Insert head restraint posts into guide sleeves and push down to engage detent spring.
3. Tighten retainer caps onto guide sleeves.
4. Adjust head restraint assembly by applying hand pressure, either upward or downward, to center area of head restraint.

HEAD REST ASSY

DETENT  
SPRING

GUIDE ROD SLEEVE  
610A18 2 REQ'D



SEAT BACK  
ASSY

R4199-A

## REMOVAL AND INSTALLATION

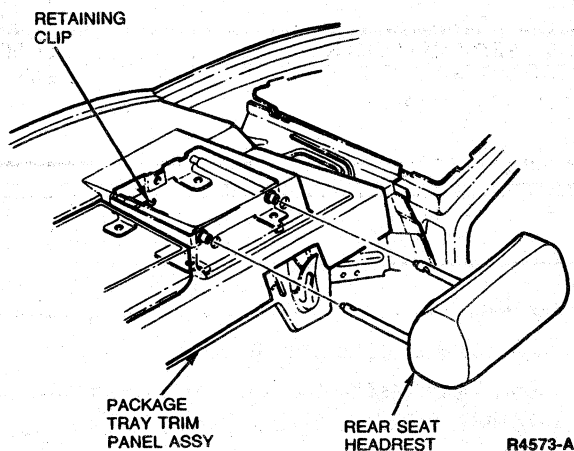
### Head Restraint, Front Seat

#### Removal

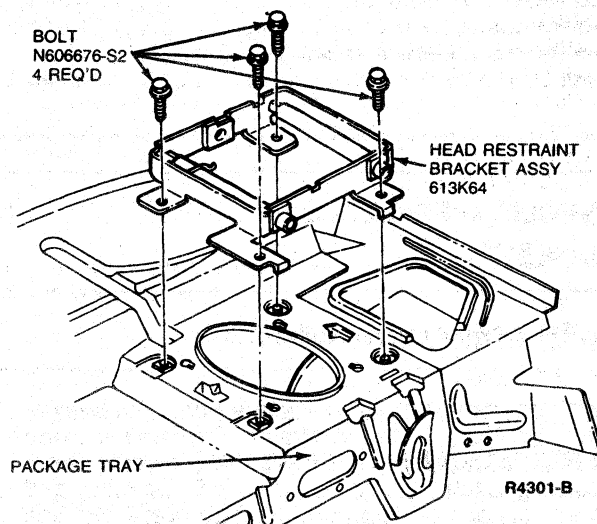
1. Unscrew retainer caps.
2. Pull up a portion of trim cover to expose detent spring head restraint.
3. Disengage detent spring by forcing spring toward shaft. Pull head restraint up and out.

**REMOVAL AND INSTALLATION (Continued)****Head Restraint, Rear Seat****Sable L.S.****Removal and Installation**

1. Remove plastic speaker cover.
2. Lift up rod retention clip.
3. Remove head restraint.
4. To install, reverse Steps 1 through 3.

**Installation**

1. Position head restraint retaining bracket to package tray. Install four retaining bolts.
2. Install package tray trim panel. Refer to Section 45-21.
3. Install head restraints as outlined.

**Head Restraint Retaining Bracket, Rear Seat****Removal**

1. Remove head restraints as outlined.
2. Remove package tray trim panel. Refer to Section 45-21.
3. Remove four bolts retaining head restraint retaining bracket to package tray.

**Head Restraint-to-Guide Rod, Rear****Removal and Installation**

1. Remove head restraint from vehicle as outlined.
2. Insert a 150mm (6-inch) piece of flat stock, 4.5mm (3/16-inch) wide, into guide sleeve in underside of head restraint. Push spring clip out of detent, while pulling guide rod from head restraint.
3. To install, position guide rods to head restraint, then push down firmly.

# SECTION 41-50 Seat and Shoulder Belts

SUBJECT	PAGE	SUBJECT	PAGE
<b>ADJUSTMENTS</b>		<b>MAJOR SERVICE OPERATIONS (Cont'd.)</b>	
Lap Belts, Rear .....	41-50-2	Seat Belt .....	41-50-7
Lap/Shoulder Belts, Front .....	41-50-2	Seat Belt Procedure After an Accident .....	41-50-8
<b>CLEANING</b>		<b>REMOVAL AND INSTALLATION</b>	
Belt Webbing .....	41-50-8	Seat Belt, Auxiliary Seat .....	41-50-6
<b>DESCRIPTION AND OPERATION</b>		Seat Belt Retractor and Harness	
Belt Buckle .....	41-50-1	Assembly—Front .....	41-50-3
Lap Belts .....	41-50-1	Seat Belts, Rear .....	41-50-6
Shoulder Harness .....	41-50-2	<b>SPECIAL SERVICE TOOLS</b> .....	41-50-9
<b>MAJOR SERVICE OPERATIONS</b>		<b>SPECIFICATIONS</b> .....	41-50-9
Functional Test Procedure .....	41-50-8	<b>VEHICLE APPLICATION</b> .....	41-50-1

## VEHICLE APPLICATION

Taurus/Sable.

## DESCRIPTION AND OPERATION

A continuous loop, single retractor restraint system is used on these vehicles.

The seat and shoulder belts are factory installed. If seat belt, or cable/buckle assemblies are removed for any reason, they should be installed as outlined. Tighten the anchor bolts and/or nuts to specification as shown in appropriate illustration.

**WARNING: BELT ASSEMBLIES MUST BE INSTALLED IN MATCHED SETS AS RECEIVED AND MUST NOT BE INTERCHANGED BETWEEN VEHICLES. IF A COMPONENT PORTION OTHER THAN THE REMOVABLE D-RING COVER (BUCKLE PORTION, RETRACTOR PORTION, ETC.) OF A SEAT BELT OR SHOULDER BELT ASSEMBLY IS NON-FUNCTIONAL OR DAMAGED, THE ENTIRE ASSEMBLY (BUCKLE, TONGUE AND SHOULDER HARNESS PORTIONS) MUST BE REPLACED. THE REPLACEMENT ASSEMBLY MUST BE INSTALLED AS A MATCHED SET AND THE MANUFACTURER'S IDENTIFICATION ON THE LABEL OF THE RETRACTOR WEBBING MUST MATCH THE MANUFACTURER'S IDENTIFICATION ON THE BUCKLE BASE. UNDER NO CIRCUMSTANCES ARE SEAT BELT OR SHOULDER BELT COMPONENTS TO BE REPLACED AS SEPARATE COMPONENTS.**

**NOTE:** Seat belt assemblies must be replaced after they have been subjected to loading by occupants in a collision.

The system incorporates a buzzer/chime and lamp warnings. The seat belt warning illuminates for approximately eight seconds after the ignition switch is turned on, regardless of seat belt usage. The seat belt warning buzzer is grounded by a switch in the LH inboard buckle. The seat belt warning buzzer/chime will sound for approximately eight seconds unless the driver's belt is connected.

### Belt Buckle

The inboard belt buckle is secured on the seat track for bucket seat applications or on the slide bar for flight bench seat applications.

Attaching the tongue and buckle secures the occupant with both lower and upper restraints. This tongue and belt attachment can be accomplished by a single, continuous movement.

### Lap Belts

Lap belts are provided for all front center (except bucket seat applications) and rear seating positions with the belts secured to the floorpan.

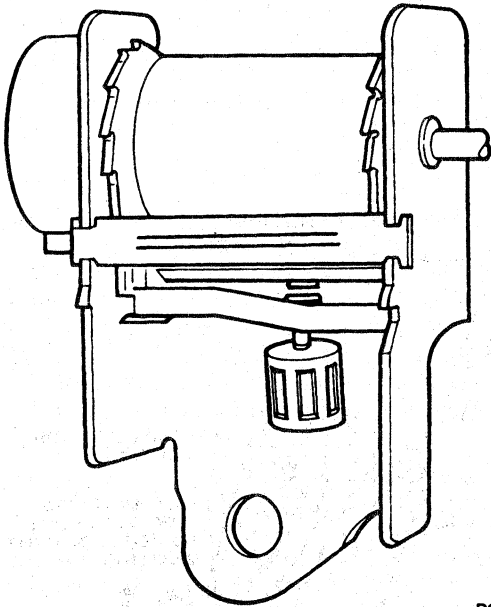
The lap belt webbing is anchored to the side of the sill (behind the scuff plate/center pillar trim panel). The shoulder harness webbing is fixed in a retractor which is located on the B-pillar post or in the quarter panel. This retractor is designed to let the webbing freely move in or out at all times, except during vehicle deceleration, when it is automatically locked by a mechanically actuated inertia sensor. The center lap belts do not have retractors.

**DESCRIPTION AND OPERATION (Continued)****Shoulder Harness**

The shoulder harness is guided through the web guide which is mounted on the B-pillar and inside of the scuff plate/center pillar trim panel.

The shoulder harness webbing is attached to a retractor. The retractor is located in the B-pillar. The webbing then passes through a guide above and behind the occupant's shoulder which directs the webbing at the proper downward angle over the occupant's shoulder and chest and attaches to the lap belt buckle.

The shoulder harness retractor is designed to let the webbing freely move in or out at all times, except during vehicle deceleration, when it is automatically locked by a mechanically actuated inertia sensor.



R3404-B

The auxiliary seat (station wagon applications) lap belt consists of a belt and buckle assembly on the outboard side and seat belt retractors with tongue on inside. Both are mounted to the floorpan. To fasten the belt, pull belt out of the retractor with a steady motion and insert the tongue into the buckle. Adjust belt snug around hips (never across the waist), and return excess belt webbing into retractor. Failure to do so may result in injury in a rear end collision.

**WARNING: NEVER INSTALL INFANT OR CHILD SAFETY SEATS IN THE AUXILIARY SEAT, BECAUSE THEY MAY NOT PROVIDE ADEQUATE PROTECTION FROM PERSONAL INJURY IN A COLLISION.**

**ADJUSTMENTS****Lap/Shoulder Belts, Front****Fastening Belts**

After entering the vehicle, adjust the front seat to obtain the best position for driving comfort and visibility. Then, use the following procedure for fastening belts.

Pull the lap-shoulder belt from the retractor so that the shoulder portion of the belt crosses the shoulder and chest. Then, insert the belt tongue into the proper buckle until a snap is heard and a latch is felt.

**Shoulder Portion Adjustment with Comfort Regulator**

The shoulder restraint portion of the belt adjusts automatically to a snug position.

To relieve belt pressure on the shoulder after the belt is fastened, a shoulder harness comfort regulator has been installed in the shoulder retractor. This regulator allows adjustment of the shoulder belt to a position for a comfortable shoulder harness length.

The comfort regulator operates similar to a window shade mechanism, and is used in the following manner:

1. Close the door.
2. Pull several inches of shoulder belt away from body and release.
3. Pull down a small amount of shoulder belt and release.

**WARNING: AN ADJUSTMENT THAT RESULTS IN MORE SLACK THAN IS REQUIRED TO INSERT A FIST BETWEEN THE SHOULDER BELT AND THE CHEST MAY REDUCE RESTRAINT SYSTEM EFFECTIVENESS. PULL AND RELEASE UNTIL THE SLACK IS MINIMIZED.**

**Comfort Regulator Release**

The comfort regulator is designed to automatically release when the respective front door is opened. As the seat belt is unbuckled, it should be hand-guided back to the retractor to prevent the belt tongue from striking nearby occupants or objects.

**Lap Portion Adjustment**

The lap portion of the front outboard belts adjusts automatically.

**Lap Belts, Rear****Fastening Belts**

Pull belt out of retractor with a steady motion and insert tongue into buckle. Adjust belt snugly around hips (never across the waist) by allowing slack to return to the retractor. Failure to do so may result in unnecessary injury in the event of a collision or sudden stop.

## REMOVAL AND INSTALLATION

**Seat Belt Retractor and Harness Assembly—Front**

NOTE: Seat Belt Bolt Bit T77L-2100-A or equivalent should be used for seat belt bolt removal and installation on front outboard belts. A metric socket is necessary to remove or install inboard buckles and center passenger belt anchors.

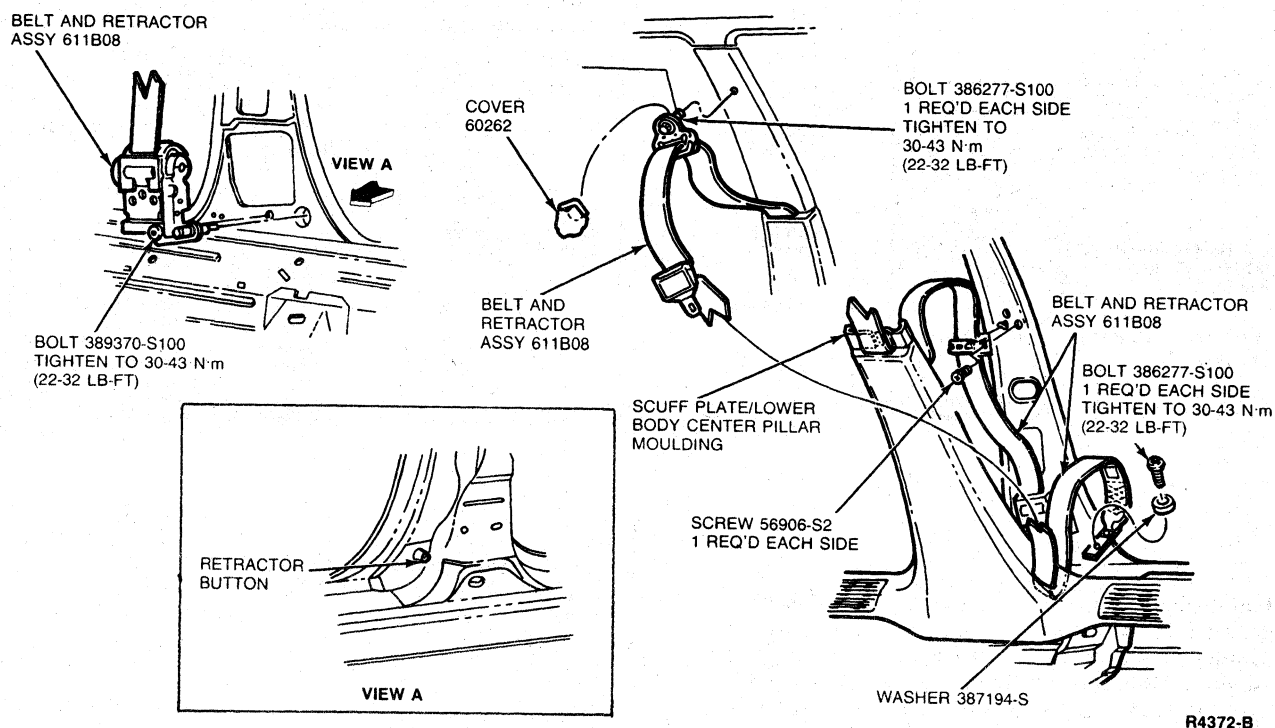
**Removal**

1. Remove D-ring cover.
2. Insert bolt bit and remove belt bolt.
3. Remove B-pillar upper trim panel.
4. Remove scuff plate/center pillar trim panel retaining screws and panel.
5. Remove seat belt through slot in upper center trim panel.
6. Remove seat belt anchor-to-sill bolt and rubber washer.
7. Remove seat belt retractor bolt.

8. Remove web guide attaching screw and slide guide rearward to remove from B-pillar.
9. Remove outboard seat belt assembly from vehicle.
10. Remove nut/bolt from inboard buckle assembly. On LH side, disconnect buzzer wire and pry locator off the seat.
11. Pull buckle upward to remove from seat.

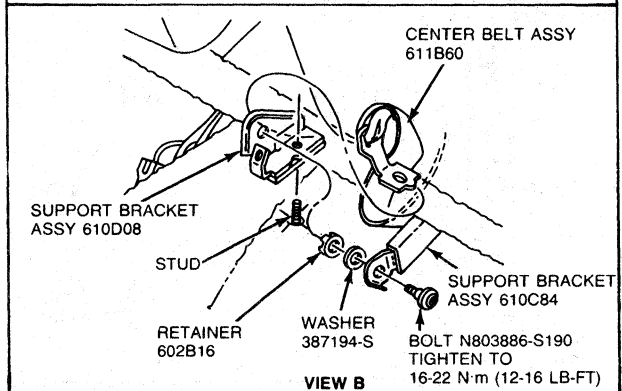
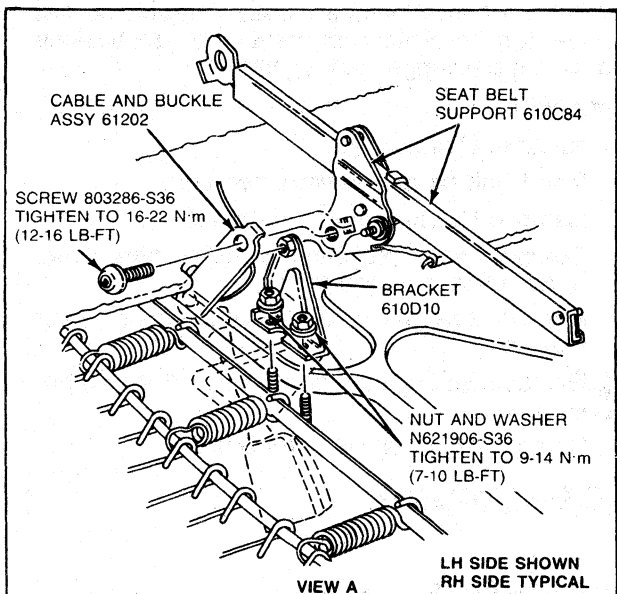
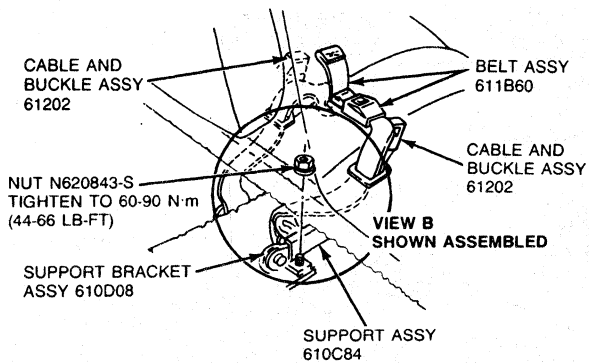
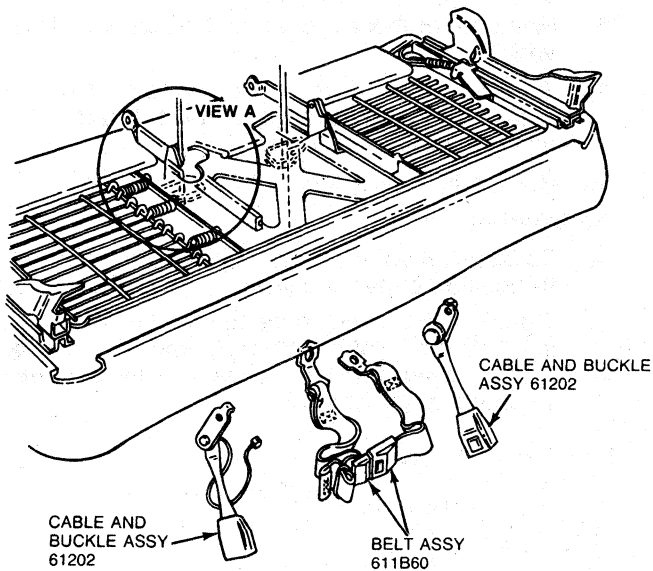
**Installation**

1. To install, reverse Removal procedure. Be sure to position belts as shown.
2. Tighten all attaching bolts to 30-43 N·m (22-32 lb-ft). Cycle system several times to ensure proper operation of retractor. Make sure webbing is not twisted.

**Seat Belts, Outboard**

## REMOVAL AND INSTALLATION (Continued)

# Seat Belts, Inboard Flight Bench

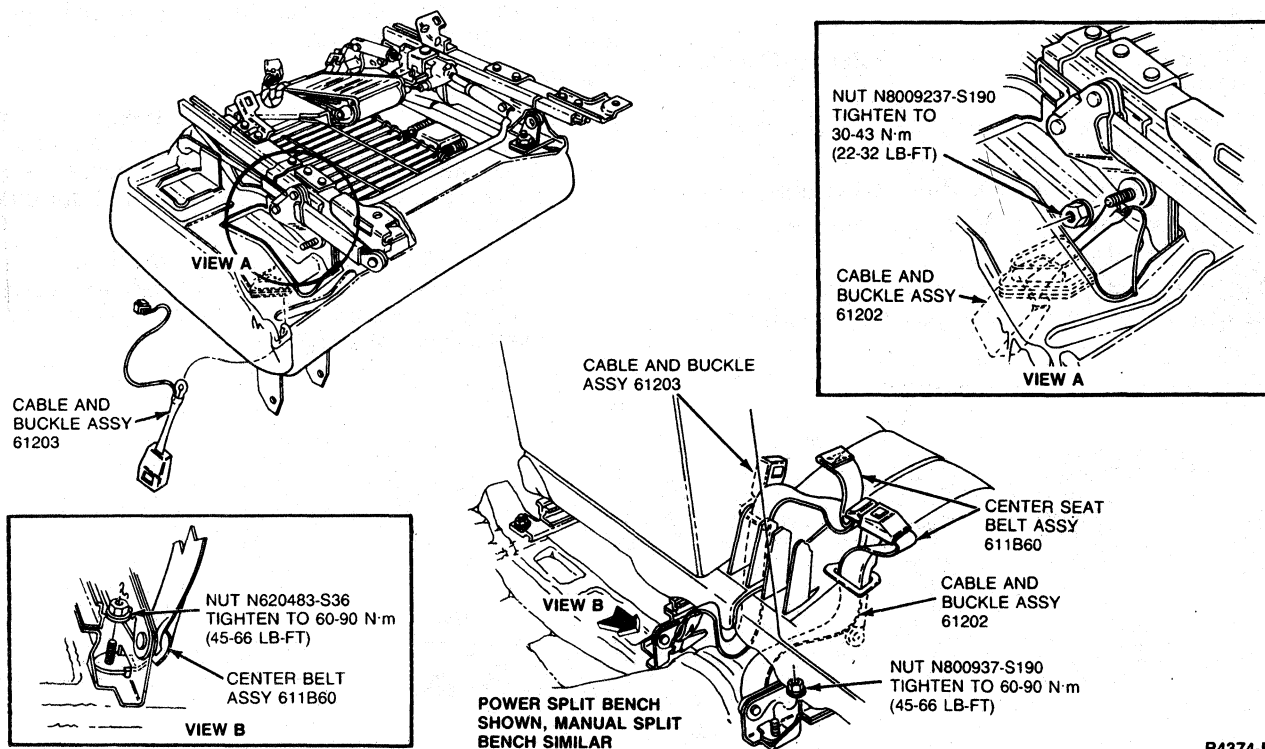


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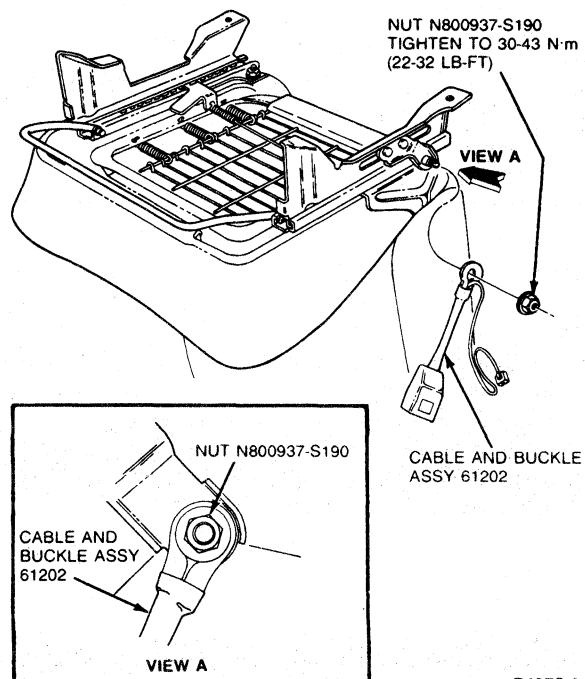
## REMOVAL AND INSTALLATION (Continued)

### Seat Belts, Inboard Split Bench



R4374-B

### Seat Belts, Inboard Bucket



R4375-A

**REMOVAL AND INSTALLATION (Continued)****Seat Belts, Rear**

Seat Belt Bolt Bit T77L-2100-A or equivalent, should be used for seat belt removal and installation.

**Removal**

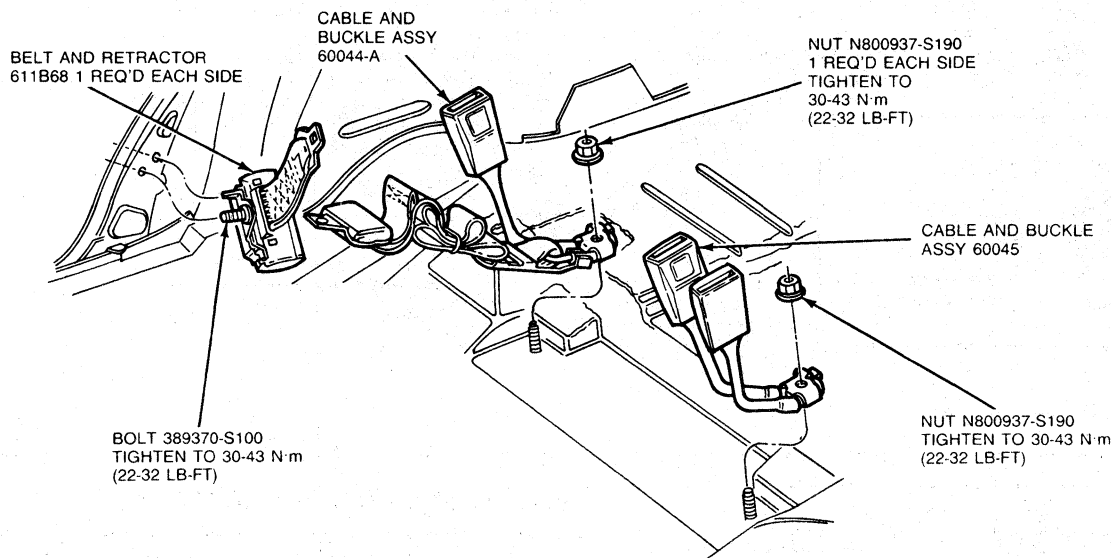
1. Remove rear seat cushion. Refer to Section 41-14.
2. Remove buckle end anchor nuts and remove buckle end belts.
3. Remove rear seat back. Refer to Section 41-14.
4. Remove attaching bolt to both rear seat retractors. Remove retractors.

NOTE: When only the outboard or center seat belt assembly is replaced, the brass ring holding one

anchor of the center seat belt assembly and the buckle end anchor of the outboard seat belt must be pried open and discarded in order to slide belt anchor out of assembly.

**Installation**

1. Reverse Removal procedure, being sure to position belts and retractor as shown. When only outboard or center seat belt assembly is replaced, slide replacement belt into boot until anchors align.
2. Tighten all attaching bolts to 30-42 N·m (22-32 lb-ft). Cycle system several times to ensure proper operation of retractor. Make sure webbing is not twisted.



R4376-B

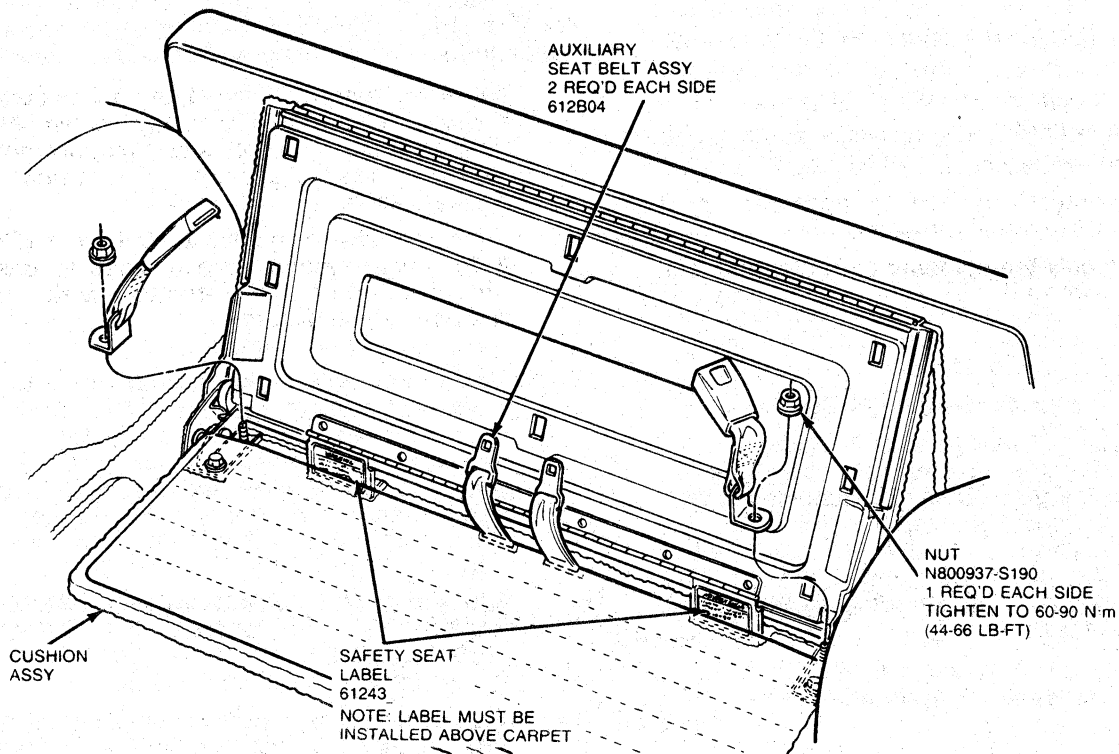
**Seat Belt, Auxiliary Seat****Wagon****Removal**

1. Remove nut to remove outboard belt and buckle assembly.
2. Remove inboard retractor. Remove rear seat back.
3. Remove three screws attaching front panel of load floor assembly.
4. Remove the front panel. Reach between floorpan and load floor and remove the nut to pull out the retractor.

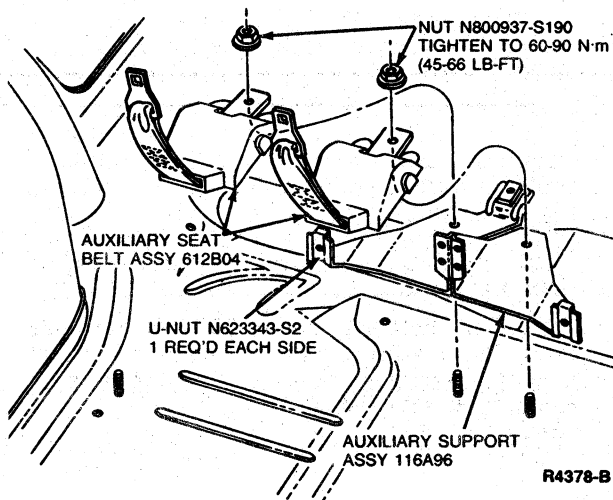
**Installation**

1. To install, reverse Removal procedure. Position belts as shown.
2. Tighten all attaching nuts to 60-90 N·m (45-66 lb-ft). Cycle retractor several times to ensure proper operation of retractor. Make sure webbing is not twisted.

## REMOVAL AND INSTALLATION (Continued)

Seat Belts, Auxiliary  
Outboard

R4556-A

Seat Belts, Auxiliary  
Inboard

R4378-B

## MAJOR SERVICE OPERATIONS

When performing seat belt service operations, refer to the appropriate illustration under Removal and Installation.

## Seat Belt

## Without Anchor Plate Thread Damage

1. Remove damaged bolt for anchor reinforcement and discard.
2. Install a new bolt. Refer to Specifications for part number. Tighten to 30-43 N·m (22-32 lb-ft).

## With Anchor Plate Thread Damage

1. Remove broken or stripped bolt and discard.
2. Drill out internal threads in seat belt anchor plate with a 27/64-inch drill.
3. Re-thread anchor plate with a 1/2-13 tap.
4. Blow out chips.
5. Install attachment parts in proper sequence. Refer to applicable illustrations under Removal and Installation. Tighten replacement bolt to specification. Original parts are to be replaced with the service parts indicated in seat belt parts replacement chart. Unless specified in the chart, use original parts.

**MAJOR SERVICE OPERATIONS (Continued)****Seat Belt Procedure After an Accident**

All seat belt assemblies must be replaced after a collision, provided:

1. The seat belt was in use at the time of the accident or,
2. The seat belt was damaged by the accident (bent retractor, torn webbing, etc.) or,
3. The seat belt attaching area(s) was damaged by the accident.

Before installing the new seat belt assembly, seat belt attaching areas must be inspected for damage and distortion. If the attaching points are damaged and distorted, the sheet metal must be reworked back to its original shape and structural integrity.

Install new seat belt(s) using the appropriate instructions. Perform Functional Test Procedure.

**Functional Test Procedure**

Determine the type(s) of seat belt assembly(s) that has been replaced. Test the new seat belt assembly using the appropriate procedure.

**Lap Belt Retractor Test—2-Point System**

Grasp new seat belt tongue and pull approximately 915mm (36 inches) of webbing out of the retractor. Return approximately 122mm (5 inches) of webbing into the retractor and pull. If retractor locks, the belt assembly is functioning properly. If retractor does not lock or the designated amount of webbing cannot be pulled from the retractor, replace with a new seat belt assembly.

**Continuous Loop Shoulder/Lap Belt Test—System With Movable Tongue and One Retractor**

1. Driver will buckle up and proceed to a safe test area. If RH passenger seat belt must be tested, a passenger should be buckled into RH seat. (The passenger belt may be tested utilizing a driver only, providing driver has the ability to grasp RH shoulder belt and extend it approximately 660mm (26 inches) with no compromise to safe driving). This method applies to 8 km/h (5 mph) test only.

NOTE: The RH shoulder belt should not be extended fully as to preclude the possibility of a false feeling (full extension vs. lockup).

2. After reaching a safe area to perform sudden stops, driver will attain a speed of approximately 8 km/h (5 mph). The driver should inform passenger (if applicable) that he is preparing to make a severe brake application. At this time, both driver and rider should grasp their respective shoulder harnesses and

prepare to lean slightly forward at the moment brake application is made.

3. The driver will make a maximum brake application without tire skid. (The maximum brake application should be on dry concrete or equivalent hard road surface; never on a wet or gravel road). The driver and passenger should lean forward slightly into shoulder harness. At this instant, belts should lock up without webbing payout.

**WARNING: THE DRIVER AND PASSENGER MUST BE PREPARED TO BRACE THEMSELVES IN THE EVENT THE RETRACTOR DOES NOT LOCK.**

4. If there is a lockup of both shoulder straps, seat belt assemblies are functioning properly. Should either or both retractors fail to lock up at the 8 km/h (5 mph) speed, repeat the test at a constant 24 km/h (15 mph). (This test must be performed with RH passenger if RH belt is to be tested.)

5. If either or both shoulder belts do not lock up at 24 km/h (15 mph) test, return vehicle for service of malfunctioning seat belts. Remove retractor and rework sheet metal in retractor's mounting surface. Install retractor assembly and re-test seat belt assembly(s) as previously stated.

NOTE: If the retractor of a new seat belt assembly has been bolted into a damaged or distorted mounting area, the new retractor could be warped and may not function. If this is the case, reshape the sheet metal and install another new complete seat belt assembly.

**CLEANING****Belt Webbing**

Clean the belt webbing with any mild soap solution recommended for cleaning upholstery or carpets; follow instructions provided with soap. **Do not bleach or redye the webbing, as webbing may weaken.**

**SPECIFICATIONS**

PRODUCTION PARTS			REPLACEMENT PARTS		
Part No.	*Code Letter	Part Name	Part No.	*Code Letter	Part Name
386277-S100	IK	Bolt — 7/16-20 x 1.38 Pan Shldr. Tapping — .50 Shldr.	385709-S36	T	Bolt — 1/2-13 x 1.38 Pan Head Shoulder Locking
389370-S100	IM	Bolt — 7/16-20 x 1.15 Pan Head Tapping	389478-S190	U	Bolt — 1/2-13 x 1.15 Pan Head Locking
N803286-S190	—	Screw — M12 x 1.75 x 20 Pan Head	—	—	—
N803886-S190	—	Bolt — M12 x 1.95 x 34 Pan Head Shoulder Pilot	—	—	—

CR3272-A

**SPECIAL SERVICE TOOLS**

Tool Number	Description
T77L-2100-A	Seat Belt Bolt Bit

CR3409-B

# SECTION 41-52 Seat, Child Restraint—Tether Attachment

SUBJECT	PAGE	SUBJECT	PAGE
DESCRIPTION .....	41-52-1	VEHICLE APPLICATION .....	41-52-1
INSTALLATION			
Tether Attachment .....	41-52-1		

## VEHICLE APPLICATION

Taurus/Sable.

## DESCRIPTION

Some aftermarket child safety seats provide a tether strap which goes over the back of the vehicle seat and attaches to an anchorage in the floor or panel behind the rear seat. (Ford Tot-Guard Child Seat does not require a top tether strap).

On Sedan models, two (one each side) 9.0mm (0.35-inch) top tether attachment holes in the package tray structure (behind the rear seat) have been provided for attachment of the anchor hardware supplied with the safety seat, if required.

On Wagon models, two (one each side) steel U-shaped load floor anchors located on the forward auxiliary floor trim panel have been provided for attachment of the child safety tethers. The tether anchors are easily accessed by inserting a small screwdriver under the attachment anchor covers and prying them off the anchors.

On Wagon models with the auxiliary (third) seat, tether attachments have been provided on the auxiliary seat center support bracket for attaching rear (second) seat tether restraints only.

**WARNING: WHEN USING ANY INFANT OR CHILD RESTRAINT SYSTEM IT IS IMPORTANT THAT YOU FOLLOW THE INSTRUCTIONS PROVIDED BY THE MANUFACTURER CONCERNING ITS INSTALLATION AND USE. FAILURE TO FOLLOW EACH OF THE RESTRAINT MANUFACTURER'S INSTRUCTIONS CAN RESULT IN A CHILD STRIKING THE VEHICLE'S INTERIOR DURING A SUDDEN STOP OR COLLISION.**

**WARNING: DO NOT PLACE INFANT OR CHILD SEATS IN THE AUXILIARY (THIRD) SEAT, BECAUSE THEY MAY NOT PROVIDE ADEQUATE PROTECTION FROM PERSONAL INJURY IN THE CASE OF A COLLISION.**

## INSTALLATION

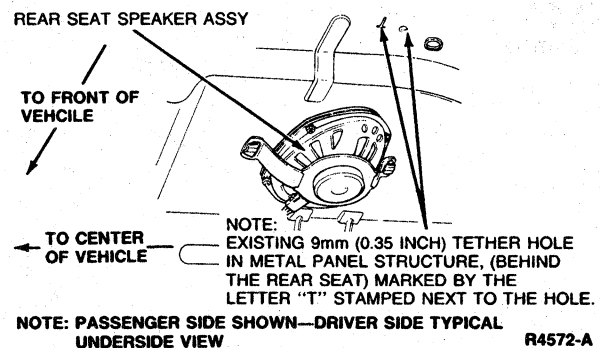
### Tether Attachment

#### Package Tray

#### Sedan

Vehicles equipped with a package tray (sill-below the rear window glass) have two 9.0mm (.35-inch) holes provided in the package tray sheet metal structure for attaching the child seat tether.

1. From inside the luggage compartment, locate the 9.0mm (.35-inch) top tether attachment holes in the package tray structure indicated by the letter "T" next to each hole.



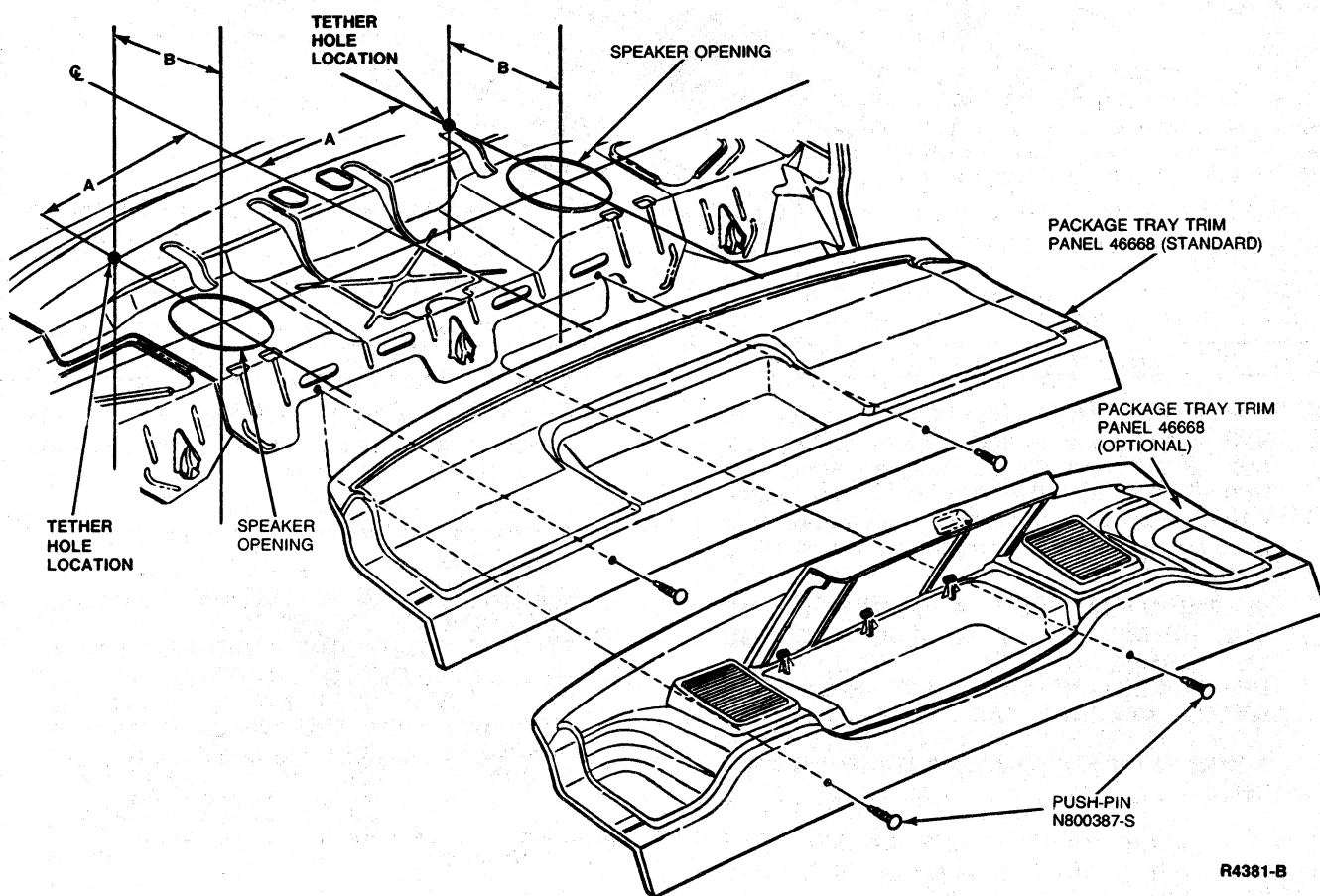
## INSTALLATION (Continued)

**Dimension A** is the distance from the centerline of the vehicle to the center of the attachment holes. **Dimension B** is the approximate distance from the center of the radio speaker opening to the center of the tether attachment holes.

Vehicle	Dimension A — Centerline to Tether Hole		Dimension B — Speaker Grille Opening To Tether Hole		Hole Size	
	mm	Inches	mm	Inches	mm	Inches
Taurus	380	14.9	222	8.75	9.0	0.35
Sable	381	15.0	248	9.75	9.0	0.35

CR4383-A

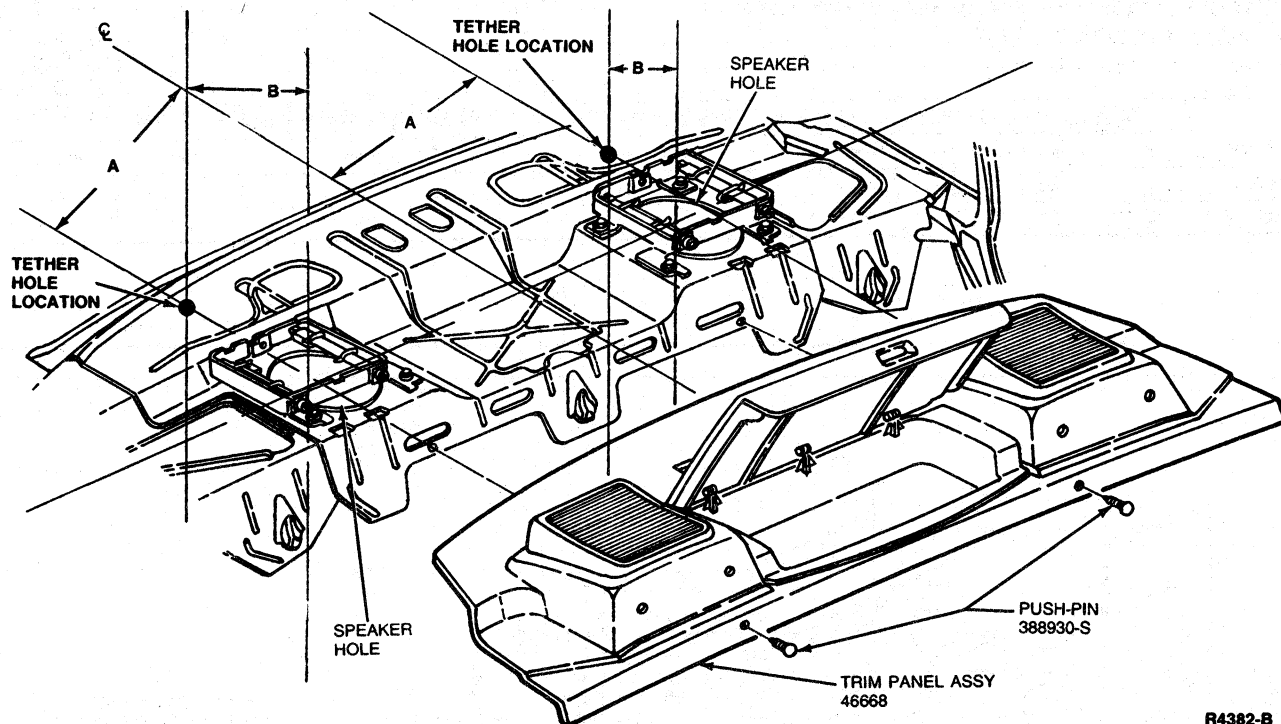
## Taurus



R4381-B

## INSTALLATION (Continued)

## Sable



R4382-B

2. Using the existing hole(s) in the package tray structure as locators and a sharp pointed tool such as an awl or ice pick, pierce a small hole through the package tray (sill) trim panel. Exercise caution to prevent the piercing tool from hitting and shattering the rear windshield glass.

**WARNING: AN ASSISTANT MUST BE INSIDE THE VEHICLE HOLDING THE PACKAGE TRAY DOWN TO PREVENT IT FROM BEING DISLODGED. THE ASSISTANT MUST ALSO AVOID HOLDING THE PACKAGE TRAY DOWN IN THE AREA THAT THE HOLE IS BEING PIERCED TO AVOID HAND OR ARM INJURY.**

3. From inside the vehicle, enlarge the hole in the trim panel until the bolt/anchor supplied by the restraint manufacturer fits.
4. Install the top tether anchor hardware according to the restraint manufacturer's instructions.

**WARNING: IT IS IMPORTANT THAT THE BOLT/ANCHOR BE SECURELY TIGHTENED TO THE RESTRAINT MANUFACTURER'S SPECIFICATIONS. OTHERWISE, THE CHILD SAFETY SEAT MAY NOT BE PROPERLY SECURED AND THE CHILD COULD BE INJURED IN CASE OF A SUDDEN STOP OR ACCIDENT.**

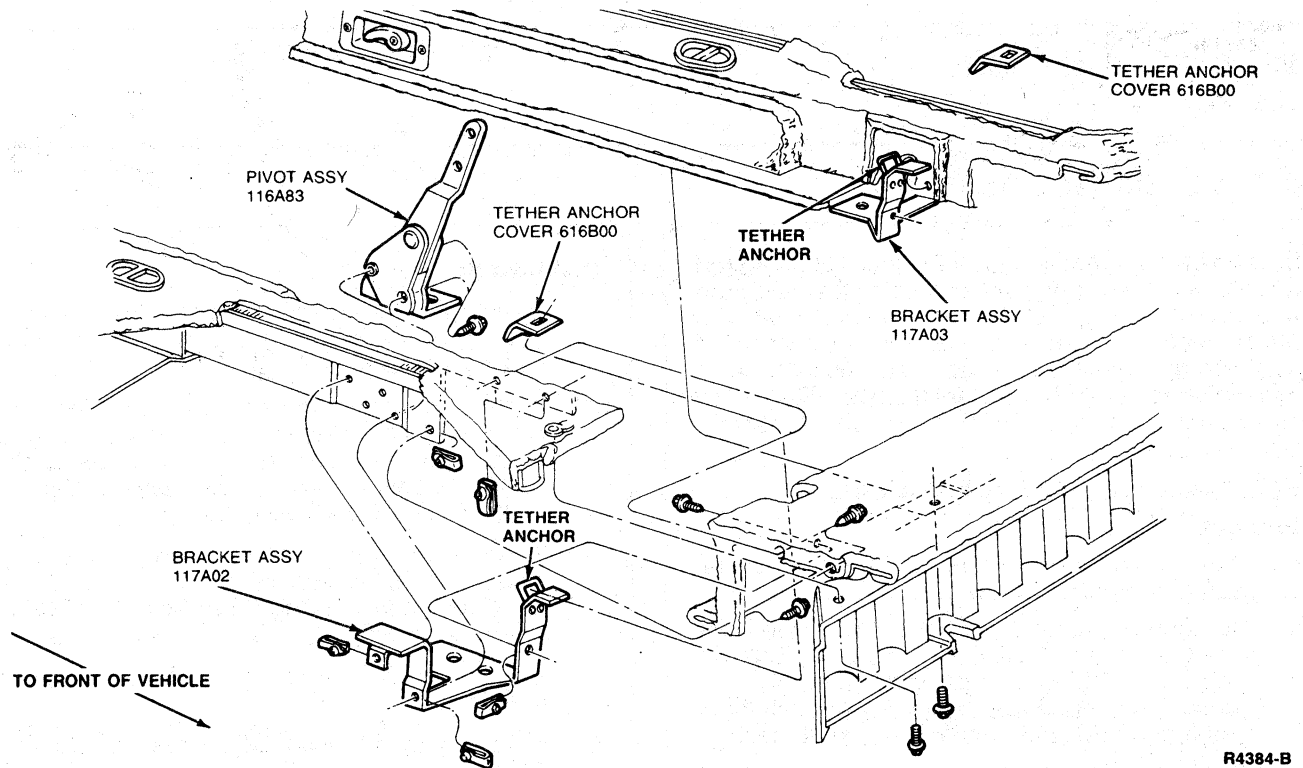


**INSTALLATION (Continued)****Floor Trim Panel, Auxiliary****Wagon**

1. Remove snap-on plastic floor anchor covers marked "CHILD SEAT RESTRAINT" using a small screwdriver to pry the cover off of the anchor.
2. Install tether restraint system per restraint manufacturer's instructions.

**WARNING: IT IS IMPORTANT THAT THE BOLT/ANCHOR BE SECURELY TIGHTENED**

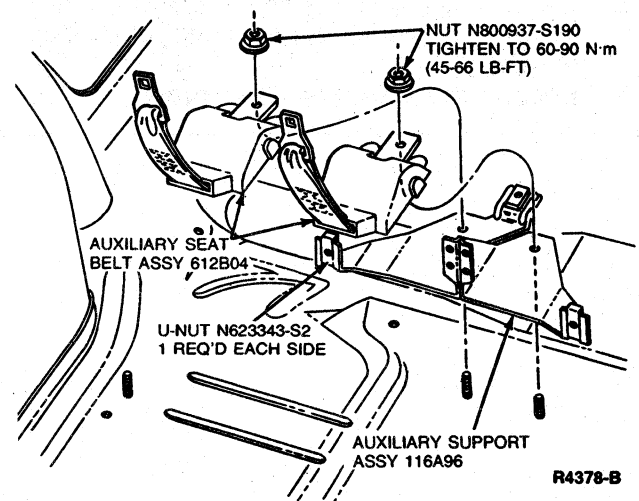
**TO THE RESTRAINT MANUFACTURER'S SPECIFICATIONS. OTHERWISE, THE CHILD SAFETY SEAT MAY NOT BE PROPERLY SECURED, AND THE CHILD COULD BE INJURED IN CASE OF A SUDDEN STOP OR ACCIDENT.**



R4384-B

**Seat Bracket, Auxiliary****Wagon**

1. Remove auxiliary seat back and cushion. Refer to Section 41-20.
2. Install tether anchor hardware according to restraint manufacturer's instructions.
3. Install auxiliary seat back and cushion. Refer to Section 41-20.



R4378-B

## SECTION 41-60 Seat Trim

SUBJECT	PAGE	SUBJECT	PAGE
<b>REMOVAL AND INSTALLATION</b>		<b>REMOVAL AND INSTALLATION (Cont'd.)</b>	
Seat, Front—Center Armrest Cover .....	41-60-5	Seat, Rear—Cushion Cover .....	41-60-3
Seat, Front—Cushion Cover .....	41-60-2	Seat Back Trim Cover, Front Seat .....	41-60-1
Seat, Rear—Back Cover .....	41-60-4	<b>VEHICLE APPLICATION</b> .....	41-60-1
Seat, Rear—Center Armrest Cover .....	41-60-6		

### VEHICLE APPLICATION

Taurus/Sable.

### REMOVAL AND INSTALLATION

If some of the removal and installation Steps do not apply to a particular model, proceed to the next Step and review the appropriate illustration. Seat trim replacement requires removal and installation of seat components such as seat tracks, seat assemblies and head restraints. Refer to appropriate Sections in this Group for these procedures.

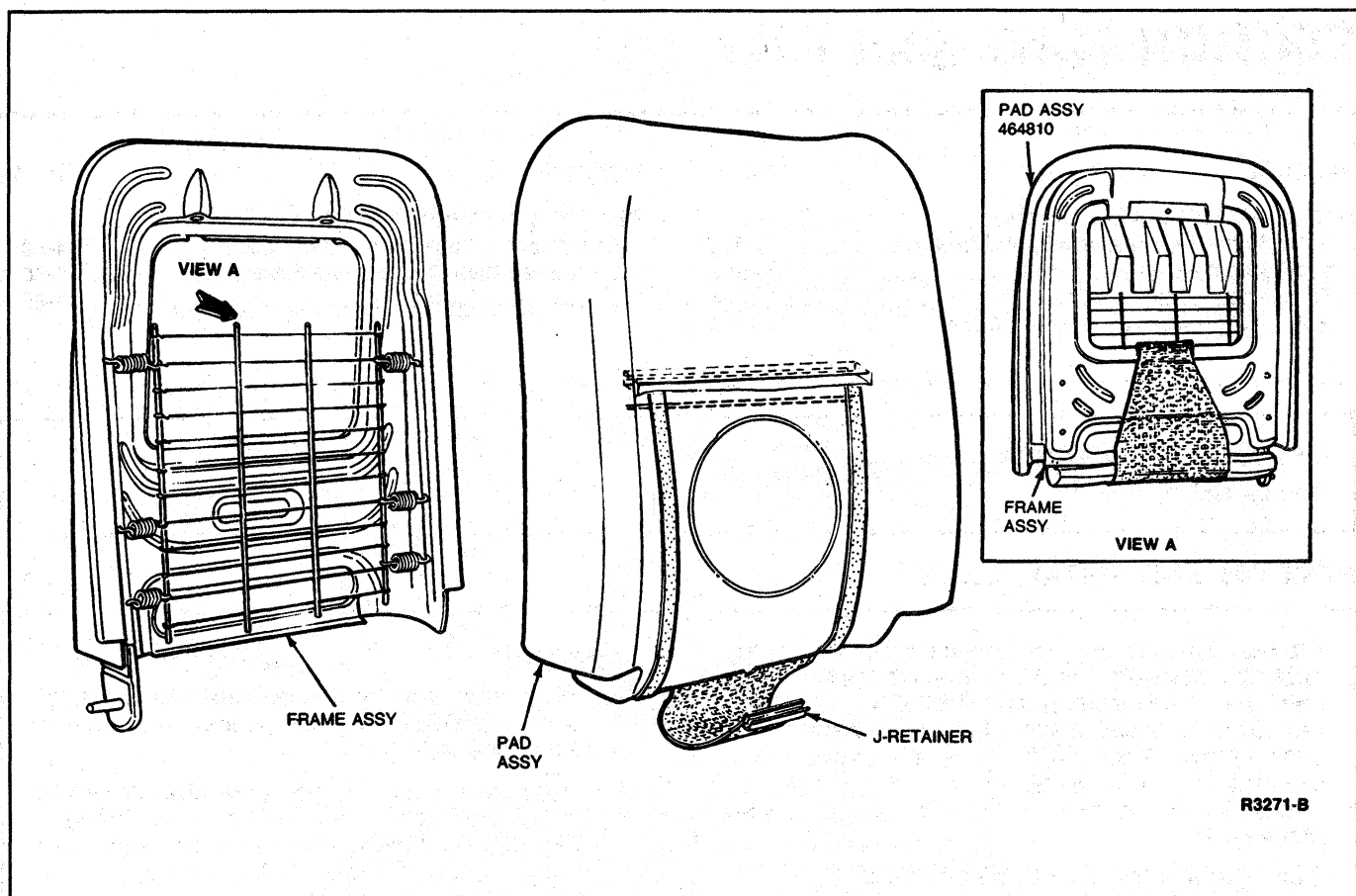
#### Seat Back Trim Cover, Front Seat

##### Removal

1. Remove seat and track assembly from vehicle. Refer to Section 41-01.
2. Remove seat back latch covers. Remove bolts retaining seat back to cushion frame. Refer to Section 41-30. Place seat back assembly on a protective surface and remove seat back latch emergency release handle and escutcheon, if so equipped.
3. Remove headrest. Refer to Section 41-40.
4. Unzip or disengage J-retainers from the trim cover at the bottom of the seat back.
5. Cut the hog rings retaining wires. Remove trim cover. Remove retaining wires from their listings.
6. Remove pad assembly, if necessary.

##### Installation

1. With the exception of the top portion, approximately 200mm (8 inches), turn the new trim cover inside out.
2. Position trim cover to pad assembly. Work trim cover down until horizontal tiedown listing is aligned with its retaining wire in pad assembly. Install tiedown wire in the listing. Secure tiedown wire to pad assembly.
3. Position remaining portion of trim cover to pad assembly. Install vertical tiedown wires (if so equipped) in their listings. Secure ends of wires to pad assembly.
4. Zip trim cover or engage J-retainers to close trim cover.
5. Install headrest assembly. Refer to Section 41-40.
6. Install seat back assembly to cushion assembly. Tighten attaching bolts as specified. Refer to Section 41-01.
7. Install seat and track assembly. Tighten attaching bolts. Refer to Section 41-01.
8. Check seat tracks for proper operation.

**REMOVAL AND INSTALLATION (Continued)**

R3271-B

**Seat, Front—Cushion Cover****Removal**

1. Remove seat and track assembly from the vehicle. Refer to Section 41-01. Place seat on a clean surface.
2. Remove seat back and seat tracks from the cushion.
3. Cut hog rings from cushion cover and/or disengage plastic retainers from seat cushion flange. Remove trim cover.
4. Remove pad assembly, if necessary.

**Installation**

1. Install pad assembly, if removed.

2. Transfer all bolster tiedown wires to their respective listings in new cover assembly.
3. Position trim cover over pad and frame assembly.
4. Install necessary hog rings and/or plastic retainers to cushion flange.
5. Install seat tracks and back assembly to cushion frame. Tighten all attaching bolts. Refer to Section 41-01.
6. Install seat and track assembly. Tighten attaching bolts. Refer to Section 41-01.
7. Check seat tracks for proper operation.

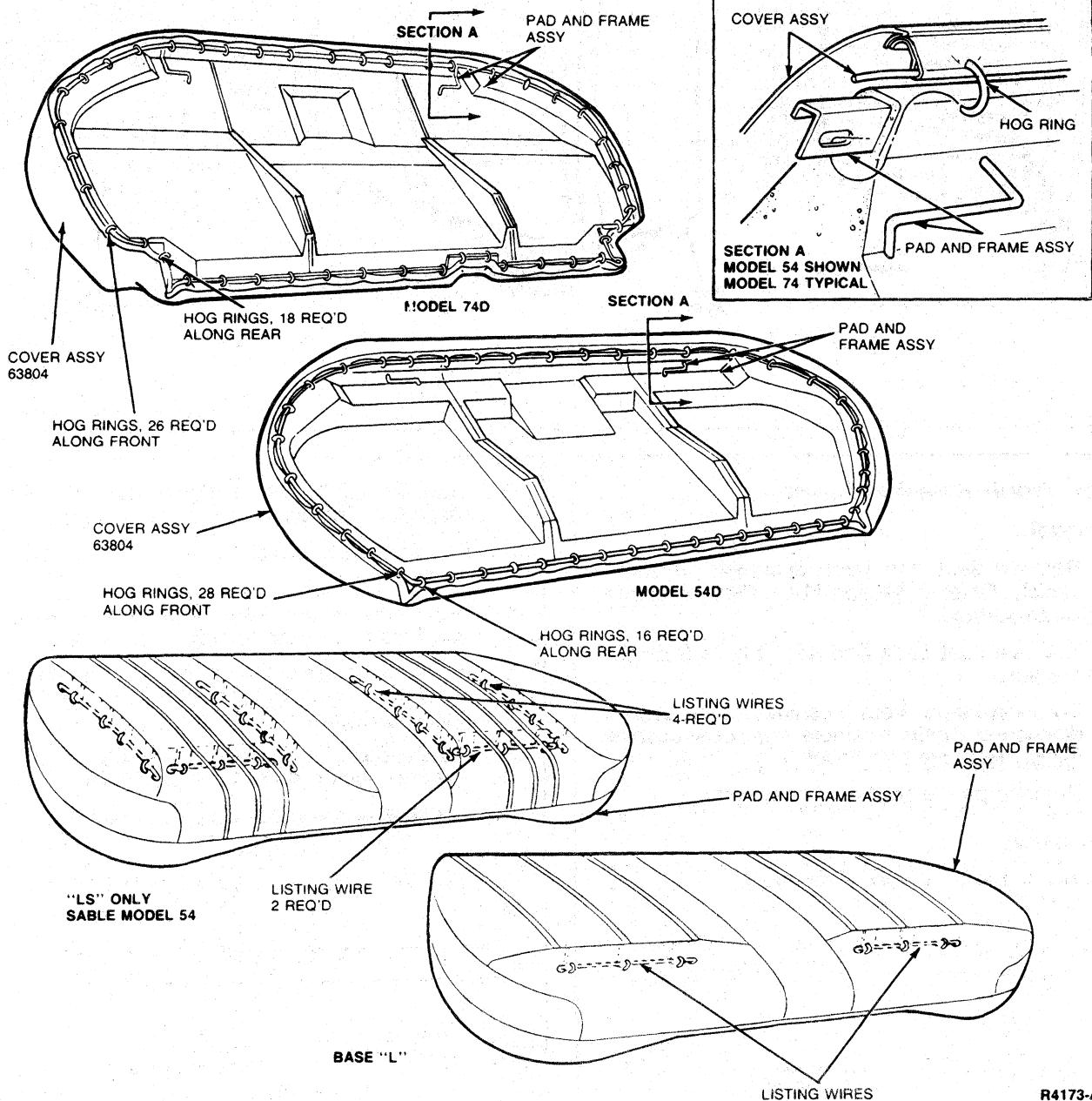
**REMOVAL AND INSTALLATION (Continued)****Seat, Rear—Cushion Cover****Removal**

1. Remove cushion assembly from vehicle and place it on a clean surface. Refer to Section 41-14.
2. Remove hog rings retaining cushion trim cover to pad and frame assembly. Remove trim cover.
3. Remove bolster tiedown wires from their listings and transfer them to their respective listings in new cover.

4. Remove pad assembly, if necessary.

**Installation**

1. Install pad assembly, if removed.
2. Position new trim cover over pad and frame assembly. Secure with hog rings.
3. Install cushion assembly in vehicle.



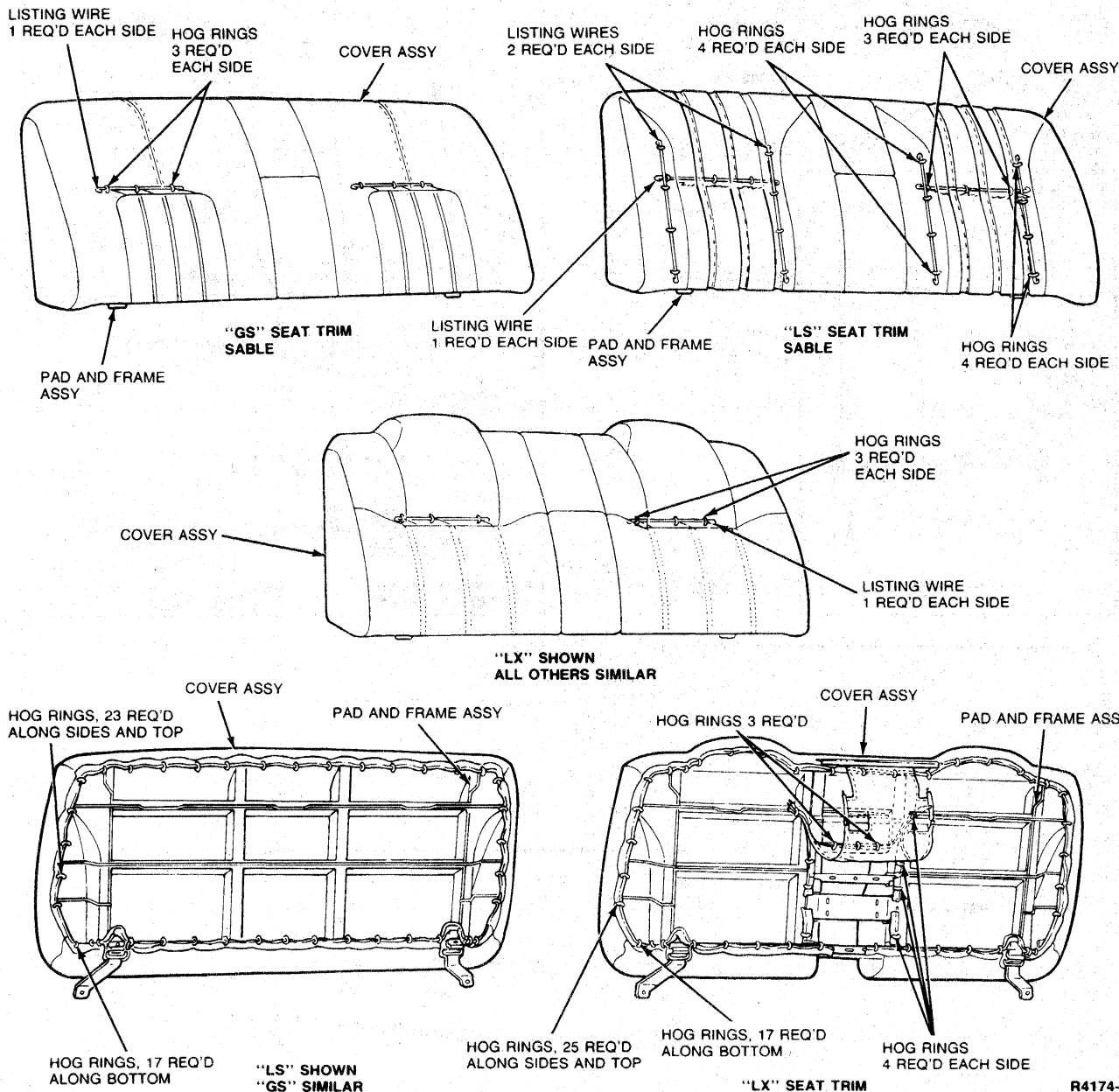
R4173-A

**REMOVAL AND INSTALLATION (Continued)****Seat, Rear—Back Cover****Removal**

1. Remove seat back assembly from vehicle and place it on a clean surface. Refer to Section 41-14.
2. Remove hog rings retaining trim cover.
3. Remove trim cover.
4. Remove bolster tiedown wires from their listings. Transfer them to their respective listings in new trim cover.

**Installation**

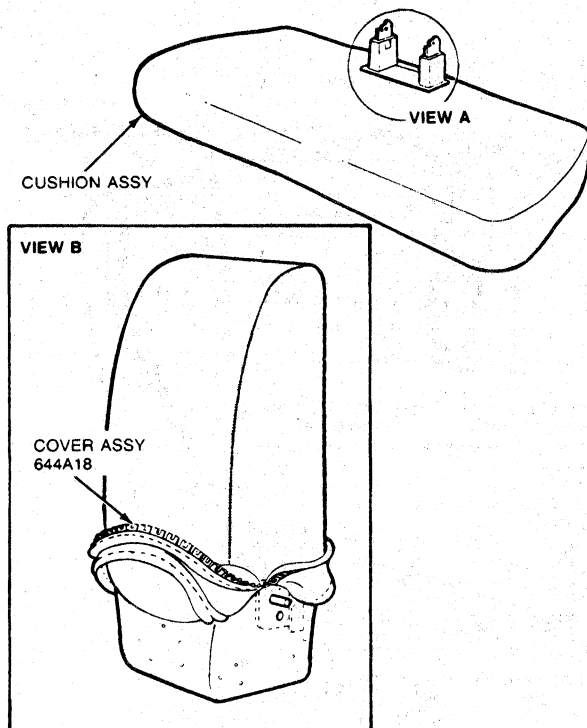
1. Position trim cover evenly to back panel and pad assembly.
2. Hog ring the vertical tiedown listings to pad assembly at each outboard location.
3. Hog ring trim cover to pad and frame assembly.
4. Install seat back assembly.



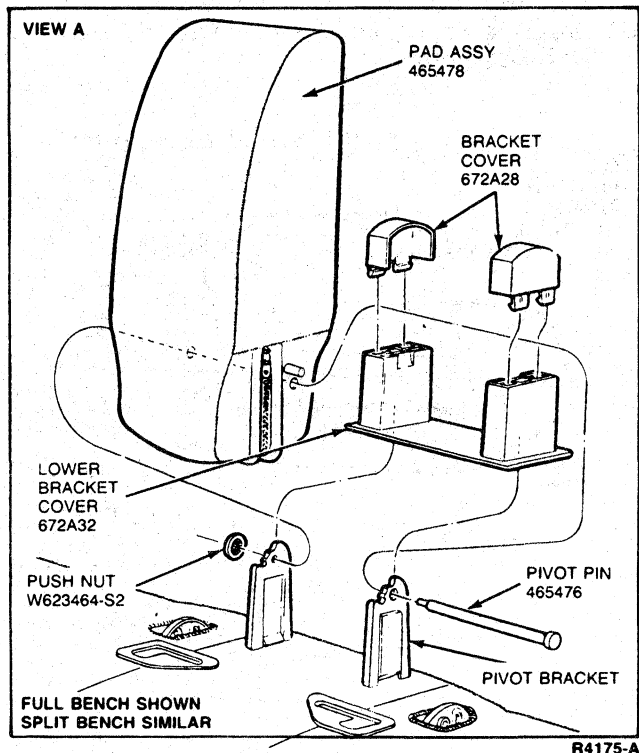
R4174-A

**REMOVAL AND INSTALLATION (Continued)****Seat, Front—Center Armrest Cover****Removal**

1. Remove armrest pivot bracket cover to gain access to pivot pin attaching armrest to seat cushion assembly.
2. Pry off pushnut and remove armrest pivot pin and armrest.
3. Unzip zipper, and slip cover off pad and base assembly.

**Installation**

1. Slip new cover over pad and base assembly and close zipper.
2. Assemble armrest to armrest pivot bracket. Install armrest pivot pin and new pushnut.
3. Install armrest pivot bracket cover.



## REMOVAL AND INSTALLATION (Continued)

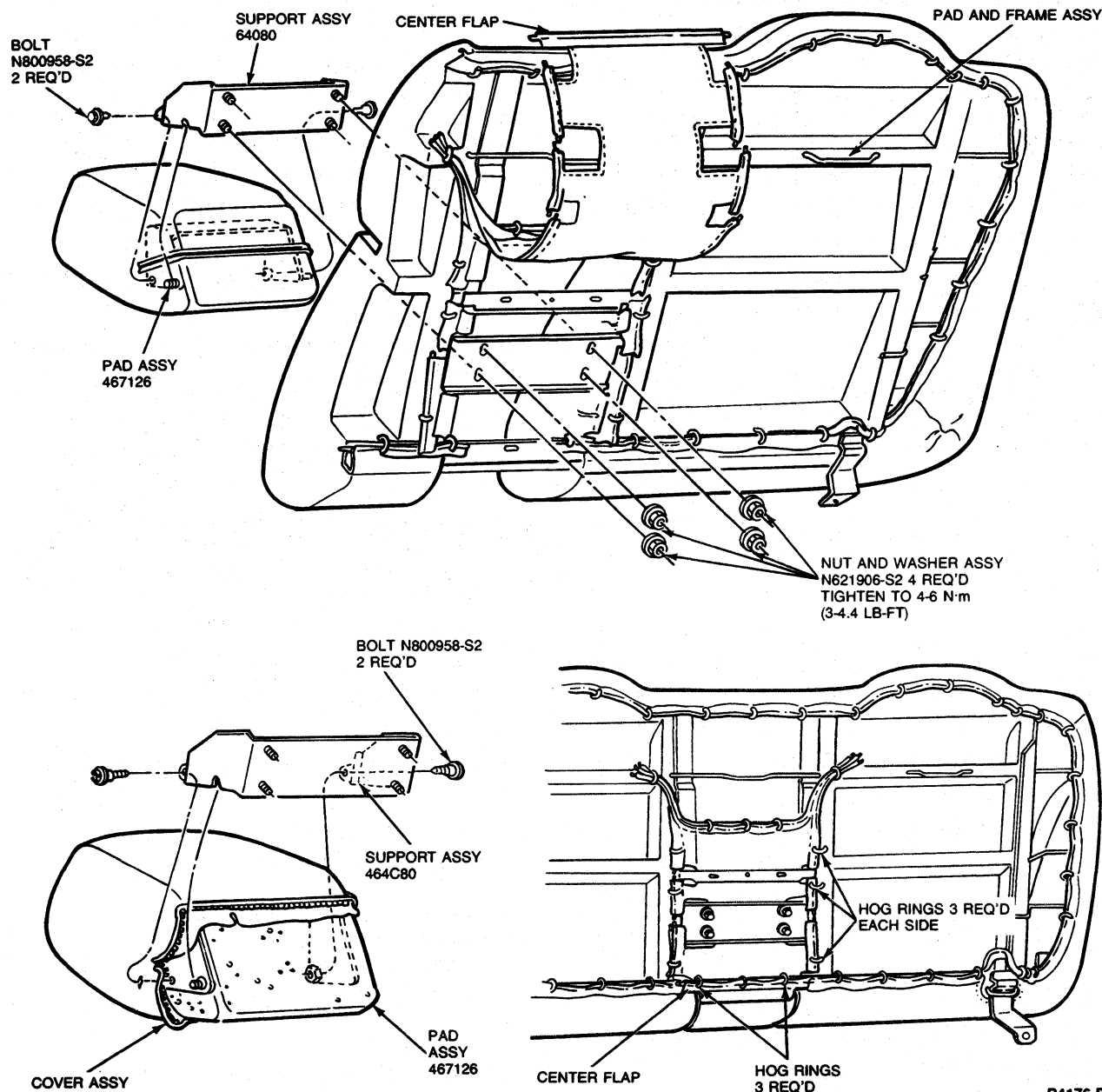
## Seat, Rear—Center Armrest Cover

## Removal

1. Remove rear seat cushion and rear seat back assembly from vehicle. Refer to Section 41-14.
2. Cut retaining hog rings. Remove rear cover from armrest opening in seat back.
3. Cut hog rings attaching armrest flap to rear seat back.
4. Remove the four bolts attaching the armrest link and vertical strainer assembly to the rear seat back and remove the armrest assembly.
5. Unzip the zipper, and slip the cover off the pad and base assembly.

## Installation

1. Slip the new cover over the pad and base assembly and close the zipper.
2. Assemble the center armrest to the rear seat back. Install the four vertical strainer-to-seat back attaching screws.
3. Fasten the armrest flap to the rear seat back with hog rings.
4. Install the rear seat back assembly and the rear seat cushion in the vehicle.







# WINDOW GLASS AND MECHANISMS

## GROUP **42** (70000)

SECTION TITLE	PAGE	SECTION TITLE	PAGE
LIFT GATE GLASS .....	42-07-1	WINDOW MECHANISMS, FRONT DOOR .....	42-03-1
MIRRORS—MANUAL .....	42-21-1	WINDOW MECHANISMS, REAR DOOR .....	42-05-1
MIRRORS—POWER .....	42-25-1	WINDOWS, POWER .....	42-08-1
WINDOW GLASS AND MECHANISMS— SERVICE .....	42-01-1		

## SECTION 42-01 Window Glass and Mechanisms—Service

SUBJECT	PAGE	SUBJECT	PAGE
LUBRICATION		VEHICLE APPLICATION .....	42-01-1
Door, Front .....	42-01-2		
Door, Rear .....	42-01-2		

### VEHICLE APPLICATION

Taurus/Sable.

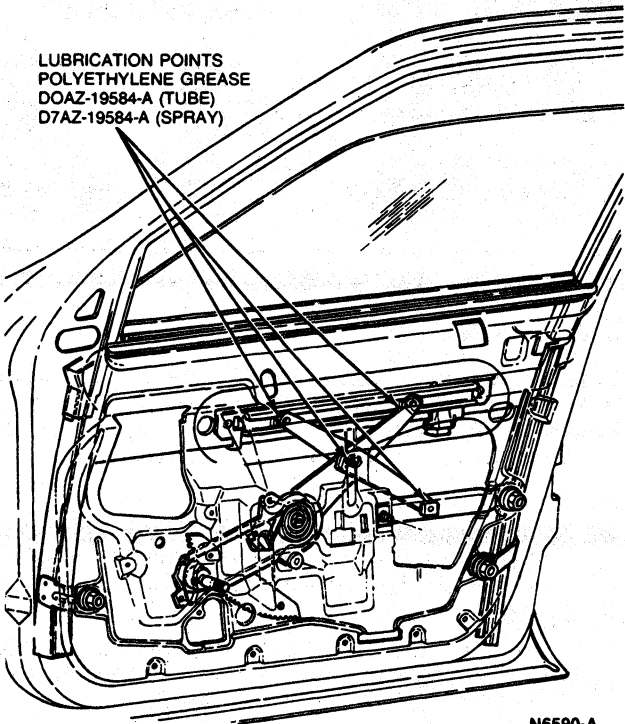
### LUBRICATION

Lubricate entire outer surface prior to assembly with Polyethylene Spray Grease D7AZ-19584-A or equivalent. Use generous amount of Polyethylene Grease DOAZ-19584-A or equivalent on tube run for smooth operation.

## LUBRICATION (Continued)

## Door, Front

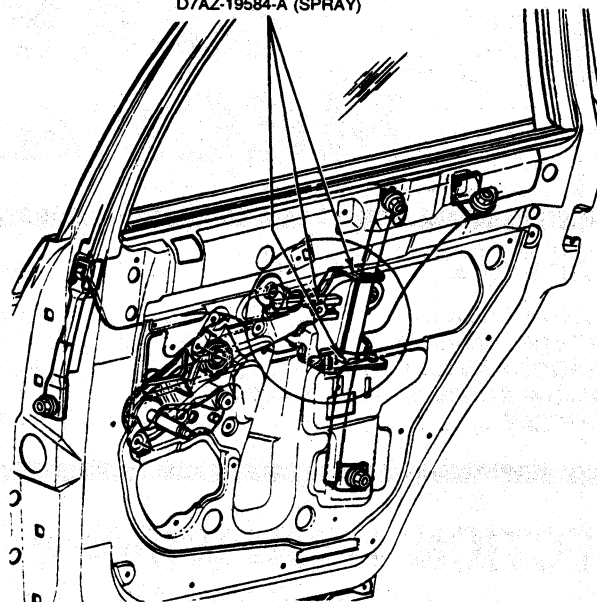
LUBRICATION POINTS  
POLYETHYLENE GREASE  
DOAZ-19584-A (TUBE)  
D7AZ-19584-A (SPRAY)



N6590-A

## Door, Rear

LUBRICATION POINTS  
POLYETHYLENE GREASE  
DOAZ-19584-A (TUBE)  
D7AZ-19584-A (SPRAY)



N6591-A

# SECTION 42-03 Window Mechanisms, Front Door

SUBJECT	PAGE	SUBJECT	PAGE
<b>ADJUSTMENTS</b>		<b>REMOVAL AND INSTALLATION (Cont'd.)</b>	
Door Glass .....	42-03-1	Door Vent Window Assembly .....	42-03-6
<b>REMOVAL AND INSTALLATION</b>		Glass Run Assembly Replacement .....	42-03-3
Door Glass .....	42-03-2	Window Regulator .....	42-03-4
Door Glass Stabilizer Assembly .....	42-03-3	<b>VEHICLE APPLICATION</b> .....	42-03-1

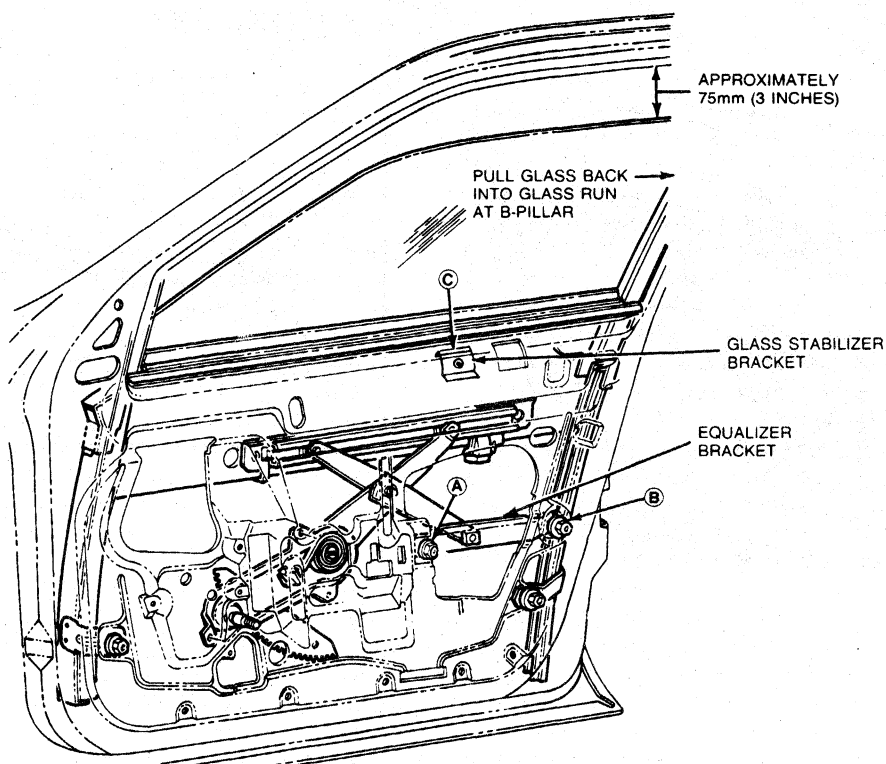
## VEHICLE APPLICATION

Taurus/Sable.

## ADJUSTMENTS

### Door Glass

1. Remove door trim panel and watershield. Refer to Section 45-03.
2. Lower door glass approximately 75mm (3 inches) from full-up position.
3. Loosen nut and washer assemblies (A) and (B) retaining the equalizer bracket to door inner panel.
4. Loosen nut and washer assembly (C) retaining door glass stabilizer.
5. With door open, place hands on each side of glass and pull glass fully into door glass run assembly at B-pillar.
6. Tighten nut and washer (A), then apply a downward pressure on the equalizer bracket and tighten nut and washer (B). Tighten to 7-11 N·m (5-8 lb-ft).
7. Set door glass stabilizer so that it is slightly touching glass and tighten nut and washer assembly to 7-11 N·m (5-8 lb-ft).
8. Cycle door glass to ensure proper function and door fit.



## REMOVAL AND INSTALLATION

## Door Glass

## Removal

1. Remove door trim panel and watershield. Refer to Section 45-03.
2. Remove inside door belt weatherstrip assembly.
3. Lower glass to access holes in door inner panel. Remove two rivets retaining glass to glass bracket.

**CAUTION:** Prior to removing center pins from the rivets, it is recommended that a suitable block support be inserted between door outer panel and glass bracket to stabilize glass during rivet removal. Remove center pin from each rivet using a drift punch. Using a 1/4-inch diameter drill, drill out the remaining rivets. Use care when drilling out the rivets to prevent enlarging the bracket and spacer holes and damaging the retainer.

4. Loosen nut and washer retaining door glass stabilizer.
5. Remove glass by tipping it forward then removing from between door belt opening to outboard side of door.

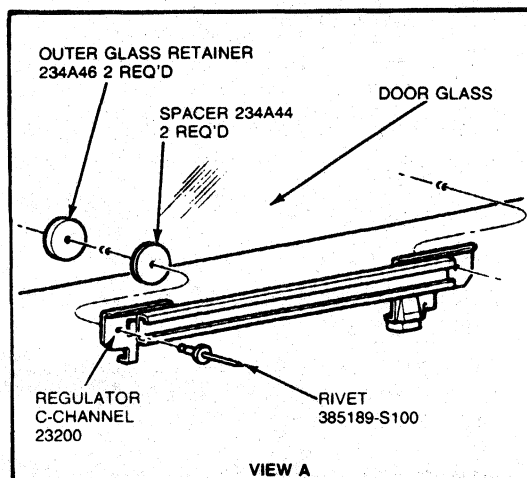
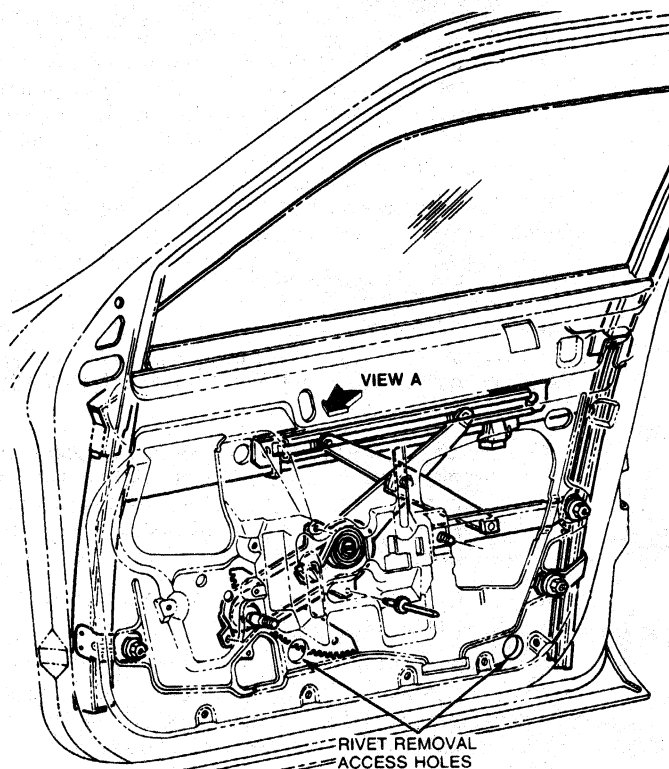
6. Remove drillings and pins from bottom of door.

## Installation

1. Snap plastic retainer and spacer into two glass retainer holes. Ensure that metal washer within retainer assembly is on outboard side of glass.
2. Install glass into door at belt. Ensure that glass is set within front and rear glass run retainers.
3. Position glass to glass bracket. Install two rivets to secure glass to glass bracket.

NOTE: Two 1/4-20 x 1-inch bolts and two 1/4-20 nut and washer assemblies may be used as alternates for glass retention. However, torque must not exceed 4-7 N·m (3-5 lb-ft). Equivalent metric retainers may be used.

4. Install inside door belt weatherstrip assembly.
5. Raise glass to within 75mm (3 inches) of full-up position and adjust glass as outlined.
6. Install door trim panel and watershield. Refer to Section 45-03.



N6682-A

**REMOVAL AND INSTALLATION (Continued)****Door Glass Stabilizer Assembly**

Refer to the illustration under Glass Adjustment and Glass Run Removal and Installation.

**Removal**

1. Remove door trim panel and watershield. Refer to Section 45-03.
2. Remove nut and washer assembly attaching stabilizer to door inner panel at belt.
3. Remove stabilizer.

**Installation**

1. With glass in full-up position, install stabilizer assembly into locator hole in door inner panel.
2. Set stabilizer pad to slightly touch door glass and tighten retaining nut and washer to 9-14 N·m (7-11 lb-ft).
3. Install door trim panel and watershield. Refer to Section 45-03.

**Glass Run Assembly Replacement****Removal**

**CAUTION: Removal of the front door glass run is recommended only if damage occurs to the run assembly. Due to the fragile make-up of the component, unnecessary removal may cause damage and/or breaks in the aluminum or light gauge steel carrier insert within the rubber seal of the run assembly.**

1. Remove the following window glass components as outlined:
  - Inside and outside door belt weatherstrips.
  - Front glass stabilizer.
  - Door window regulator.
  - Regulator equalizer bracket.
  - Front door glass and vent window assemblies.
2. To remove glass run assembly, carefully pull run assembly off window opening pinch weld and remove through window opening.

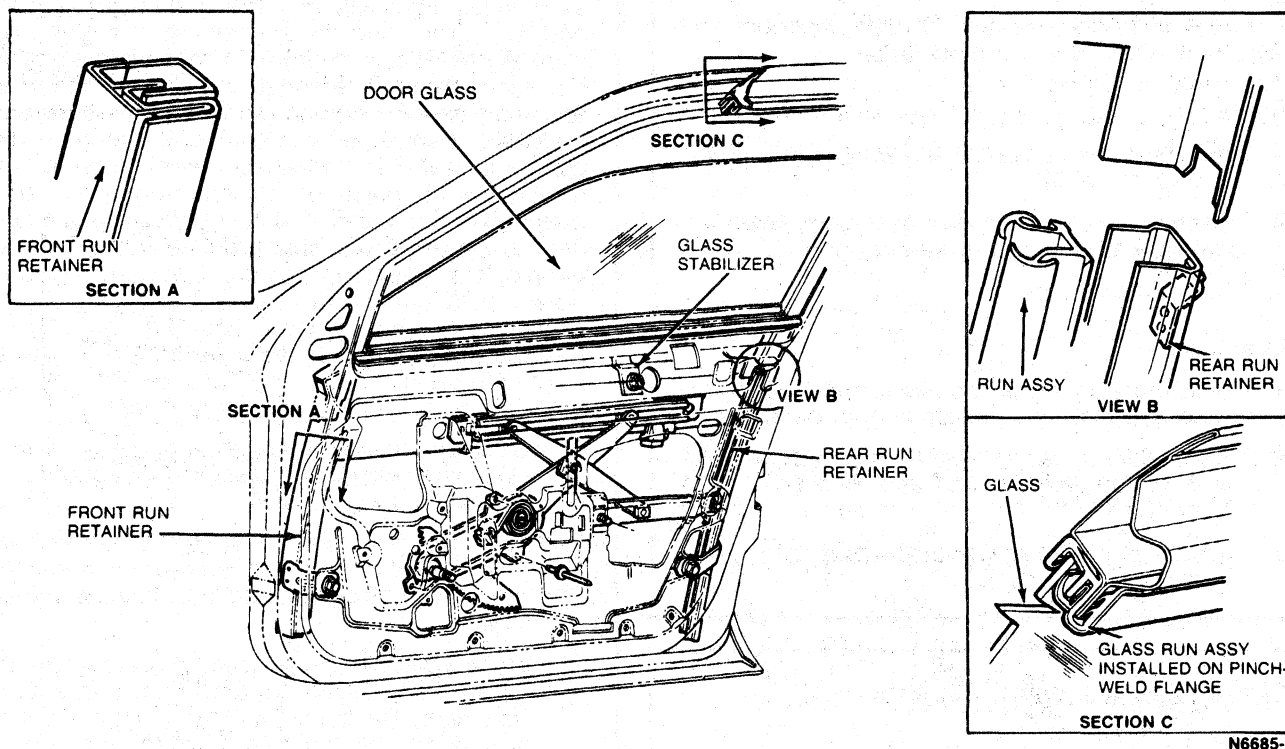
**Installation and Handling**

**CAUTION: The front door glass run requires very "CRITICAL/SPECIAL TYPE HANDLING". The glass run must be handled by the center section only—"NEVER FROM FRONT OR REAR LEGS". The glass runs must be handled in a manner that prevents damage to the A- and B-pillar moulded corners.**

The glass run must be handled with special care even when installing into the door window glass opening. From outside the vehicle the glass run front leg (A-pillar section) is installed into the front door run retainer so that the hole in the run assembly and the hole in the front run retainer are matched. Use a 6mm (1/4-inch) diameter drift punch or similar tool to align these two parts. The front leg of the glass run with the front run retainer attached is then eased into the front door at the door belt opening. **NOTE:** This procedure requires two people, one inserting the front leg and another person holding the remainder of glass run at center section to prevent bending. After the front (A-pillar section) and the rear (B-pillar section) of the glass run assembly is inserted into the door, the glass run is installed per the following procedures:

1. Locate molded B-pillar corner of glass run from pinch weld flange to upper corner of door frame (arrow "A").
2. Apply hand pressure to glass run from belt line area of B-pillar and push run upward (vertically) into corner. Ensure run is fully flush with sheet metal.
3. While applying upward pressure along B-pillar (arrow "B"), install run onto door frame pinch weld along B-pillar starting from top and moving downward. Use hand pressure to ensure glass run is flush with outer door panel sheet metal.
4. Use hand pressure from center of upper door frame area (arrow "C"), and push glass run rearward along pinch weld flange into B-pillar upper corner. Ensure glass run is flush with outer door panel sheet metal at corner.
5. While applying hand pressure rearward, install glass run onto door frame pinch weld along upper door frame starting from B-pillar and going to A-pillar.
6. Use hand pressure from lower A-pillar leg of glass run and push run upward (vertically) into corner (arrow "D"). Ensure run is fully flush with outside sheet metal.
7. While applying upward hand pressure along A-pillar, install glass run onto door frame pinch weld and front retainer. Use hand pressure to fully seat run. Ensure glass run leg is fully seated.
8. Install rear retainer to door inner panel with nut and washer assembly.
9. Insert glass run leg at B-pillar into front door rear retainer and install retainer by telescoping upper end into door reinforcement and attaching nut and washer assembly.

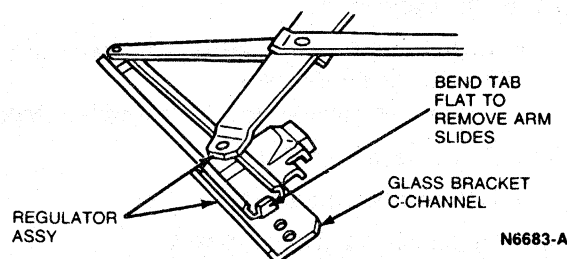
## REMOVAL AND INSTALLATION (Continued)



## Window Regulator

## Removal

1. Remove door trim panel and watershield. Refer to Section 45-03.
2. Remove inside door belt weatherstrip and glass stabilizer.
3. Remove door glass as outlined.
4. Remove two nut and washer assemblies attaching the equalizer bracket.
5. Remove three rivets (manual) or four rivets (power) attaching the regulator base plate to door inner panel.
6. Remove regulator and glass bracket assembly from vehicle.
7. Working on a bench, carefully bend tab flat to remove arm slides from glass bracket C-channel.
8. Install new regulator arm plastic guides into glass bracket C-channel and bend tab back to 90 degrees (use care not to break tab, if tab is cracked or broken, replace glass bracket assembly. Ensure rubber bumper is installed properly on new glass bracket, if replacement is made).



**WARNING: IF THE REGULATOR COUNTERBALANCE SPRING MUST BE REMOVED OR REPLACED FOR ANY REASON, ENSURE THAT THE REGULATOR ARMS ARE IN A FIXED POSITION PRIOR TO REMOVAL TO PREVENT POSSIBLE INJURY DURING C-SPRING UNWIND.**

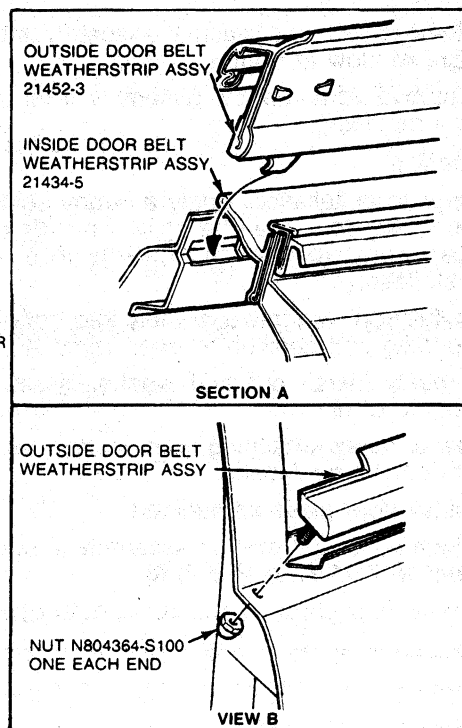
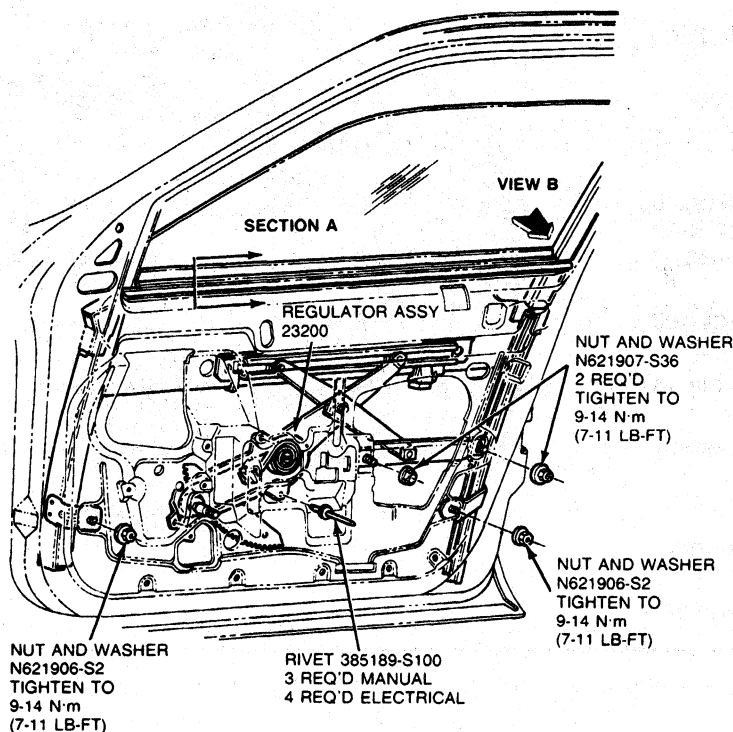
## Installation

The glass bracket assembly and regulator assembly are installed into the vehicle as one assembly. The glass bracket assembly may be disassembled from the regulator as described in Steps 7 and 8 of Window Regulator Removal.

1. Install regulator with preassembled glass bracket into vehicle. Set the regulator base plate to door inner panel using base plate locator tab as a guide.

## REMOVAL AND INSTALLATION (Continued)

2. Install three (manual) or four (power) rivets (385189-S100) to attach regulator to door inner panel.
3. Install equalizer bracket.
4. Install inside door belt weatherstrip and glass stabilizer.
5. Lower regulator arms to access holes in door inner panel. Install door glass as outlined.
6. Adjust glass to ensure proper alignment with glass run. Cycle glass for smooth operation.
7. Install door trim panel and watershield. Refer to Section 45-03.



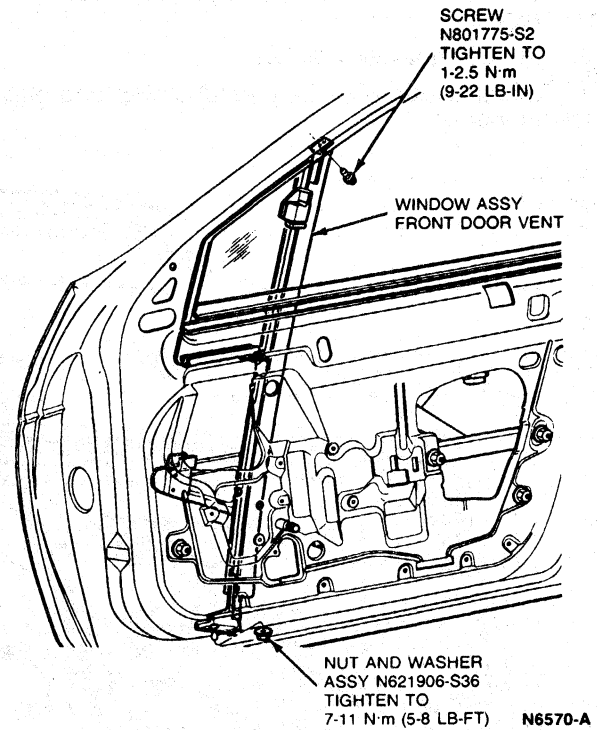
N6684-A

**REMOVAL AND INSTALLATION (Continued)****Door Vent Window Assembly****Removal**

1. Remove door trim panel and watershield. Refer to Section 45-03.
2. Remove door glass as outlined.
3. Remove screw attaching vent window at door frame A-pillar.
4. Remove nut and washer assembly attaching vent window at bottom of door.
5. Remove vent window assembly from door at belt moulding.

**Installation**

1. Prior to installation, apply a soapy solution to vent window weatherstrip and door belt weatherstrip for lubrication and easier installation.
2. Install vent window assembly into door at belt opening and position to door frame A-pillar.
3. Loosely install nut and washer assembly at bottom of door.
4. Install screw attaching vent window assembly at door frame A-pillar.
5. Install door glass as outlined.
6. Tighten nut and washer assembly at bottom of door to 7-11 N·m (5-8 lb-ft).
7. Cycle door glass to ensure smooth operation.





# SECTION 42-05 Window Mechanisms, Rear Door

SUBJECT	PAGE	SUBJECT	PAGE
<b>ADJUSTMENTS</b>		<b>REMOVAL AND INSTALLATION (Cont'd.)</b>	
Door Glass .....	42-05-1	Run and Bracket Assembly .....	42-05-5
<b>REMOVAL AND INSTALLATION</b>		Window Regulator .....	42-05-3
Door Glass .....	42-05-2	<b>SPECIAL SERVICE TOOLS</b> .....	42-05-5
Glass Run Assembly .....	42-05-3	<b>VEHICLE APPLICATION</b> .....	42-05-1

## VEHICLE APPLICATION

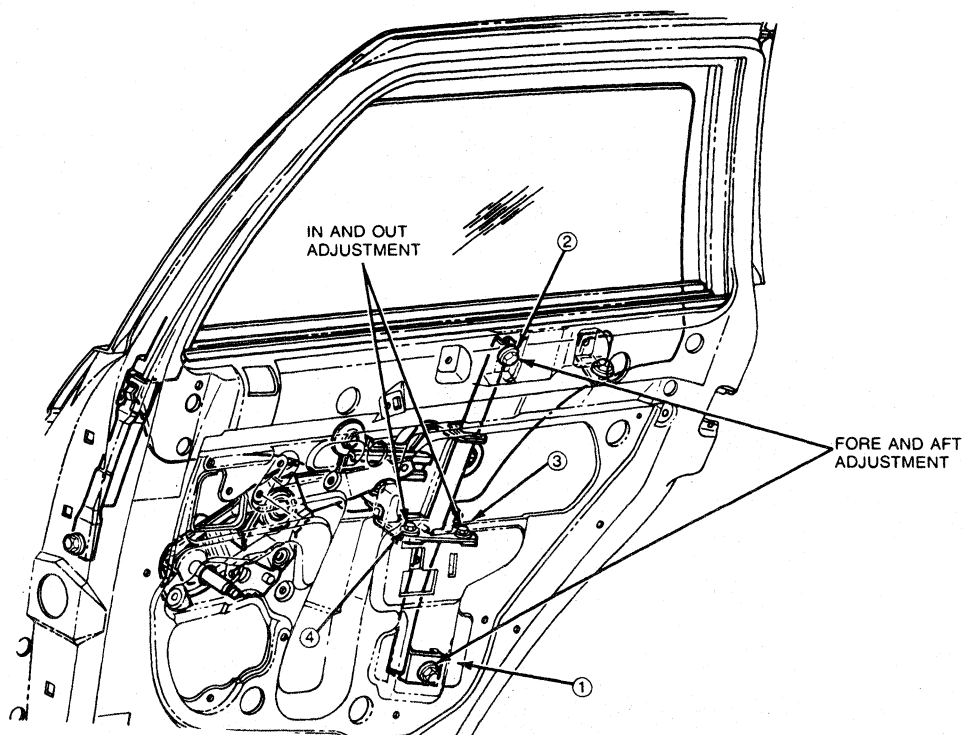
Taurus/Sable.

## ADJUSTMENTS

### Door Glass

The rear door glass has in-and-out and fore-and-aft adjustments. The in-and-out adjustment may be accomplished by loosening the two screws in the lower glass bracket assembly and moving the glass in or out as required. The fore-and-aft adjustment is accomplished by loosening the tube run upper screw and washer assembly, and the lower nut and washer assembly attaching the rear door run and bracket assembly to the inner door panel, and adjusting the glass fore or aft as required.

When setting the glass to the window opening, lower the glass approximately 50mm (2 inches) from full-up position with the four retention points loosely installed. Set the glass forward into the B-pillar and tighten lower run nut and washer number one, then numbers two, three and four.



N6620-A

**REMOVAL AND INSTALLATION****Door Glass****Removal**

1. Remove door trim panel and watershield. Refer to Section 45-03.
2. Remove inner door belt weatherstrip by gently pulling weatherstrip from door flange.
3. Remove the glass-to-glass bracket attaching rivets.

**CAUTION:** Prior to removing rivet center pins, a suitable block support should be inserted between the door outer panel and glass to stabilize the glass during rivet pin removal. Use a 1/4-inch diameter drill to drill out remainder of rivet, using care not to enlarge sheet metal holes and damage the plastic retainer and spacer.

4. Remove glass stabilizer bracket retaining screw and washer and bracket.
5. Lift the glass up between the door belt moulding opening and remove from the door.

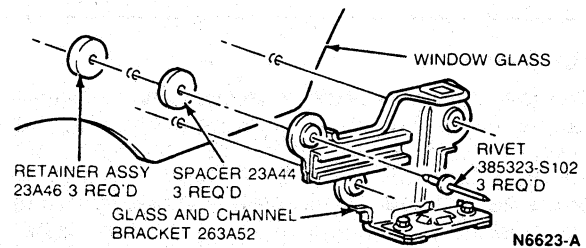
**Installation**

1. Install plastic spacer and retainers into main glass. Install main glass into door.
2. Secure glass-to-glass bracket using Heavy Duty Riveter D80L-23200-A or equivalent to install two rivets.

**NOTE:** Two 1/4-20 x 1-inch bolts and two 1/4-20 nut and washer assemblies may be used as alternates for glass retention. However, torque must not exceed 4-7 N·m (36-61 lb-in).

**NOTE:** Equivalent metric retainers may be used.

3. Install inner door belt weatherstrip, using hand pressure to push weatherstrip onto door flange.
4. Install glass stabilizer bracket and retaining screw and washer. Tighten to 4-7 N·m (36-61 lb-in).
5. Cycle glass to ensure smooth operation.
6. Install watershield and door trim panel. Refer to Section 45-03.



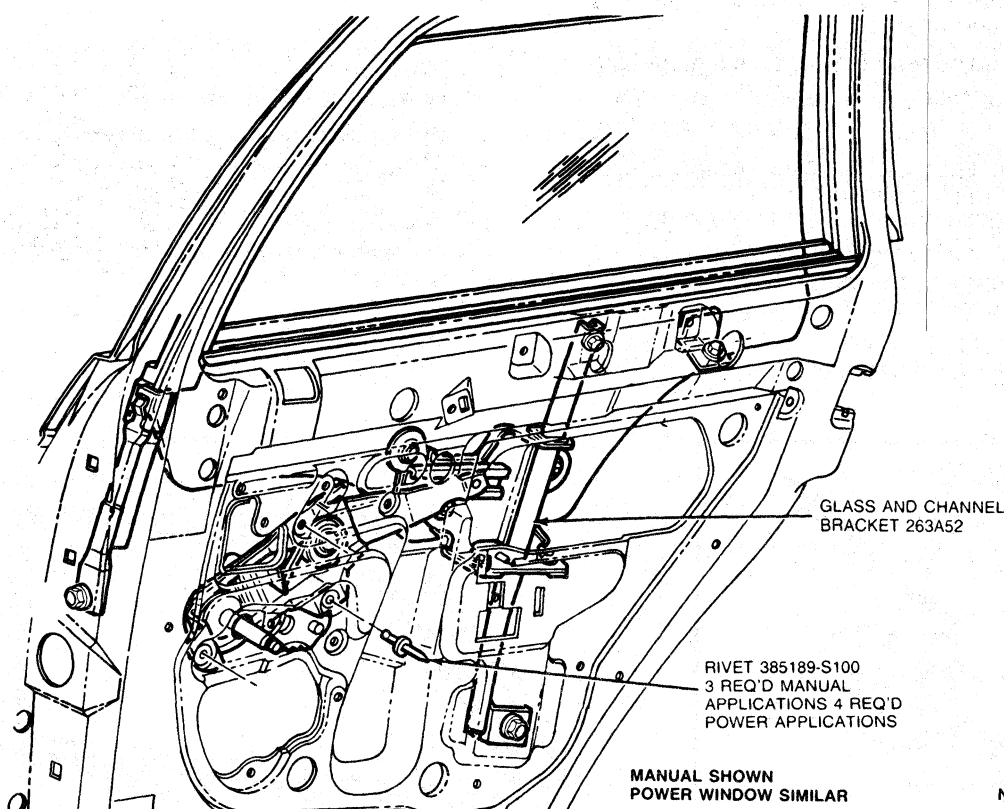
**REMOVAL AND INSTALLATION (Continued)****Window Regulator****Removal**

1. Remove door trim panel and watershield. Refer to Section 45-03.
2. Prop glass in full-up position.
3. Remove three rivets (manual applications) or four rivets (power windows) attaching regulator mounting plate assembly to door inner panel.
4. Slide regulator arm plastic guides out of C-channel, and disconnect power wiring connector lift.
5. Remove window regulator from door.

NOTE: Use access hole in door inner panel for removal/installation. Refer to Section 42-08 for power regulator removal.

**Installation**

1. Install window regulator through the access hole in the rear door and slide regulator arm plastic guides into glass bracket C-channel.
2. Install rivets (385189-S100) using Heavy Duty Riveter D80L-23200-A or equivalent, or 1/4-20 x 1/2-inch screw and washer assemblies and 1/4-20 nut and washer assemblies to secure regulator mounting plate to door inner panel.  
NOTE: Equivalent metric retainers may be used.
3. Cycle glass to check for smooth operation.
4. Install watershield and door trim panel. Refer to Section 45-03.



N6624-A

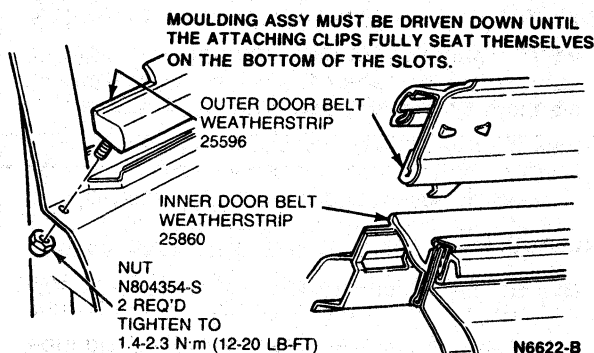
**Glass Run Assembly**

**CAUTION:** Removal of the rear door glass run is recommended only if damage to the run assembly occurs. Due to the fragile make-up of the component, unnecessary removal may cause damage and/or breaks in the light gauge metallic carrier insert within the rubber seal of the run assembly.

**Removal**

1. Remove door trim panel and watershield. Refer to Section 45-03.
2. Remove two outer door belt moulding retention nuts, and remove moulding by disengaging clips.
3. Remove inner door belt weatherstrip by gently pulling weatherstrip from door flanging.

## REMOVAL AND INSTALLATION (Continued)



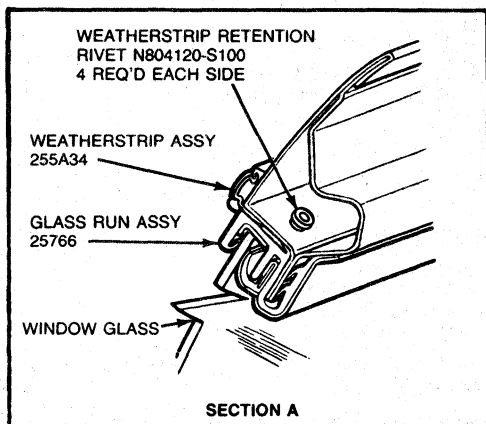
4. Remove glass stabilizer retaining screw and washer, and stabilizer.
5. Remove door glass as outlined.
6. Remove regulator assembly, if necessary, as outlined.
7. Remove front glass run retainer bracket retaining screw.
8. Remove glass run from door by gently pulling run from pinch weld in door.

## Installation

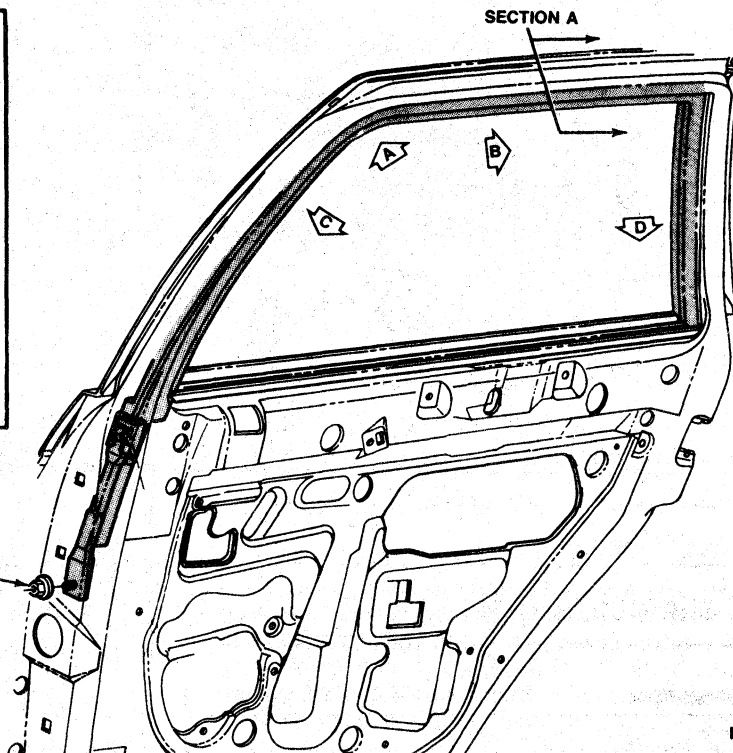
**CAUTION:** Special care should be taken when handling glass run. The glass run must be handled by the center section only. The moulded corner for the B- and C-pillars must be handled with special care when installing the corners to avoid damage to the metallic insert.

1. Install front glass run bracket and retaining nut. Tighten to 7-11 N·m (5-8 lb-ft).
2. Feed glass run ends through window opening and into weatherstrip belt opening.
3. Position moulded B-pillar corner to upper corner of door frame (arrow A).

4. Working from B-pillar corner to rear, hand pressure to push run into upper frame until flush with upper frame (arrow B).
5. Working from top to bottom of B-pillar, use hand pressure to push run assembly into B-pillar (arrow C).
6. Working from top to bottom of C-pillar (arrow D), use hand pressure to push run assembly C-pillar.
7. Cut any excess run assembly at belt moulding line.



NUT AND WASHER ASSY N621906-S36  
TIGHTEN TO  
7-11 N·m  
(5-8 LB-FT)



**REMOVAL AND INSTALLATION (Continued)**

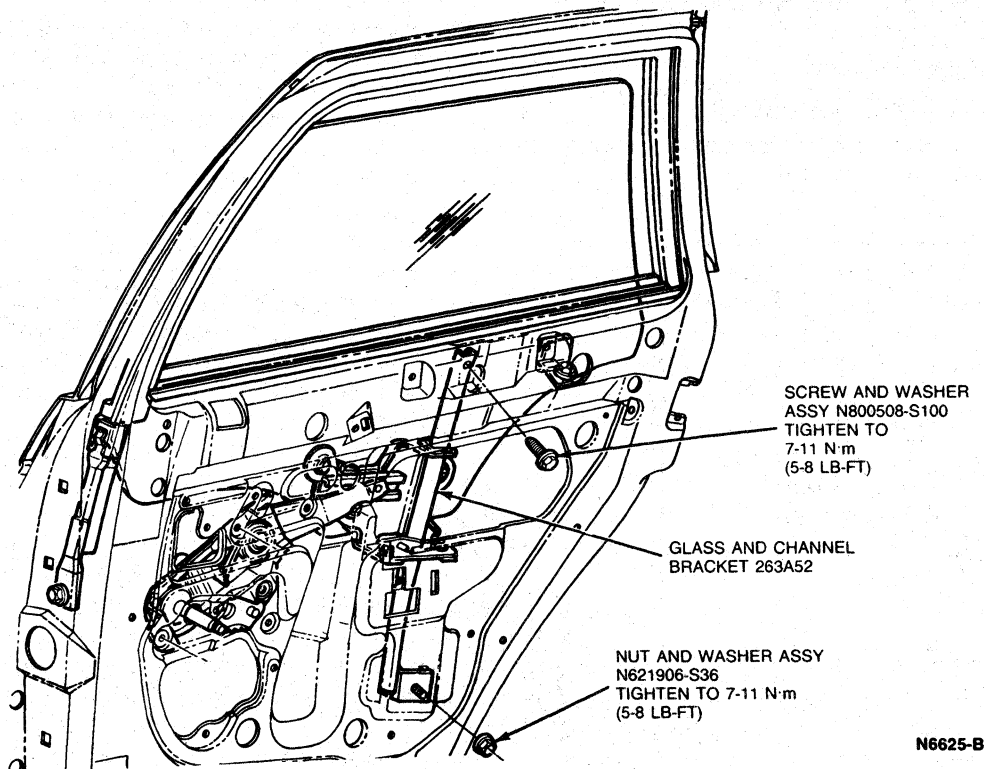
8. Install regulator assembly (if removed) as outlined.
9. Install door glass as outlined.
10. Install inner door belt weatherstrip using hand pressure to push weatherstrip onto door flange.
11. Install exterior door belt weatherstrip by engaging retention clips and installing two retaining nuts. Tighten nuts to 1.4-2.3 N·m (12-20 lb-in).
12. Install door trim panel and watershield. Refer to Section 45-03.

**Run and Bracket Assembly****Removal**

1. Remove door trim panel and watershield. Refer to Section 45-03.
2. Prop glass in the full-up position and remove glass-to-glass bracket attaching rivets as outlined under Glass Removal.
3. Remove screw and washer assembly attaching tube run at door belt.
4. Remove nut and washer attaching tube run bottom bracket to door inner panel.
5. Tilt run and bracket to remove C-channel from regulator arm plastic guide.
6. Remove run and bracket assembly from door.

**Installation**

1. Insert run and bracket assembly into door, and slide regulator arm plastic guide into C-channel.
2. Install nut and washer assembly attaching tube run bottom bracket to door inner panel and tighten to 7-11 N·m (5-8 lb-ft).
3. Install screw and washer attaching tube run to door belt panel and tighten to 7-11 N·m (5-8 lb-ft).
4. Install glass-to-glass bracket attaching rivets (or screws) as outlined under Glass Installation.
5. Install door trim panel and watershield. Refer to Section 45-03.



N6625-B

**SPECIAL SERVICE TOOLS****REAR DOOR WINDOW**

Tool Number	Description
D80L-23200-A	Heavy-Duty Riveter

CN5486-A

## SECTION 42-07 Lift Gate Glass

SUBJECT	PAGE	SUBJECT	PAGE
REMOVAL AND INSTALLATION .....	42-07-1	VEHICLE APPLICATION .....	42-07-1

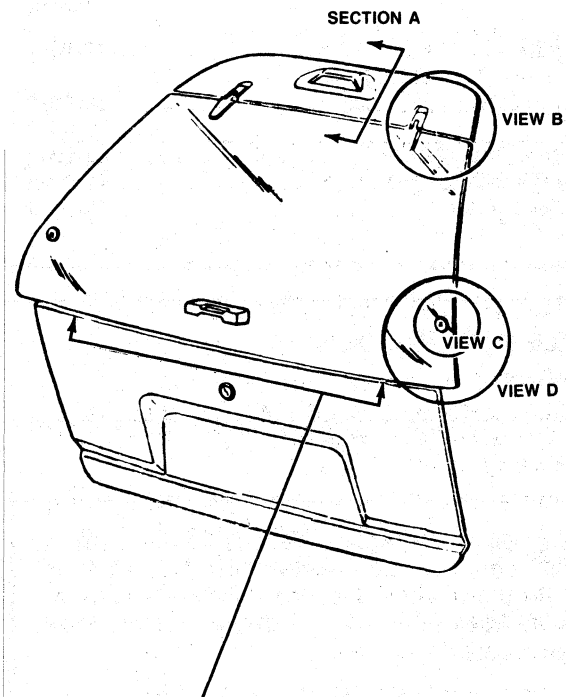
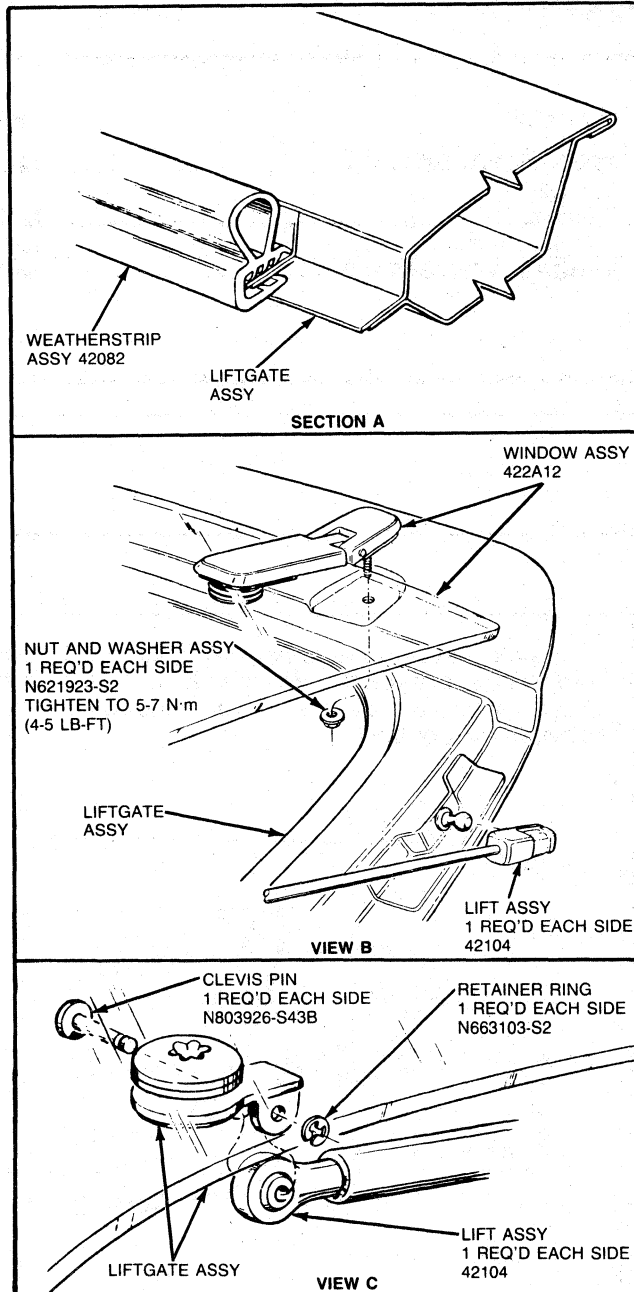
### VEHICLE APPLICATION

Taurus/Sable.

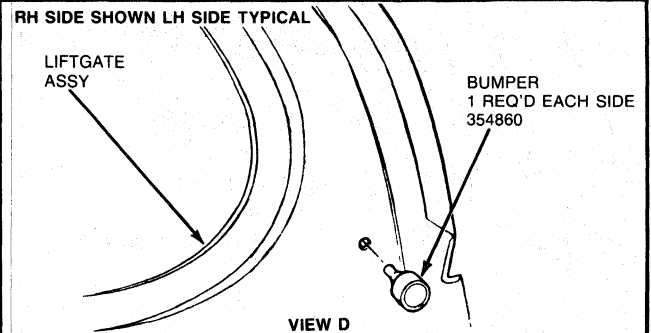
### REMOVAL AND INSTALLATION

1. Remove RH and LH rear pillar mouldings to gain access to nut and washer assemblies retaining lift gate window hinges to lift gate assembly. Refer to Section 45-03.
2. Remove nut and washer assemblies retaining RH and LH lift gate window hinges to lift gate assembly.
3. Remove clevis pins from RH and LH lift gate assemblies.
4. Remove lift gate window.
5. To install, reverse Steps 1 through 4.

## REMOVAL AND INSTALLATION (Continued)



**NOTE:**  
COMPRESS EXCESS LENGTH OF WEATHERSTRIP  
ALONG LOWER BELT AREA.



N6947-A

# SECTION 42-08 Windows, Power

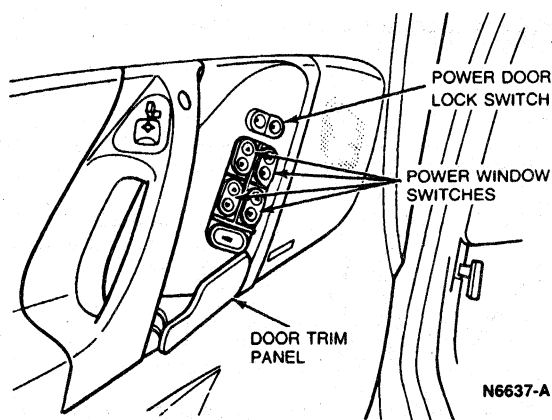
SUBJECT	PAGE	SUBJECT	PAGE
DESCRIPTION .....	42-08-1	SPECIFICATIONS .....	42-08-4
REMOVAL AND INSTALLATION		TESTING	
Motor .....	42-08-2	Motor Test .....	42-08-3
Switch .....	42-08-2	Switch Tests .....	42-08-4
Front and Rear Doors .....	42-08-2	VEHICLE APPLICATION .....	42-08-1
Switch Connector Wire .....	42-08-2		
Window Regulator .....	42-08-3		

## VEHICLE APPLICATION

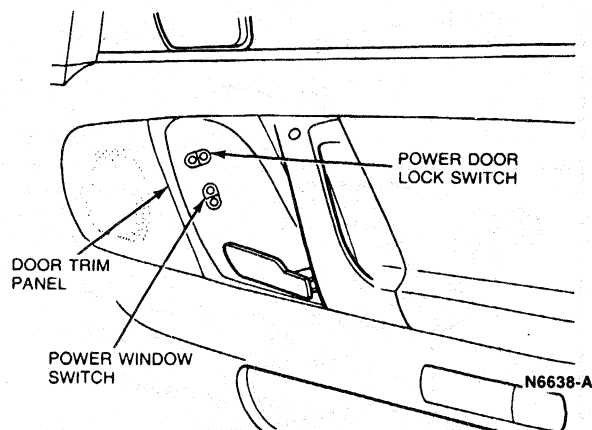
Taurus/Sable.

## DESCRIPTION

The power window switches are located on the front door trim panels. The master control switch is located on the driver's door trim panel and can be used to activate any or all of the power windows from one location.



A single power window switch is located on all door trim panels except the driver's door. This switch allows activation of the power window for the individual doors only.





## REMOVAL AND INSTALLATION

### Switch

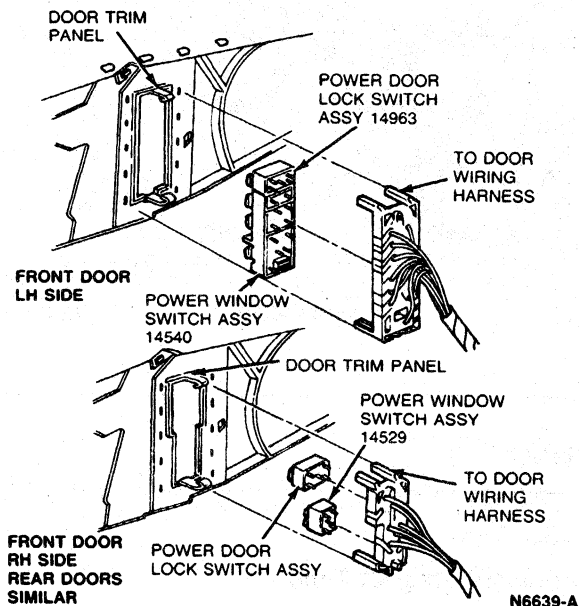
#### Front and Rear Doors

##### Removal

1. Remove door pull handle upper retaining screw. Remove pull handle by pulling the top out and the handle up.
2. Remove two switch plate retaining screws and carefully pry switch plate away from door trim panel using a flat-blade tool. Refer to Section 45-03.
3. Rotate switch plate and remove wiring connector by carefully spreading two retaining legs.
4. Using a small screwdriver, pry switch from connector.

##### Installation

1. Position switch to connector and firmly press the switch into the connector.  
NOTE: All the switches are keyed and can only be installed one way.
2. Position switch and connector assembly to switch plate and snap in place.
3. Install switch plate to door trim panel by inserting three studs into retaining clips, pressing firmly and driving two retaining screws.
4. Install door pull handle by inserting two studs into armrest opening and driving upper retaining screw.

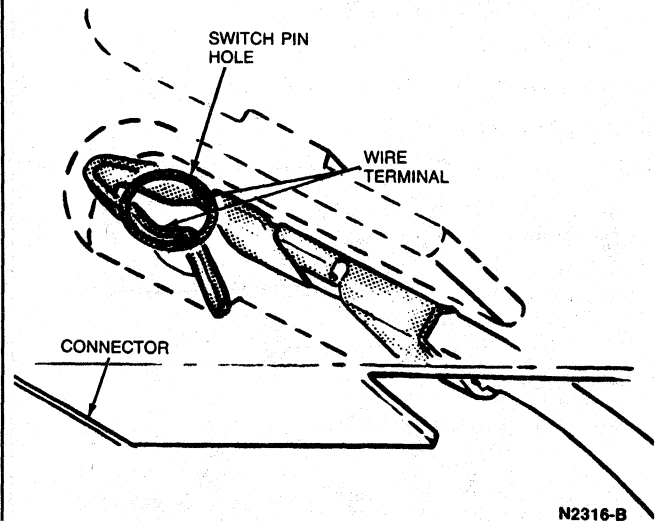


### Switch Connector Wire

#### Removal and Installation

If replacement of the switch connector or a wire leading to the connector is necessary, the wire(s) can be removed from the connector without disassembling the connector.

1. Insert needle-like tool into edge of terminal hole.
2. Bend terminal in.
3. Pull wire and terminal from connector.
4. To install terminal in connector, open terminal and insert into wire hole.



### Motor

#### Front and Rear Doors

##### Removal

1. Raise window to full-up position, if possible. If glass cannot be raised and is in a partially down or full-down position, it must be supported so that it will not fall into door well during motor removal.
2. Disconnect battery ground cable.
3. Remove door trim panel and watershield. Refer to Section 45-03. Disconnect window motor wiring leads.
4. Remove two forward regulator mounting plate attaching rivets.

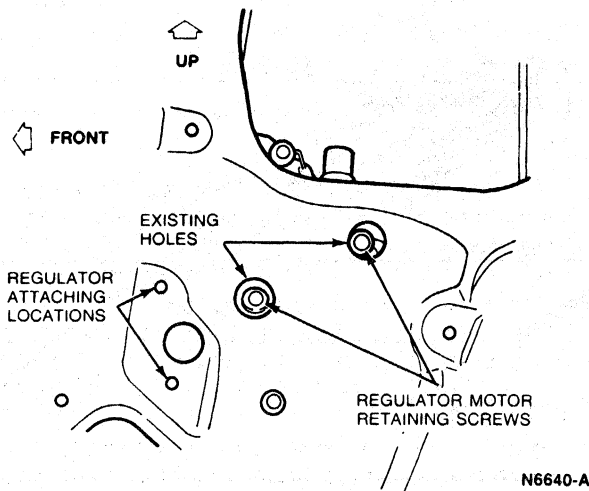
**CAUTION:** Prior to motor drive assembly removal, ensure that the regulator arm is in a fixed position to prevent dangerous counterbalance spring unwind.

5. Remove three window motor mounting screws.
6. Push regulator mounting plate outboard sufficiently to remove power window motor.

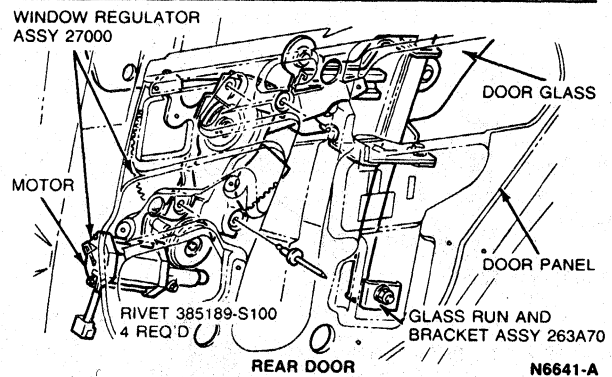
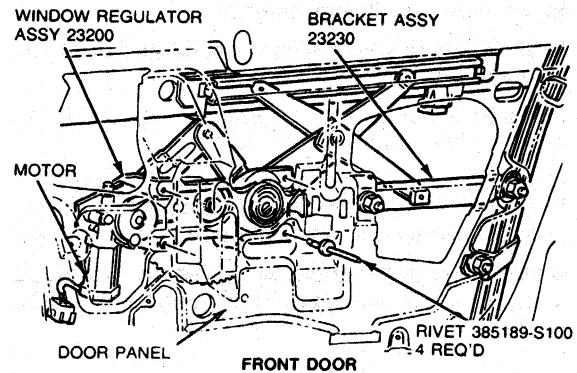
**REMOVAL AND INSTALLATION (Continued)****Installation**

1. Install new motor and drive assembly. Tighten three motor mounting screws to 5.6-9.6 N·m (50-85 lb-in).
2. Install two regulator mounting plate rivets.
3. Connect window motor wiring leads.
4. Connect battery ground cable.
5. Check power window for proper operation.
6. Install door trim panel and watershield. Refer to Section 45-03.

NOTE: Verify that all drain holes at bottom of doors are open to prevent water accumulation over motor.

**Installation**

1. Position glass in full-up position.
2. Install window regulator through access hole in door and insert arm slide/roller into glass bracket C-channel.
3. Slide regulator tube assembly down into position in door and loosely assemble retainers with nut and washer, and screw and washer assemblies.
4. Install four rivets to secure regulator mounting plate to door inner panel.
5. Tighten nut and washer, and screw and washer assemblies to secure regulator tube.
6. Cycle glass to ensure smooth operation.
7. Install door watershield and trim panel. Refer to Section 45-03.

**Window Regulator****Removal**

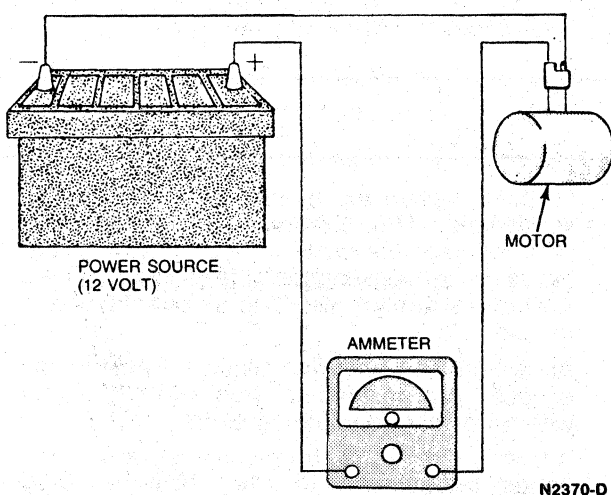
1. Remove door trim panel and watershield. Refer to Section 45-03.
2. Prop glass in full-up position.
3. Remove four rivets attaching regulator plate to door inner panel. Remove center pin from each rivet with a drift punch. Drill out the remainder of rivet using a 6.35mm (1/4-inch) drill. Use care not to enlarge sheet metal retaining holes.
4. Remove nut and washer, and screw and washer attaching regulator tube to inner panel and doorsill. Slide tube up into door belt, adjacent to the glass.
5. Remove window regulator from door through large access hole.

**TESTING****Motor Test****Permanent Magnet Type**

To test the current draw of a power window motor, remove the motor and drive assembly from the vehicle.

**TESTING (Continued)****Test Procedure**

1. Connect an external power source (power-pac or a fully charged battery) to motor with an ammeter in series as shown.
2. Operate motor and observe current draw. The current draw for the no-load test should not exceed specification and should not fluctuate. Reversal of motor wire connections will reverse the direction of motor rotation. Replace the motor if the current draw exceeds specification.

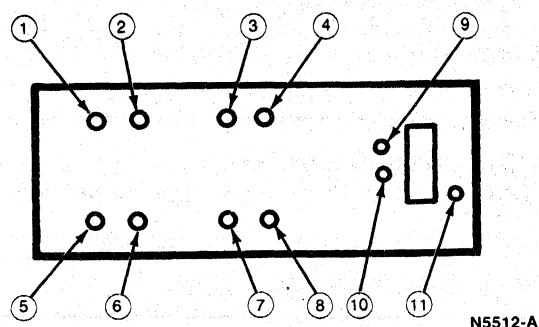
**Switch Tests**

Testing of the power window switches should be performed with the switches removed from the vehicle. Use a self-powered test lamp or an ohmmeter.

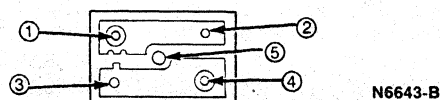
**Master Window Switch**

1. With switch in the NEUTRAL position, there should be continuity between terminals 1,2,3,4,5,6,7,8 and 9 and terminals 10 and 11.
2. With all the switch rocker pushed upward (to close the windows) there should be continuity between terminals 1,3,5,7,10 and 11 and terminals 2,4,6,8 and 9.
3. With all switch rockers pushed downward (to open the windows), there should be continuity between terminals 1,3,5,7 and 9 and terminals 2,4,6,8,10 and 11.

4. With the lock out depressed into its detented position, terminal 11 should not have continuity with any other terminal.
5. If the switch does not test as stated, replace the switch assembly.

**Master Switch****Single Window Switch**

1. With the switch in the NEUTRAL position, there should be continuity between terminals 1 and 2 and terminals 3 and 4. Terminal 5 should be disconnected from any other terminal.
2. With the switch rocker pushed upward (to close the windows), there should be continuity between terminals 1 and 5 and terminals 3 and 4. Terminal 2 should be disconnected from any other terminal.
3. With the switch rocker pushed downward (to open the windows), there should be continuity between terminals 1 and 2 and terminals 4 and 5. Terminal 3 should be disconnected from any other terminal.
4. If the switch does not test as stated, replace the switch assembly.

**Single Switch****SPECIFICATIONS****WINDOW MOTOR CURRENT DRAW**

Description	Specification
No Load	5 amperes or less at 12.8 volts

CN4725-B

# SECTION 42-21 Mirrors—Manual

SUBJECT	PAGE	SUBJECT	PAGE
<b>CLEANING</b>		<b>REMOVAL AND INSTALLATION (Cont'd.)</b>	
Mirror, Outside Rearview .....	42-21-2	Mirror, LH Remote Control .....	42-21-2
<b>REMOVAL AND INSTALLATION</b>		Mirror, Outside Rearview .....	42-21-1
Mirror, Inside Rearview .....	42-21-1	<b>VEHICLE APPLICATION</b> .....	42-21-1

## VEHICLE APPLICATION

Taurus/Sable.

## REMOVAL AND INSTALLATION

### Mirror, Inside Rearview

#### Setscrew Type

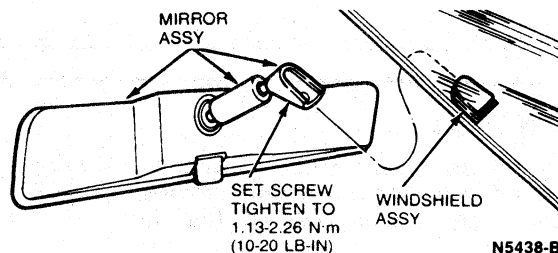
##### Removal

1. Loosen mirror assembly-to-mounting bracket setscrew.
2. Remove mirror assembly by sliding upward and away from mounting bracket.
3. If bracket vinyl pad remains on windshield, apply low heat from an electric heat gun until the vinyl softens. Peel vinyl off the windshield and discard.

##### Installation

1. Make sure glass, bracket and adhesive kit, (Rearview Mirror Repair Kit D9AZ-19554-B or equivalent) are at least at room temperature of 18-3°-23.9°C (65-75 °F).
2. Locate and mark mirror mounting bracket location on the outside surface of the windshield with a wax pencil.
3. Thoroughly clean bonding surfaces of glass and bracket to remove old adhesive. Use mild abrasive cleaner on glass and fine sandpaper on bracket to lightly roughen surface. Wipe clean with alcohol-moistened cloth.
4. Crush accelerator vial (part of Rearview Mirror Repair Kit D9AZ-19554-B or equivalent), and apply accelerator to bonding surface of bracket and windshield. Let dry for three minutes.
5. Apply two drops of adhesive (Rearview Mirror Repair Kit D9AZ-19554-B or equivalent) to the mounting surface of the bracket. Using a clean toothpick or wooden match, quickly spread the adhesive evenly over the mounting surface of the bracket.

6. Quickly position the mounting bracket on the windshield. The 9.6mm (3/8-inch) circular depression in the bracket must be toward the inside of the passenger compartment. Press the bracket firmly against the windshield for one minute.
7. Allow bond to set for five minutes. Remove any excess bonding material from the windshield with an alcohol dampened cloth.
8. Attach the mirror to the mounting bracket and tighten the setscrew to 1.13-2.26 N·m (10-20 lb-in).



N5438-B

### Mirror, Outside Rearview

#### Standard Manual Type-RH Only

##### Removal

1. Remove inside sail cover.
2. Remove nut and washer assemblies and lift mirror off door.

##### Installation

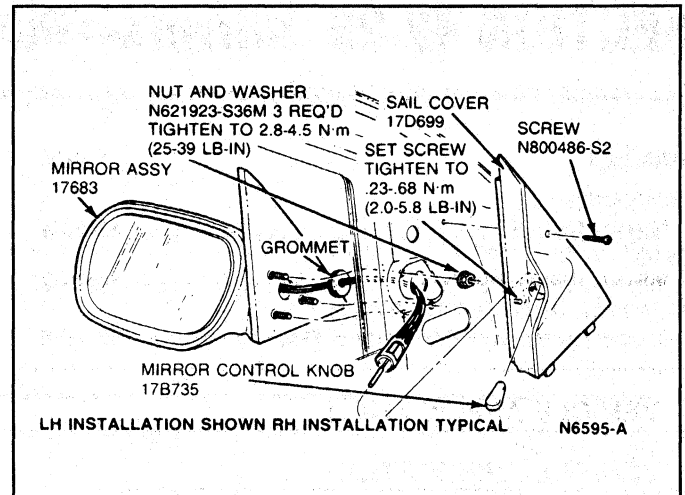
1. Install mirror on door.
2. Install and tighten nut and washer assemblies to specification.
3. Install inside sail cover.

**REMOVAL AND INSTALLATION (Continued)****Mirror, LH Remote Control****Removal**

1. Pull knob assembly to remove from control shaft.
2. Remove interior sail cover retaining screw and remove cover.
3. Loosen setscrew retaining control assembly to sail cover.
4. Remove mirror attaching nuts, washers and grommet. Remove mirror and control assembly.

**Installation**

1. Seat grommet in outer door panel and position mirror to door. Install attaching nuts and washers and tighten to 2.8-4.5 N·m (25-39 lb-in).
2. Route control mechanism through door and position to sail trim panel. Tighten setscrew to 23-68 N·m (2-5.8 lb-in).
3. Position sail cover to door and install retaining screw.
4. Position rubber knob onto control shaft and push to install.

**CLEANING****Mirror, Outside Rearview**

Outside rearview mirrors should not be cleaned with a dry cloth or abrasive cleaning powders. Do not remove ice with a scraper. The mirror should only be cleaned with a soft, clean cloth and mild detergent and water.

# SECTION 42-25 Mirrors—Power

SUBJECT	PAGE	SUBJECT	PAGE
DESCRIPTION		REMOVAL AND INSTALLATION (Cont'd.)	
Mirror, Power .....	42-25-1	Mirror Glass—Replacement .....	42-25-3
DIAGNOSIS		Mirror Switch, Power .....	42-25-3
Mirrors, Power .....	42-25-2	VEHICLE APPLICATION .....	42-25-1
REMOVAL AND INSTALLATION			
Mirror Assembly—RH and LH Door .....	42-25-3		

## VEHICLE APPLICATION

Taurus/Sable.

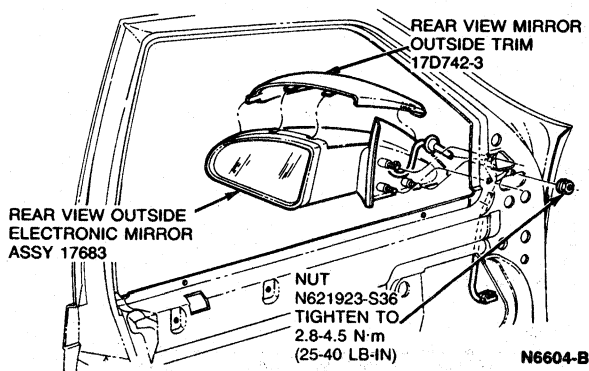
## DESCRIPTION

### Mirror, Power

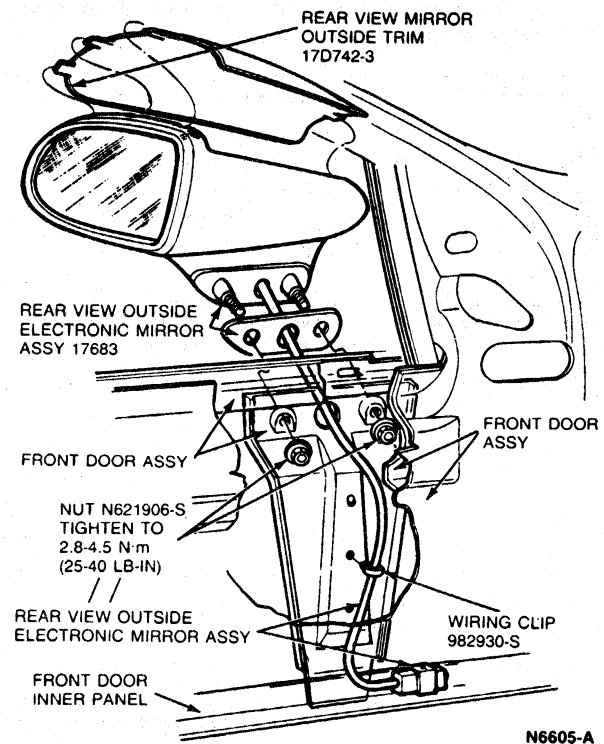
A RH and LH electrically powered outside rearview mirror is available. The servo motor can be serviced separately. The mirror glass and back assembly can be serviced.

The switch for controlling adjustments is located in the driver's door grab handle. One control switch operates both RH and LH mirrors. Selection can be made by moving the selector switch to the LH or RH position to control the appropriate mirror requiring adjustment. When not being used, the switch selector should be in the middle (DOT) NEUTRAL position. The switch is designed to tilt the mirror up, down, left and right by moving the toggle-type knob in the direction of the arrow indicating the desired operation.

### Mirror-Sail Mounted



### Mirror-Door Mounted





## REMOVAL AND INSTALLATION

### Mirror Assembly—RH and LH Door

#### Removal

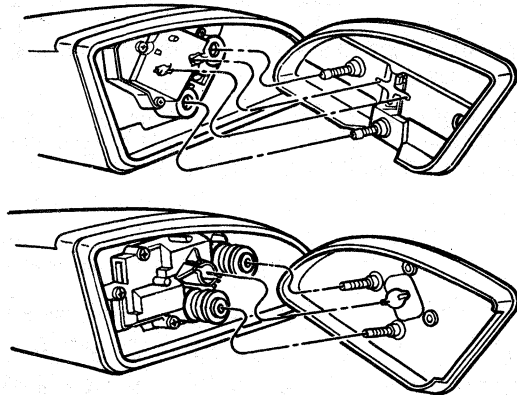
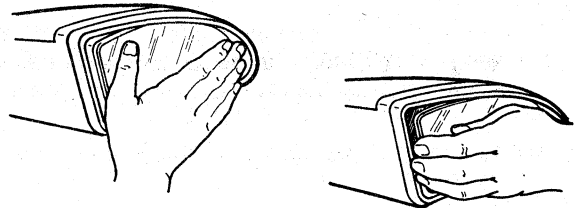
Refer to illustrations under Description.

1. Disconnect battery ground cable.
2. Remove one screw retaining mirror mounting hole cover and remove cover.
3. Remove door trim panel. Refer to Section 45-03.
4. Disconnect mirror assembly wiring connector. Remove necessary wiring guides.
5. Remove three mirror retaining nuts on sail mirrors, two on door mirrors. Remove mirror while guiding wiring and connector through hole in door.

#### Installation

1. Install mirror assembly by routing connector and wiring through hole in door. Attach with three retaining nuts on sail mirrors, two on door mirrors. Tighten retaining nuts to specification.
2. Connect mirror wiring connector and install wiring guides.
3. Replace mirror mounting hole cover and install one screw.
4. Replace door trim panel. Refer to Section 45-03.
5. Connect battery ground cable.
6. Snap on new trim (Part No. 17D742-3—Top Finish Panel) if new mirror assembly has been installed.

3. Position the mirror glass as shown. With the palm of the hand, firmly push glass into place until it feels secure.



N6952-A

### Mirror Glass—Replacement

1. Push outer edge of mirror glass into housing, as shown.
2. Grip inner edge of mirror glass and pull out until mirror glass snaps out of motor assembly.

NOTE: When removing the glass, a snap will be heard. This is normal and does not mean that the driving mechanism has been damaged.

NOTE: On some vehicles, the cross-tee pivot or drive screw(s) may remain attached to the motor assembly. In this case, carefully pry the pivot out of the motor and turn the drive screw(s) (counterclockwise) out of the motor assembly. The pivot and drive screw(s) may be discarded, as they are contained in the new glass assembly.

### Mirror Switch, Power

#### Removal and Installation

1. Remove screw attaching driver's door grab handle. Lift up and swing inboard to expose switch wiring.
2. Disconnect switch and remove by depressing the retaining clips on switch housing and pushing base of switch.
3. Peel bonded wire free from grab handle.
4. To install new switch, reverse Steps 1 through 3.



# STATIONARY WINDOW GLASS

## GROUP 43

(70000)

SECTION TITLE	PAGE	SECTION TITLE	PAGE
GLASS, STATIONARY—BUTYL/URETHANE TYPE SEAL .....	43-11-1	HEATED WINDSHIELD SYSTEM .....	43-20-1

## SECTION 43-11 Glass, Stationary—Butyl/Urethane Type Seal

SUBJECT	PAGE	SUBJECT	PAGE
REMOVAL AND INSTALLATION		SPECIAL SERVICE TOOLS .....	43-11-8
Mouldings .....	43-11-1	VEHICLE APPLICATION .....	43-11-1
Quarter Window .....	43-11-6		
Windshield/Rear Window Glass—Urethane Seal .....	43-11-1		

### VEHICLE APPLICATION

Taurus/Sable.

### REMOVAL AND INSTALLATION

#### Mouldings

The windshield and rear window mouldings on most models are on the edge of glass. The moulding must be removed before actual glass removal. Remove finisher portion of moulding by zipping it out of moulding slot.

NOTE: Sable rear window does not have removable mouldings.

#### Windshield/Rear Window Glass—Urethane Seal

##### Glass Removal, Music Wire Method

##### Two-Man Operation

1. Remove windshield wiper arms and blades, if rear window is being removed. Disconnect heated rear window on equipped models.

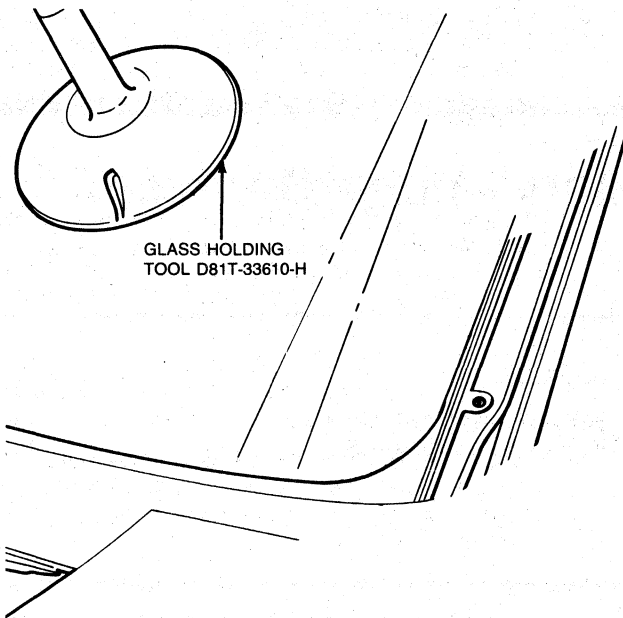
2. Remove mouldings.
3. Remove leaf screen. On rear window, remove finisher portion of moulding by zipping it out of moulding slot.
4. Remove windshield rearview mirror.
  - a. Loosen mirror mounting bracket setscrew.
  - b. Pull mirror assembly upward to remove from windshield retainer.
5. Using a 914mm (3-ft) length of single strand steel music wire (smallest OD available), cut the urethane seal and rubber seal around entire edge of windshield/rear window.
  - a. Force wire through seal at bottom of windshield/rear window. (A 4.8mm (3/16-inch) maximum OD aluminum rod with a notch cut in one end can aid in forcing wire through bottom seal).

**REMOVAL AND INSTALLATION (Continued)**

- b. With one technician holding the end of the wire inside the vehicle, the other technician should yank the wire to cut the seal (first along the bottom of the (rear window) windshield, and then along the sides and top).

**CAUTION: Use care to avoid damage to the instrument panel or rear package tray cover panel.**

6. Remove windshield/rear window and moulding assemblies from the vehicle using Glass Holding Tool D81T-33610-H or equivalent.



N6948-A

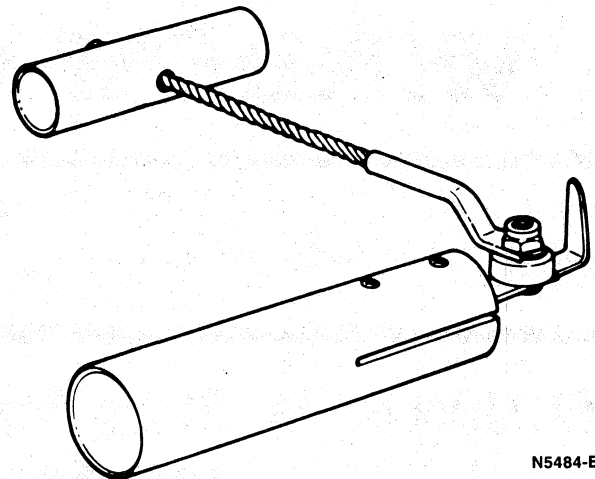
7. Remove any excess urethane, using care not to smear the urethane on component parts, crash pad and vinyl roof.

**NOTE:** If the urethane has cured all the way through, it will not be necessary to remove the urethane which remains on the sheet metal.

8. Check flange sealing area for damaged sheet metal or foreign objects which may have caused, or may cause, glass breakage. Service metal if necessary.

**Glass Removal, Dual-Handle Knife Method**

1. Perform Steps 1 through 4 of Glass Removal, Music Wire Method.
2. Insert blade of Dual-Handle Knife D81P-42006-B or equivalent, into urethane seal.



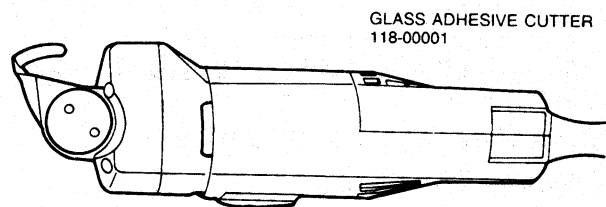
3. With knife handle extended, yank knife blade through urethane seal around entire edge of windshield/rear window. Continue until all urethane is cut. Thick areas of urethane not cut by dual-handle knife can be cut with a utility knife.

**NOTE:** A long-bladed knife is needed to cut away the two rows of urethane at the cowl top.

4. Remove windshield/rear window from vehicle using a Glass Holding Tool D81T-33610-H or equivalent.

**Glass Adhesive Cutting Tool Method**

1. Perform Steps 1 through 4 of Music Wire Method.
2. Use Rotunda Glass Adhesive Cutter 118-00001 or equivalent to cut sealer. Refer to manufacturer's instructions when using tool.
3. Remove windshield/rear window from vehicle using Glass Holding Tool D81T-33610-H or equivalent.



N6999-A

**REMOVAL AND INSTALLATION (Continued)****Glass Installation****WARNING: WINDSHIELD/REAR WINDOW GLASS SPACERS SHOULD NOT BE USED WITH THIS PROCEDURE.**

NOTE: If existing (fully cured) urethane remains on the windshield/rear window opening flange, the new urethane should be applied on top of the existing urethane. However, at no point should the existing urethane material exceed 2.54mm (.10-inch) above the flange sheet metal. If necessary, reduce the height of the existing urethane at various points using a razor blade or Stanley® knife.

1. Using a clean brush, apply urethane metal primer ESB-M2G234-A or equivalent to windshield/rear window opening flange.

NOTE: A minimum of 30 minutes is required for primer surface to dry.

2. Place windshield/rear window on a low stable work surface, inside up.
3. Clean windshield/rear window and install rearview mirror.
4. Using a lint-free cloth, wipe inside surface of glass around periphery in from edge with Urethane Glass Cleaner ESB-M5B280-A as follows:
  - a. Windshield—21.0mm (0.80-inch) along top and sides, 70.0mm (2.75-inch) along bottom.
  - b. Rear Window—21.0mm (0.80-inch) along top and sides, 30.0mm (1.20-inch) along bottom.
5. Install windshield/rear window moulding.

NOTE: Wipe off cleaner immediately after application because it flash dries.

6. Properly align windshield/rear window glass to body.

- a. Place windshield/rear window glass into opening. Center it top and bottom, side-to-side.
- b. Using masking tape or crayon, make alignment marks at points on four sides of both glass and window opening.

7. Remove windshield/rear window glass and moulding assemblies from vehicle and place it back on work table.

8. Thoroughly shake and stir urethane glass primer ESB-M2G224-A or equivalent to ensure uniform pigment mixing.

9. Using a clean brush, apply primer to glass edge (21mm (0.8-inch) wide along top and sides and 70mm (2.75-inch) wide along bottom windshield, 30mm (1.20-inch) wide along bottom rear window).

10. Apply an even bead of urethane ESB-M2G246-A or equivalent around entire sheet metal flange using an air pressure cartridge gun. (Air line pressure should be around 40 psi.). The bead should be triangular in shape, 14mm (0.55-inch) high, and 8.0mm (1/3 (.33-inch)) at base.

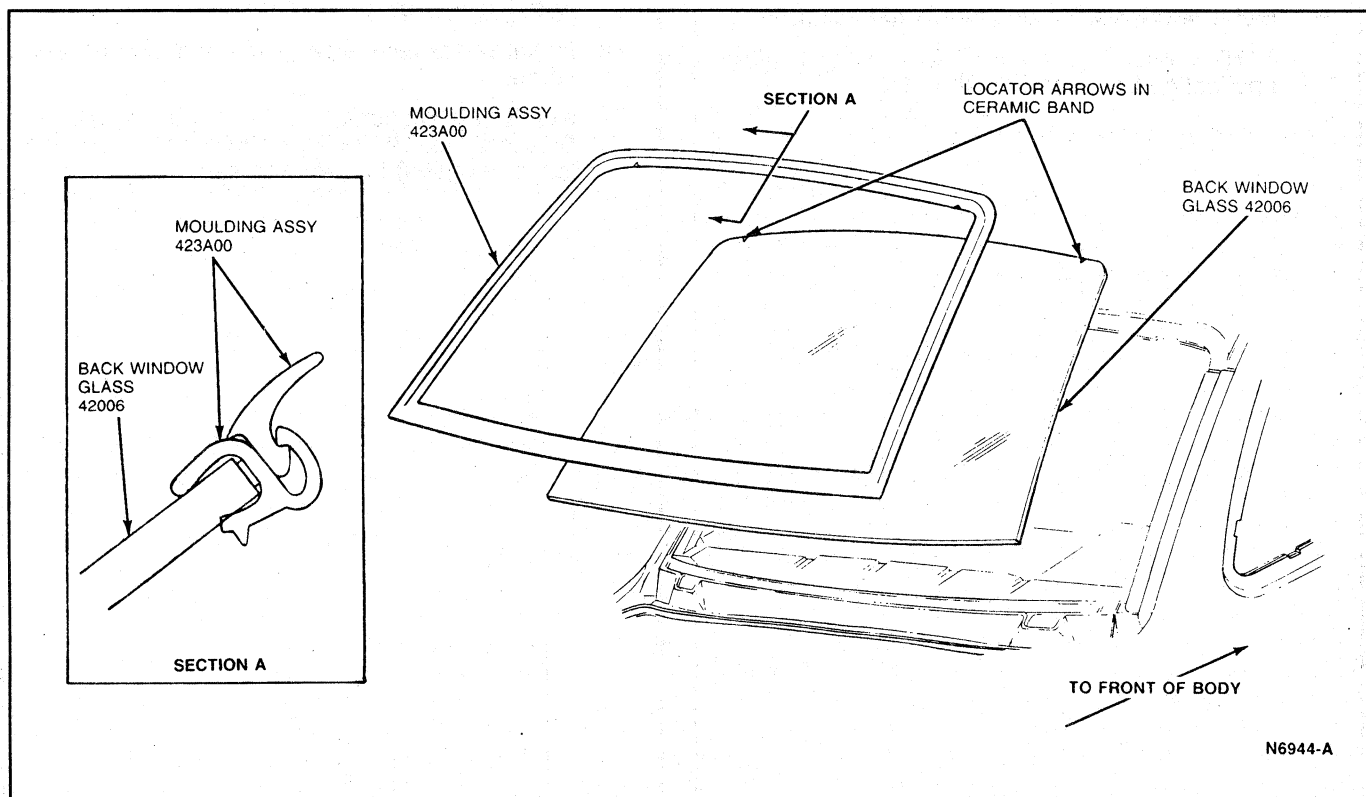
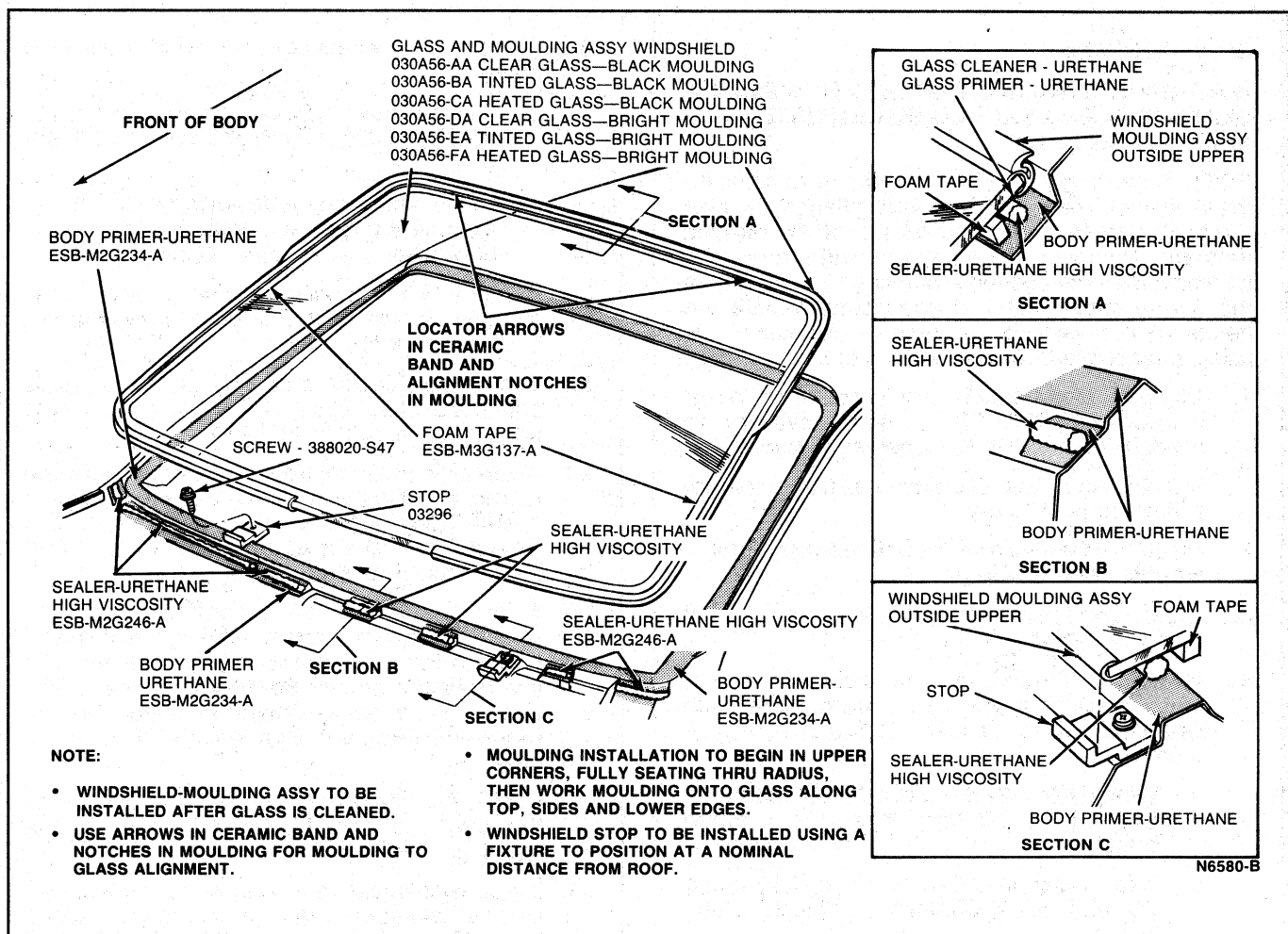
NOTE: Apply a double bead of urethane along the cowl top and the bottom of windshield opening.

11. Install windshield/rear window assembly onto vehicle, taking care to align marks on glass to body. This must be done within 15 minutes of applying urethane.

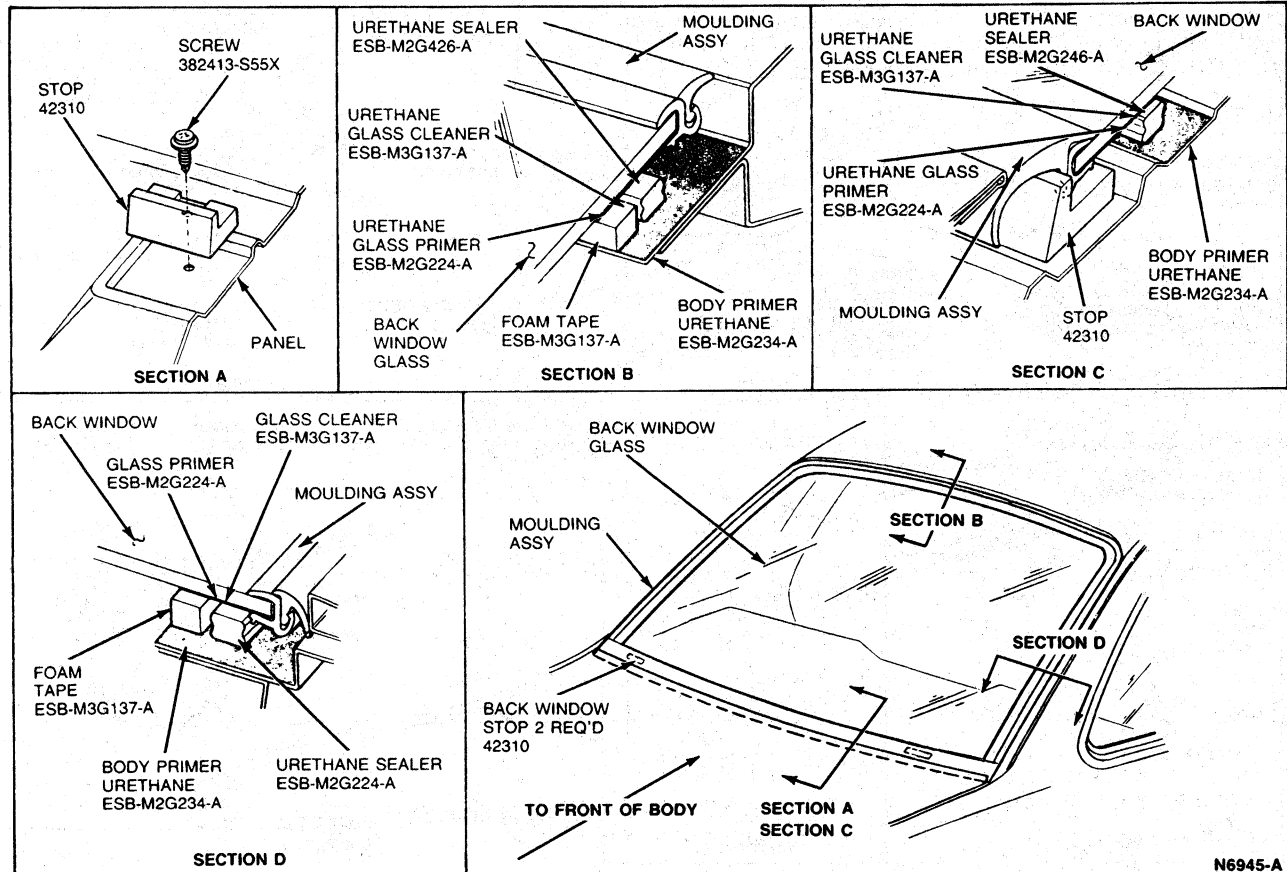
12. Install windshield wiper arms, blades and leaf screen.

NOTE: It is acceptable to use Ford Liquid Butyl Sealer C9AZ-19954-B or equivalent to service leaks (fill gaps) in urethane seal.

## REMOVAL AND INSTALLATION (Continued)

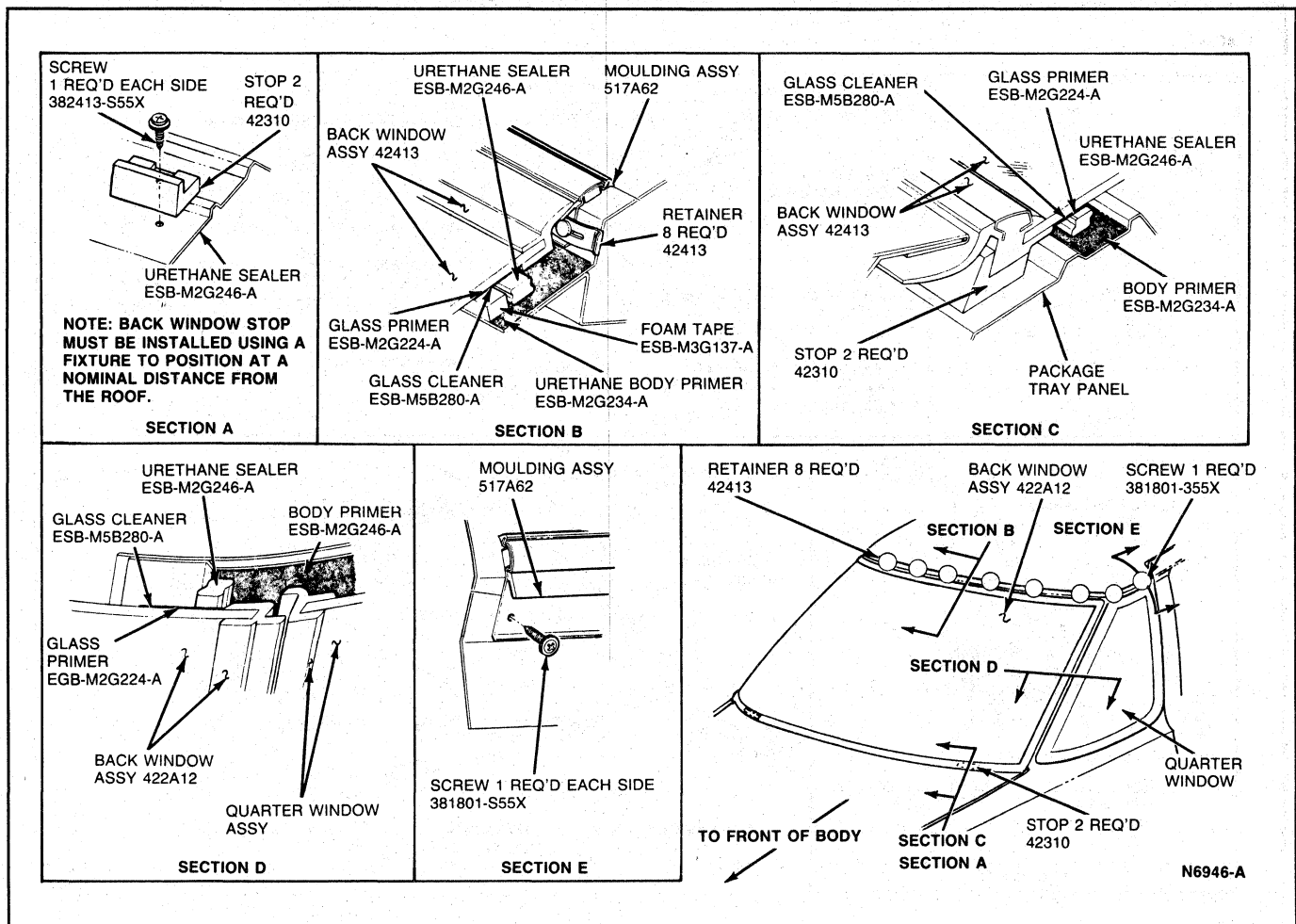


## REMOVAL AND INSTALLATION (Continued)



N6945-A

## REMOVAL AND INSTALLATION (Continued)



## Quarter Window

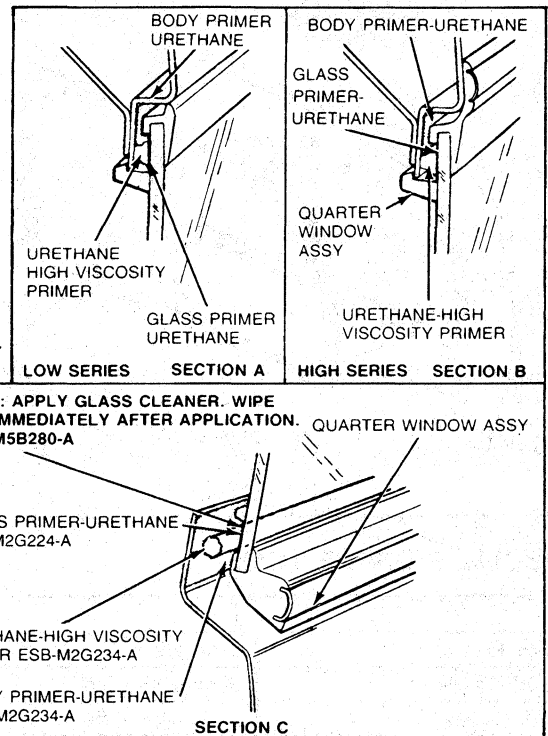
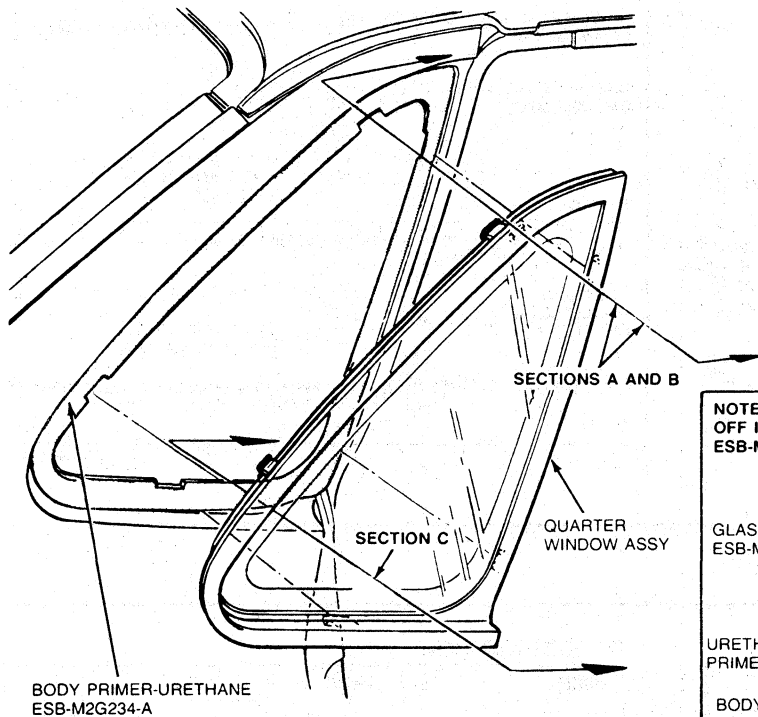
## Removal and Installation

- Remove angel wing quarter trim panel.
- From inside vehicle, use a screwdriver to disengage moulding clips and remove spring retainers.
- Using a 914mm (3-ft) length of single strand steel music wire (smallest OD available), cut urethane seal around entire edge of quarter window.
  - Force wire through seal at bottom of window module.
  - With one technician holding end of wire inside vehicle, other technician should work wire around edge of module flange to cut seal.
- If glass is shattered, cutting urethane seal is also permissible.
  - Insert blade of Dual-Handle Knife D819-42006-B or equivalent into urethane seal.
  - With knife handle extended, yank knife blade around entire edge of glass.
- Remove urethane from flange as close to sheet metal as possible, using a razor blade or utility (Stanley®) knife.
- Using a clean brush, apply Urethane Metal (Body) Primer ESB-M2G234-A or equivalent to window opening flange.
 

NOTE: A minimum of 30 minutes is required for primer surface to dry.
- Using a lint-free cloth, wipe the 10.0mm (3/8-inch) wide glass track on inside surface of window module with Urethane Glass Cleaner ESB-M5B280-A or equivalent.
 

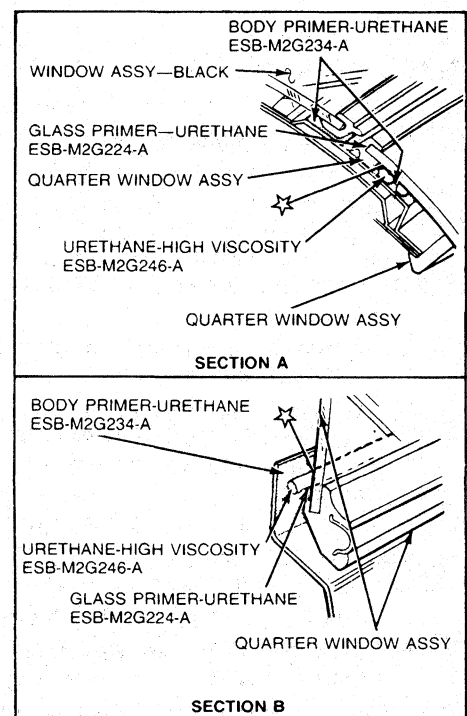
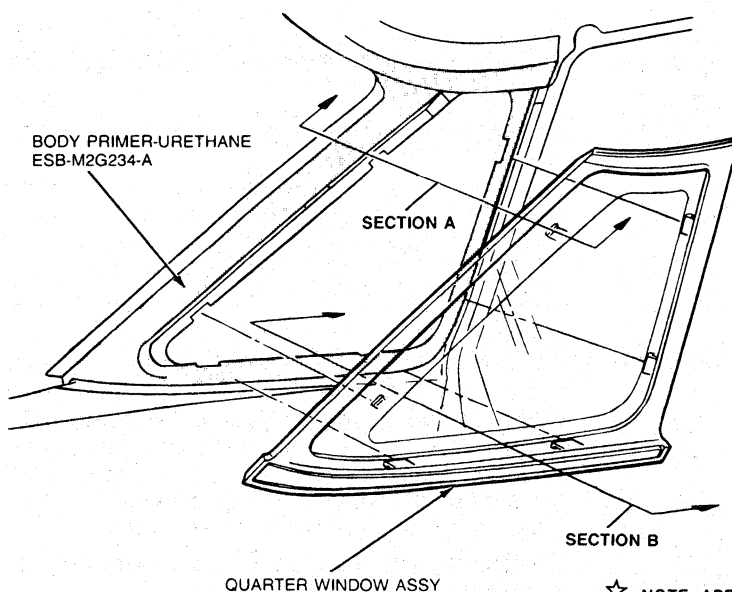
NOTE: Wipe off cleaner immediately after application, before it flash dries.
- Apply a bead of high viscosity Urethane Adhesive ESB-M2G246-A or equivalent in the track on the inside surface of the window. The bead of adhesive should be triangular with a 8.0mm (0.32-inch) base and a 14mm (0.55-inch) height (bead size large enough for proper sealing with no objectionable expulsion).
- Position glass and moulding to flange and press retaining tabs into flange to engage.
- Install spring retainers.
- Install angel wing quarter trim panel.

## REMOVAL AND INSTALLATION (Continued)

Sedan  
Taurus

N6579-B

## Sable



☆ NOTE: APPLY GLASS CLEANER, WIPE OFF IMMEDIATELY AFTER APPLICATION. ESB-M5B280-A

N6573-B

## REMOVAL AND INSTALLATION (Continued)

## Wagon

URETHANE BODY  
PRIMER (BLACK)  
ESB-M2G234-A

SECTION B

QUARTER  
WINDOW  
ASSY

FRONT OF BODY

SECTION A

URETHANE BODY PRIMER (BLACK)  
ESB-M2G234-A

QUARTER WINDOW ASSY

URETHANE HIGH-VISCOSITY  
ESB-M2G246-A

GLASS  
CLEANER  
URETHANE  
ESB-M5B280-A

GLASS PRIMER  
URETHANE (BLACK)  
ESB-M2G224-A

SECTION A

URETHANE BODY PRIMER (BLACK)  
ESB-M2G234-A

URETHANE  
HIGH VISCOSITY  
ESB-M2G246-A

QUARTER WINDOW ASSY

GLASS PRIMER-URETHANE  
(BLACK) ESB-M2G224-A

WINDOW ASSY  
QUARTER

SECTION B

NOTE: APPLY GLASS CLEANER AND WIPE  
OFF IMMEDIATELY AFTER APPLICATION  
ESBM5B280-A

N6571-A

## SPECIAL SERVICE TOOLS

Tool Number	Description
D61T-33610-H	Glass-Holding Tool
D61P-42006-B	Dual Handle Knife

CN6949-A

## ROTUNDA EQUIPMENT

Model	Description
118-00001	Glass Adhesive Cutter

CN7000-A



# SECTION 43-20 Heated Windshield System

SUBJECT	PAGE	SUBJECT	PAGE
<b>DESCRIPTION</b>		<b>DIAGNOSIS AND TESTING</b>	
Circuit Protection .....	43-20-2	Preliminary Checks .....	43-20-3
Control Module .....	43-20-1	<b>OPERATION</b> .....	43-20-2
Power Relay .....	43-20-1	<b>REMOVAL AND INSTALLATION</b>	
Sense Resistor .....	43-20-1	Switch .....	43-20-2
Windshield .....	43-20-1	<b>SPECIAL SERVICE TOOLS</b> .....	43-20-11
		<b>VEHICLE APPLICATION</b> .....	43-20-1

## VEHICLE APPLICATION

Taurus/Sable.

## DESCRIPTION

**WARNING: THE ELECTRICALLY HEATED WINDSHIELD SYSTEM OPERATES AT 30 TO 70 VOLTS WHEN ACTIVATED. EXERCISE EXTREME CAUTION TO AVOID POSSIBLE PERSONAL INJURY WHEN SERVICING OR TESTING.**

The heated windshield system is available as an option on Taurus and Sable vehicles.

The electrically heated windshield is designed to rapidly melt morning frost and ice coverings.

System components include:

- Electrically conductive windshield.
- Power relay.
- Control module.
- On/off switch.
- Sense resistor.

During operation of the heated windshield, the alternator and electronic voltage regulator also become part of the system.

### Windshield

The windshield is a standard three layer construction with a plastic laminate sandwiched between two layers of glass. A silver and zinc oxide mixture, fused onto the back of the outer glass layer, forms an electrical conductor within the windshield.

Silver buss bars attached to the top and bottom of the windshield connect the conductive material in the glass to the power and ground circuits. The bottom buss bar is connected to the power feed circuit.

The electrical resistance of the windshield is approximately 2.6 ohms.

### Power Relay

The power relay is mounted in a protected area between the RH front fender and the inner fender splash shield.

When energized by the control module, the power relay switches alternator output from the vehicle electrical system to the heated windshield.

### Control Module

The control module is mounted behind the instrument cluster on the steering column support bracket.

In addition to its switching functions, the control module also:

- Contains a thermistor that prevents system operation if passenger compartment temperature is above 10°C (50°F).
- Contains timers that limit system operation to approximately four minutes per cycle.
- Has a link to the EEC-IV engine control module that is used to adjust engine idle during certain operating conditions.
- Has a link to the resistor that prevents system operation if the windshield is damaged.

### Sense Resistor

The sense resistor is mounted with the power relay under the RH front fender.

Installation of the sense resistor prevents operation of the system if the windshield is damaged. The control module monitors voltage across the resistor and will turn off the system if a voltage drop is detected due to an opening in the windshield circuit. (This may be caused by a cracked windshield).

**DESCRIPTION (Continued)****Circuit Protection**

The low voltage control circuit is protected by a 15 amp fuse located in the fuse panel.

The high voltage power circuit is protected by a fusible link at the power relay.

**OPERATION**

The heated windshield system will not operate unless the engine is running, the interior temperature of the vehicle is below 10°C (50°F), and battery voltage is at least 11 V.

When the system is switched on, the control module:

- Turns indicator lamp on.
- Turns voltage regulator off causing alternator to stop generating current.
- Energizes power relay, switching alternator output leads from vehicle's normal electrical system to windshield power circuit.
- Restores alternator charging output by turning voltage regulator back on.

The windshield power circuit is now connected directly to the alternator output terminal through the power relay, causing the remaining vehicle electrical system to operate on battery power.

After it is disconnected from the alternator, battery voltage will drop to approximately 12 volts. Sensing a drop in battery voltage, the voltage regulator will full field the alternator.

With the battery out of the charging circuit and full field power, alternator output voltage will rise to between 30 and 70 volts depending on engine speed.

To prevent windshield overload at higher engine speeds, alternator output is limited to 70 volts by the control module and the electronic voltage regulator.

The module also monitors battery voltage. If battery voltage drops below 11 volts, the control module will reconnect the vehicle electrical system to the alternator by cutting off power to the power relay.

The heated windshield control module is also connected to the EEC-IV engine control module.

If the system is switched on and the driver does not shift the transmission into gear, the windshield control module will signal the EEC-IV module to increase engine speed to 1400 rpm.

The higher engine idle speed ensures the alternator is spinning fast enough to produce a desired voltage for the de-ice function.

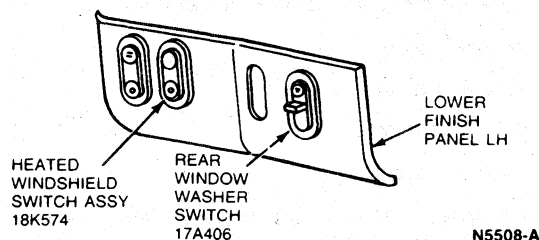
As soon as the driver shifts into a gear, the EEC-IV module will resume its normal idle speed control methods.

The control module is connected to the EEC-IV module through the same wiring used by the A/C compressor "ON" signal. Although it is unlikely, if the A/C is on at the same time as the heated windshield system, the A/C signal will override the signal from the windshield control module.

At the completion of the four minute cycle, the control module again turns off the regulator, de-energizes the power relay and returns to normal charging system operation.

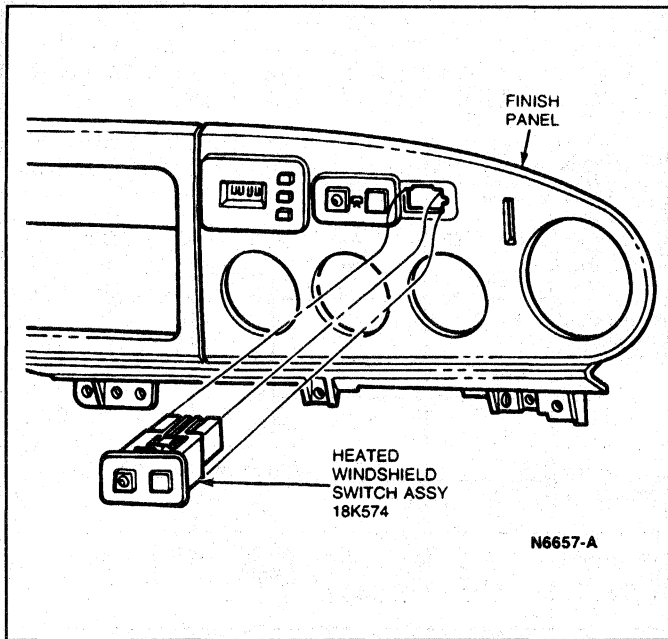
**REMOVAL AND INSTALLATION****Switch****Taurus****Removal and Installation**

1. Remove lower left finish panel.
2. Disconnect electrical connector.
3. Depress spring locking tabs on switch and push out of finish panel.
4. To install, reverse Steps 1 through 3.

**Sable****Removal and Installation**

1. Remove instrument cluster finish panel.
2. Disconnect electrical connector.
3. Depress spring locking tabs on switch and push out of finish panel.
4. To install, reverse Steps 1 through 3.

## REMOVAL AND INSTALLATION (Continued)



## DIAGNOSIS AND TESTING

**WARNING: HIGH VOLTAGE. THE ELECTRICALLY HEATED WINDSHIELD SYSTEM OPERATES AT 30 TO 70 VOLTS WHEN ACTIVATED. EXERCISE EXTREME CAUTION TO AVOID POSSIBLE PERSONAL INJURY WHEN SERVICING OR TESTING THE FOLLOWING COMPONENTS:**

- ALTERNATOR.
- ALTERNATOR OUTPUT RELAY.
- CONTROL MODULE.
- ASSOCIATED WIRING (DO NOT PROBE).

**NOTE:** The heated windshield is designed to turn off if the temperature in the vehicle is above 10°C (50°F). To operate the windshield at temperatures above 10°C (50°F) for test purposes, it is necessary to connect the black test lead (739 circuit found underhood) to ground.

**WARNING: DO NOT TEST HEATED WINDSHIELD SYSTEM IF WINDSHIELD IS CRACKED. REPLACE WINDSHIELD BEFORE TESTING. THE SENSE RESISTOR SHUTS THE SYSTEM OFF IF THERE IS AN OPEN OR INTERMITTENT CIRCUIT IN THE WINDSHIELD. HOWEVER, CONNECTING THE TEST LEAD TO GROUND OVERRIDES THIS FEATURE.**

**Preliminary Checks**

Before performing the operational tests in the diagnosis charts for the heated windshield system, it is necessary to determine if the charging system is in proper working order. Check for the following:

1. Clean and tight wiring connections at the alternator, alternator output relay, regulator, battery and engine.
2. Charging system function. Refer to Section 31-01.

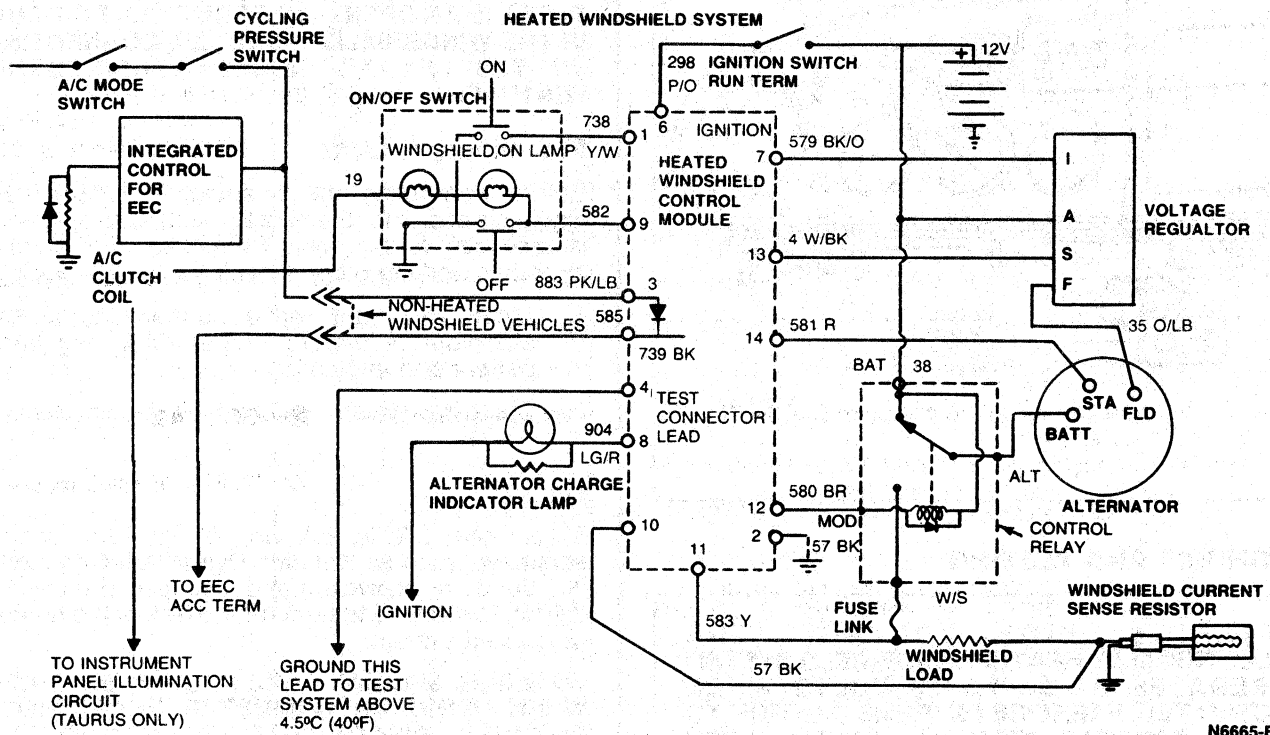
**Testing**

A voltmeter (0V to 20V and 0V to 100V scale), ohmmeter such as Rotunda Digital Volt-Ohmmeter 007-00001 or equivalent and a jumper wire are the only tools required to perform a check of the heated windshield system.

**WARNING: SPECIAL CARE SHOULD BE TAKEN WHEN USING AN OHMMETER NEAR "HOT" CIRCUITS. DISCONNECT THE COMPONENT BEING CHECKED OR DISCONNECT THE BATTERY CABLES TO PREVENT DAMAGE TO THE OHMMETER. CAUTION SHOULD ALSO BE USED WHEN MEASURING ANY OF THE CIRCUIT CONNECTIONS BETWEEN THE ALTERNATOR OUTPUT AND WINDSHIELD. THIS CIRCUIT CARRIES UP TO 70 VOLTS WHEN THE HEATED WINDSHIELD IS ON.**

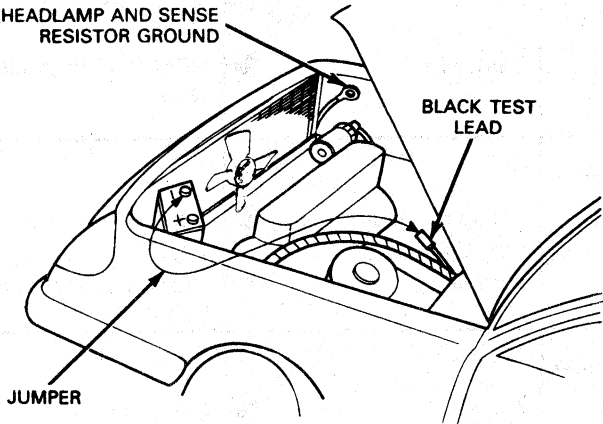
Refer to the following electrical schematic and diagnosis charts to diagnose problems with the heated windshield system.

## DIAGNOSIS AND TESTING (Continued)



## DIAGNOSIS AND TESTING (Continued)

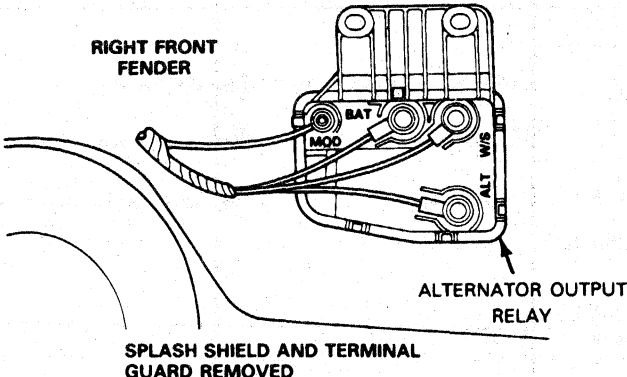
## WINDSHIELD HEAT INDICATOR TURNS ON BUT WINDSHIELD WILL NOT HEAT

TEST STEP		RESULT	ACTION TO TAKE
<b>A1</b>	<b>PRELIMINARY CHECKS</b>		
Check the Following: <ul style="list-style-type: none"> <li>• Battery terminals</li> <li>• Belt tension</li> <li>• Wiring connections at alternator, electronic voltage regulator (EVR), alternator output relay, heated windshield control (HWC) module, control module ground and engine to body ground.</li> <li>• Charging system function — charging system must be functional for the heated windshield system to operate.</li> </ul>		(OK) ► GO to <b>A2</b> . (X) ► <b>SERVICE and/or REPLACE</b> as necessary. REFER to Section 31-01.	
<b>A2</b>	<b>ALTERNATOR OUTPUT VOLTAGE TEST</b>		
<ul style="list-style-type: none"> <li>• Connect jumper wire from black test lead (739 circuit) to ground.</li> <li>• Connect voltmeter to alternator BAT terminal (100V scale).</li> <li>• Start engine and run at 1000 to 1500 rpm with no electrical load except windshield.</li> <li>• Turn windshield heat on and read voltmeter after 10 seconds.</li> </ul> <p>NOTE: Heated windshield system cannot be operated above 10°C (50°F) unless HWC module test wire is grounded.</p> <ul style="list-style-type: none"> <li>• Voltage at alternator BAT terminal should be above 30V.</li> </ul>		Voltage is above 30V ► GO to <b>A7</b> . Voltage is 13 to 15V ► GO to <b>A3</b> . Zero volts ► <b>REPLACE HWC module</b> .	
			

CN6666-B

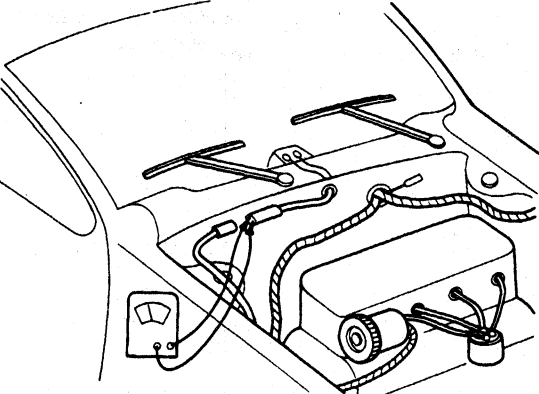
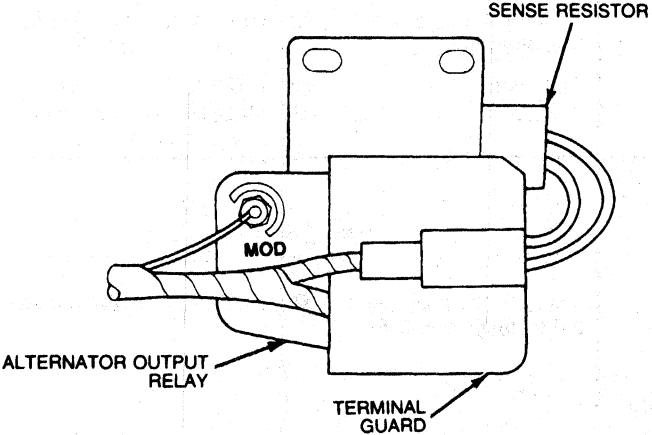
## DIAGNOSIS AND TESTING (Continued)

## WINDSHIELD HEAT INDICATOR TURNS ON BUT WINDSHIELD WILL NOT HEAT — Continued

TEST STEP	RESULT	ACTION TO TAKE
<b>A3</b> ALTERNATOR OUTPUT RELAY TEST 1 <ul style="list-style-type: none"> <li>• Turn ignition switch to RUN and turn windshield heat on (engine not running).</li> <li>• Connect voltmeter to MOD terminal of alternator relay.</li> <li>• Voltage at MOD terminal of relay should be approximately one volt.</li> </ul>  <p>RIGHT FRONT FENDER</p> <p>SPLASH SHIELD AND TERMINAL GUARD REMOVED</p> <p>ALTERNATOR OUTPUT RELAY</p>	<div> <div>OK</div> <div>▶</div> </div> GO to A5.  Zero volts <div>▶</div> GO to A4.  Greater than 2V <div>▶</div> GO to A8.	
<b>A4</b> ALTERNATOR OUTPUT RELAY TEST 2 <ul style="list-style-type: none"> <li>• Remove push-on connector from alternator relay MOD terminal and connect voltmeter to MOD terminal.</li> <li>• Voltage at MOD terminal should be 12V with connector removed.</li> </ul>	<div> <div>OK</div> <div>▶</div> </div> GO to A8.  Zero volts <div>▶</div> REPLACE alternator relay.	
<b>A5</b> ALTERNATOR OUTPUT RELAY TEST 3 <ul style="list-style-type: none"> <li>• Repeat Test A2 with voltmeter connected to W/S terminal of alternator output relay. Refer to illustration under A3.</li> <li>• Voltage at W/S terminal should be above 30V.</li> </ul>	Voltage is above 30V <div>▶</div> GO to A6.  Zero volts <div>▶</div> REPLACE alternator output relay.	
<b>A6</b> WINDSHIELD VOLTAGE TEST <ul style="list-style-type: none"> <li>• Connect voltmeter between windshield connector and ground — (100V scale).</li> <li>• Start engine and run at 1000 to 1500 rpm with no electrical load except windshield.</li> <li>• Turn windshield heat on and read voltmeter after 10 seconds.</li> <li>• Voltage at windshield connector should be above 30V.</li> </ul>	Above 30V <div>▶</div> GO to A7.  Zero volts <div>▶</div> SERVICE wiring from alternator output relay to windshield connector.	

## DIAGNOSIS AND TESTING (Continued)

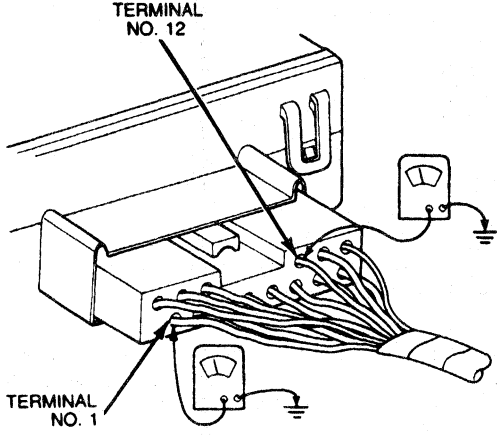
## WINDSHIELD HEAT INDICATOR TURNS ON BUT WINDSHIELD WILL NOT HEAT — Continued

TEST STEP	RESULT	ACTION TO TAKE
<b>A7 WINDSHIELD RESISTANCE TEST</b> <ul style="list-style-type: none"> <li>• Disconnect windshield connector and measure resistance across windshield.</li> <li>• Should read between one and 4 ohms.</li> </ul> 	<p> <span style="border: 1px solid black; border-radius: 50%; padding: 2px;">OK</span> ➤ GO to A8.         </p> <p>           Less than one ohm or greater than 4 ohms ➤ REPLACE or SERVICE windshield.         </p>	
<b>A8 SENSE RESISTOR TEST</b> <ul style="list-style-type: none"> <li>• Disconnect current sense resistor connector and measure resistance across resistor.</li> <li>• Should read 0.1 ohms or less.</li> </ul> 	<p> <span style="border: 1px solid black; border-radius: 50%; padding: 2px;">OK</span> ➤ GO to A9.         </p> <p>           Above 0.1 ohms ➤ REPLACE sense resistor.         </p>	

CN6668-A

## DIAGNOSIS AND TESTING (Continued)

## WINDSHIELD HEAT INDICATOR TURNS ON BUT WINDSHIELD WILL NOT HEAT — Continued

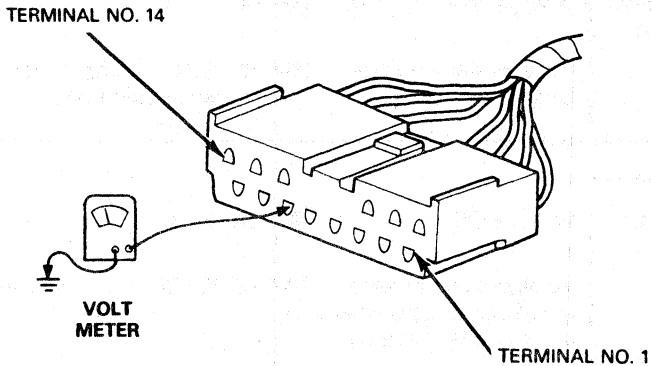
TEST STEP	RESULT	ACTION TO TAKE
<b>A9 CONTROL MODULE TEST 1</b> <ul style="list-style-type: none"> <li>Connect voltmeter between terminal No. 6 of (HWC) module and ground with ignition in RUN.</li> <li>Battery voltage should be present.</li> </ul> 	Battery voltage present Zero volts	GO to <b>A10</b> . SERVICE lead from ignition switch or REPLACE fuse as necessary.
<b>A10 CONTROL MODULE TEST 2</b> <ul style="list-style-type: none"> <li>Connect voltmeter between terminal No. 12 of (HWC) module and ground with ignition key OFF. Refer to illustration, Test A9.</li> <li>Battery voltage should be present.</li> </ul>	Battery voltage present Greater than zero but less than 10V Zero volts	GO to <b>A11</b> . REPLACE HWC module. SERVICE wire from alternator output relay coil to control module.
<b>A11 CONTROL MODULE TEST 3</b> <ul style="list-style-type: none"> <li>Maintain voltmeter hookup in A10.</li> <li>Start engine and run at 1000 to 1500 rpm with no electrical load except windshield.</li> <li>Turn windshield heat on and read voltmeter initially and after 10 seconds.</li> <li>Voltage at terminal No. 12 should drop from battery voltage (12V) to approximately one volt a few seconds after windshield heat is turned on.</li> </ul>	(OK) Voltage stays above 3V or less than 0.5V	System OK. REPLACE HWC module.

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## DIAGNOSIS AND TESTING (Continued)

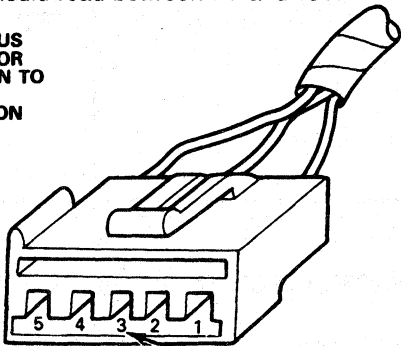
**HEATED WINDSHIELD WILL NOT TURN ON — WINDSHIELD INDICATOR LAMP STAYS OFF  
OR WINDSHIELD HEAT WILL NOT STAY ON FOR THREE MINUTES**

TEST STEP		RESULT	ACTION TO TAKE
<b>B1</b>	<b>PRELIMINARY CHECKS</b>		
<p>Check the following:</p> <ul style="list-style-type: none"> <li>• Battery state of charge</li> <li>• Battery terminals</li> <li>• Wiring connections at alternator, electronic voltage regulator (EVR), alternator output relay and windshield</li> <li>• Charging system function</li> </ul> <p>NOTE: Heated windshield will not operate if battery is in a low state of charge.</p>		<p>OK ► GO to <b>B2</b>.</p> <p>✗ OK ► SERVICE and/or REPLACE as necessary. REFER to Section 31-01.</p>	
<b>B2</b>	<b>POWER TO MODULE TEST</b>		
<p>NOTE: It is necessary to ground black test lead (739 circuit) to operate heated windshield system above 10°C (50°F). Refer to illustration under Test A2.</p> <ul style="list-style-type: none"> <li>• Connect voltmeter between terminal No. 6 of heated windshield control (HWC) module and ground with ignition switch in RUN.</li> <li>• Battery voltage (12V) should be present.</li> </ul>		<p>Battery voltage present ► GO to <b>B3</b>.</p> <p>Zero volts ► SERVICE lead or fuse from ignition switch to control module.</p>	
<p>TERMINAL NO. 14</p>  <p>TERMINAL NO. 1</p>			
<b>B3</b>	<b>HWC MODULE TEST</b>		
<ul style="list-style-type: none"> <li>• Connect voltmeter between terminal No. 1 of HWC module and ground with ignition switch in RUN. Refer to illustration under Test A9.</li> <li>• Meter should read between 7V and 10V.</li> </ul>		<p>Voltage OK ► GO to <b>B4</b>.</p> <p>Zero volts ► REPLACE HWC module.</p>	

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## DIAGNOSIS AND TESTING (Continued)

**HEATED WINDSHIELD WILL NOT TURN ON — WINDSHIELD INDICATOR LAMP STAYS OFF  
OR WINDSHIELD HEAT WILL NOT STAY ON FOR THREE MINUTES — Continued**

TEST STEP		RESULT	ACTION TO TAKE
B4	ON/OFF SWITCH TEST		
<ul style="list-style-type: none"><li>Connect voltmeter between terminal No. 3 of heated windshield switch and ground with ignition switch in RUN.</li><li>Meter should read between 7V and 10V.</li></ul> <p>NOTE: ONLY TAURUS HAS WIRE FOR CONNECTION TO INTERNAL ILLUMINATION LAMP</p>  <p>ON/OFF SWITCH CONNECTOR</p>		Voltage OK  Zero volts	GO to B5.  SERVICE wire from HWC module to on/off switch.
B5	ON/OFF SWITCH TEST		
<ul style="list-style-type: none"><li>Maintain voltmeter hookup in B4 with ignition switch in RUN, and hold windshield heat on button down.</li><li>Voltage should drop to zero.</li></ul>		Voltage drops to zero  Voltage stays above zero	GO to B6.  REPLACE on/off switch or repair wiring as necessary.
B6	HWC MODULE LOW VOLTAGE TEST		
<ul style="list-style-type: none"><li>Connect voltmeter between terminal No. 9 of HWC module and ground with ignition switch in RUN. Refer to illustration under Test A9.</li><li>Hold windshield heat on button down and read meter.</li><li>Release on button and read meter.</li><li>Voltage should increase from zero to approximately 11V and stay at 11V after on button is released.</li></ul>		Voltage OK  Voltage stays at zero or returns to zero when on button is released	GO to B7.  REPLACE HWC module.
B7	OPERATION WITH LOADS ON		
<ul style="list-style-type: none"><li>Connect voltmeter across battery.</li><li>Start engine, run at approximately 1000 rpm and turn heated windshield on.</li><li>Turn on headlamps, heater blower (highest speed) and heated rear window for 3 minutes.</li><li>Battery voltage should not go below 11V and heated windshield should stay on if battery stays above 11V.</li><li>NOTE: Heated windshield will turn off if battery drops below 11V.</li></ul>		Voltage drops below 11V  HWC module turns off with battery above 11V and A/C off	CHARGE or REPLACE battery as necessary.  NOTE: Correct battery size must be used for proper heated windshield operation.  REPLACE HWC module.

## DIAGNOSIS AND TESTING (Continued)

## ALTERNATOR CHARGE INDICATOR LAMP COMES ON WHEN HEATED WINDSHIELD IS TURNED ON

TEST STEP		RESULT	ACTION TO TAKE
<b>C1</b>	<b>CHARGE INDICATOR LAMP ON TEST</b>		
	<ul style="list-style-type: none"> <li>Turn ignition switch to RUN (engine not running) and check alternator indicator lamp.</li> <li>Alternator lamp should be on.</li> </ul>	Lamp is on	GO to C2.
		Lamp is off	GO to C4.
<b>C2</b>	<b>CHARGE INDICATOR LAMP ON TEST (Cont'd)</b>		
	<ul style="list-style-type: none"> <li>Remove connector from HWC module and turn ignition switch to RUN.</li> <li>Alternator lamp should be off.</li> </ul>	Lamp is off	GO to C3.
		Lamp is on	Service wire from alternator lamp to HWC module (904 circuit).
<b>C3</b>	<b>CHARGE INDICATOR LAMP ON TEST (Cont'd)</b>		
	<ul style="list-style-type: none"> <li>Connect wiring connector to HWC module and connect a jumper wire from HWC module test lead (739 circuit) to ground. Refer to illustration under Test A2.</li> <li>Start engine and turn heated windshield on.</li> <li>Alternator lamp should be off.</li> </ul>	Lamp is off	System OK.
		Lamp is on	REPLACE HWC module.
<b>C4</b>	<b>LAMP AND WIRING CHECK</b>		
	<ul style="list-style-type: none"> <li>Disconnect harness connector from HWC module and connect a jumper from Pin No. 8 to ground on the harness connector. Refer to illustration under Test B5.</li> <li>Turn ignition switch to RUN (engine not running).</li> <li>Alternator lamp should be on.</li> </ul>	Lamp is on	GO to C5.
		Lamp is off	SERVICE Alternator Indicator lamp or wiring from HWC module.
<b>C5</b>	<b>ALTERNATOR LAMP CIRCUIT TEST</b>		
	<ul style="list-style-type: none"> <li>Connect a jumper wire from Pin No. 8 to Pin No. 7 of the HWC harness connector.</li> <li>Turn ignition switch to RUN.</li> <li>Alternator lamp should be on.</li> </ul>	Lamp is on	GO to C6.
		Lamp is off	SERVICE 904 circuit to voltage regulator REFER to Section 31-01.
<b>C6</b>	<b>ALTERNATOR INDICATOR LAMP CIRCUIT TEST (Cont'd.)</b>		
	<ul style="list-style-type: none"> <li>Connect wiring connector to HWC module.</li> <li>Turn ignition switch on (engine not running).</li> <li>Alternator lamp should be on.</li> </ul>	Lamp is on	System OK.
		Lamp is off	REPLACE HWC module.

CN6672-A

## SPECIAL SERVICE TOOLS

ROTUNDA EQUIPMENT	
Model	Description
007-00001	Digital Volt — Ohmmeter
CJ2820-B	



# DOORS, HOOD, LUGGAGE COMPARTMENT DOOR AND LIFTGATE

GROUP  
**44**  
(16000 & 17000)

SECTION TITLE	PAGE	SECTION TITLE	PAGE
DOOR, HINGE AND WEATHERSTRIP .....	44-06-1	KEYLESS DOOR ENTRY SYSTEM .....	44-18-1
DOOR AND TAILGATE—SERVICE .....	44-01-1	LUGGAGE, GLOVE COMPARTMENT DOOR, HINGE, LATCH, LOCK AND WEATHERSTRIP .....	44-10-1
DOOR LOCKS AND LATCHES—POWER AND MECHANICAL .....	44-16-1		
HOOD, HINGE AND LATCH .....	44-08-1		

## SECTION 44-01 Door and Tailgate—Service

SUBJECT	PAGE	SUBJECT	PAGE
LUBRICATION		LUBRICATION (Cont'd.)	
Door and Roof Rail Weatherstrip Lubricant .....	44-01-1	Lock Cylinder .....	44-01-2
Door Hinge .....	44-01-2	VEHICLE APPLICATION .....	44-01-1
Hood and Luggage Compartment Latches and Hinges .....	44-01-2		

### VEHICLE APPLICATION

Taurus/Sable.

### LUBRICATION

#### Door and Roof Rail Weatherstrip Lubricant

**Silicone Lubricant C0AZ-19553-A (Jelly) and  
D7AZ-19553-A (Spray)**

Use this lubricant on the door and window weatherstrips. Apply silicone lubricant to the weatherstrips whenever necessary. Silicone lubricant helps avoid weatherstrip squeaks, and retards excess weatherstrip wear from chafing

between the door glass upper frame and the weatherstrip. It also helps to retain door window alignment by reducing friction between the glass frame and the rubber weatherstrip.

**LUBRICATION (Continued)****Hood and Luggage Compartment Latches and Hinges****Polyethylene Grease D7AZ-19584-A**

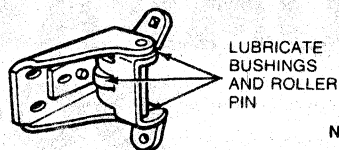
This lubricant is used to lubricate hood and luggage compartment hinges and latches. Apply an even coat to all movable hinge surfaces when a binding condition occurs. The hood latch and auxiliary latch should be checked every six months.

**Lock Cylinder****Lock Lubricant D8AZ-19587-A**

This lubricant is used to eliminate sticking or binding of all key lock cylinders.

**Door Hinge**

Use Disc Brake Caliper Slide Grease D7AZ-19590-A or equivalent to lubricate door hinges.



N6585-B

# SECTION 44-06 Door, Hinge and Weatherstrip

SUBJECT	PAGE	SUBJECT	PAGE
<b>ADJUSTMENTS</b>		<b>REMOVAL AND INSTALLATION (Cont'd.)</b>	
Door Alignment .....	44-06-1	Doors .....	44-06-1
Door Latch Striker .....	44-06-1	Hinge .....	44-06-2
<b>REMOVAL AND INSTALLATION</b>		Weatherstrips .....	44-06-4
Door Hinge Check .....	44-06-3	<b>SPECIAL SERVICE TOOLS</b> .....	44-06-5
Door Striker .....	44-06-4	<b>VEHICLE APPLICATION</b> .....	44-06-1

## VEHICLE APPLICATION

Taurus/Sable.

## ADJUSTMENTS

Refer to the illustrations under Removal and Installation while performing the following adjustments.

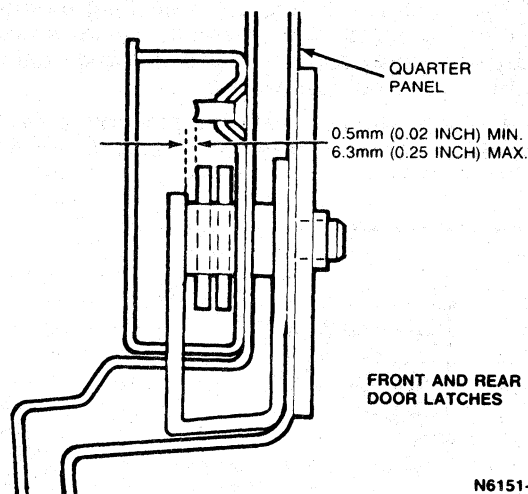
### Door Alignment

The door hinges provide sufficient adjustment to correct most door misalignment conditions. The holes of the hinge and/or the hinge attaching points are enlarged or elongated to provide for hinge and door alignment. **Do not cover up a poor door alignment with a latch striker adjustment.**

#### Doors, Side

1. Determine which hinge bolts and nuts must be loosened to move door in desired direction.
2. Loosen hinge bolts and nuts just enough to permit movement of door with padded pry bar.
3. Move door the distance estimated to be necessary. Tighten hinge bolts and nuts to 18-29 N·m (13-21 lb-ft) and check door fit to ensure there is no bind or interference with adjacent panel.
4. Repeat operation until desired fit is obtained, and check striker plate alignment for proper door closing.

Move striker assembly in or out to provide a flush fit at the door and pillar or quarter panel. Use correct bit from Torx Drive Bit Set D79P-2100-T or equivalent to loosen and tighten the latch striker. Tighten striker to 33-44 N·m (24-33 lb-ft).



### Door Latch Striker

The striker pin can be adjusted laterally and vertically as well as fore-and-aft. **The latch striker should not be adjusted to correct door sag.**

The latch striker should be shimmed to get the clearance shown between the striker and the latch. To check this clearance, clean latch jaws and striker area. Apply a thin layer of dark grease to striker. As door is closed and opened, a measurable pattern will result on the latch striker. Use a maximum of two shims under the striker.

## REMOVAL AND INSTALLATION

### Doors

#### Removal

1. Support door using Rotunda Bumper and Door Installer 047-00001 or equivalent.
2. Remove hinge attaching bolts and nuts from door and remove door.
3. Disconnect wiring harness connectors, if so equipped.

## REMOVAL AND INSTALLATION (Continued)

4. If door is to be replaced, transfer the following components to the new door if in usable condition: trim panel, watershield, outside mouldings, clips, window regulators and door latch components.

## Installation

1. Position door hinges and partially tighten bolts.
2. Align door and tighten bolts securely.

## Hinge

## Door, Front

## Removal

1. Open door and support it with Rotunda Bumper and Door Installer 047-00001 or equivalent.
2. Scribe hinge location to door.
3. Remove two washer head bolts attaching hinge to door.
4. Move door stand so that door is far enough away from body to allow access to hinge bolts on pillar.
5. Remove cowl side trim panel. Refer to Section 45-03.
6. **RH Door and LH Door, Lower:** Push insulator aside and remove lower nut and washer.
7. **RH Door, Upper:** Open glove compartment. Press sides of glove compartment bin to clear instrument panel stops and lower glove compartment door and bin. Reaching through glove compartment opening, bend sound absorber down from 8mm hinge nut and washer and remove nut and washer.
8. **LH Door, Upper:** Remove steering column opening cover. Refer to Section 45-61.

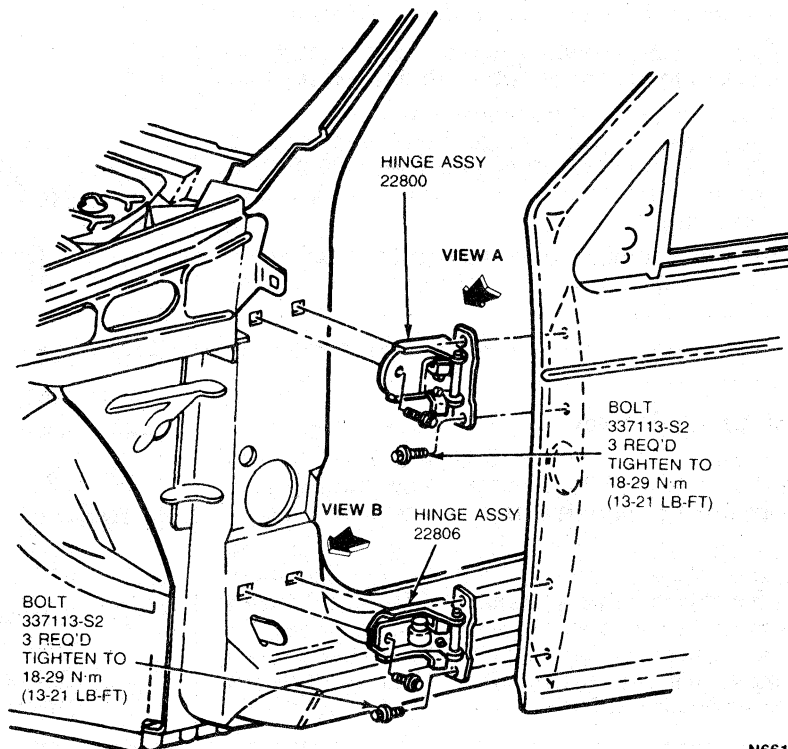
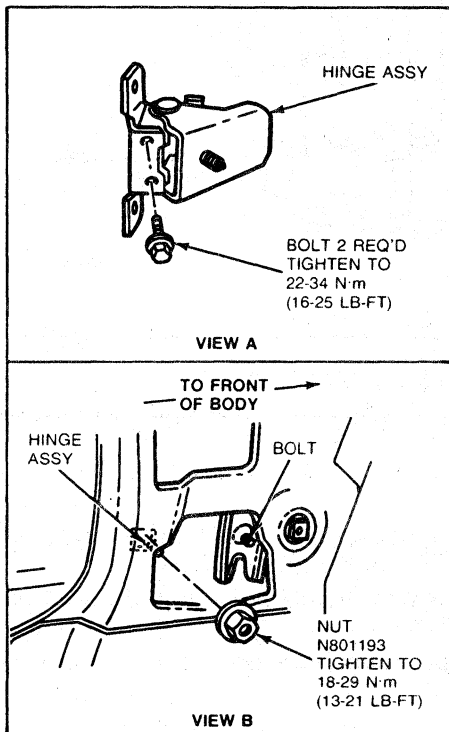
Reaching through cover opening, bend sound absorber down from pillar access hole. Use ratchet extension and 8mm universal socket to loosen hinge nut and washer and remove nut and washer.

9. From outside vehicle, remove upper and lower hinge-to-body attaching bolts. Remove hinges.

**CAUTION: Take care not to damage painted surface when removing and installing hinge-to-body attaching screws.**

## Installation

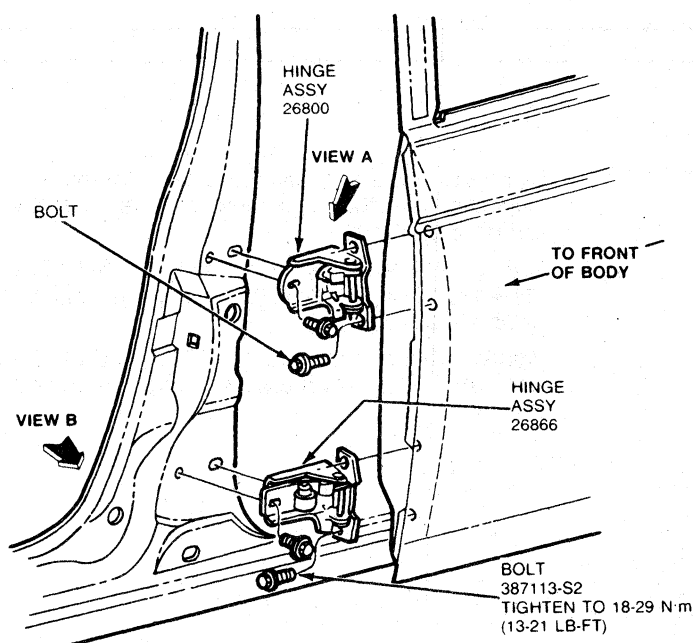
1. Install upper and lower hinge-to-body attaching bolts. Tighten to 18-29 N·m (13-21 lb-ft).
2. Install upper and lower hinge nuts and washers. Install sound absorbers.
3. Position door to hinges and install four washer head bolts attaching hinges to door. Tighten to 18-29 N·m (13-21 lb-ft).
4. **LH Door:** Install steering column opening cover. Refer to Section 45-61.
5. **RH Door:** Install glove compartment.



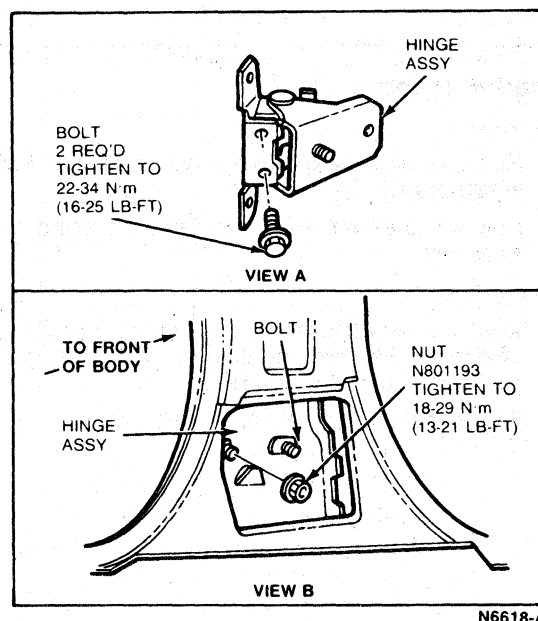


**REMOVAL AND INSTALLATION (Continued)****Door, Rear****Removal**

1. Remove scuff plate. Refer to Section 45-26.
2. Remove center pillar trim panel. Refer to Section 45-03.
3. Remove seat belt assembly. Refer to Section 41-50.
4. Open door and support it with Rotunda Bumper and Door Installer 047-00001 or equivalent.
5. Scribe hinge location to door.
6. Remove upper and lower hinge-to-door hinge attaching washer head bolts.
7. Remove upper and lower hinge-to-body attaching bolts.
8. Remove upper and lower hinge-to-body nut and washer assemblies. Remove hinges.

**Installation**

1. Install upper and lower hinge-to-body attaching bolts. Tighten to 18-29 N·m (13-21 lb-ft).
2. Install upper and lower hinge-to-body nuts and washers. Tighten to 18-29 N·m (13-21 lb-ft).
3. Position door to hinges and install upper and lower attaching washer head bolts. Tighten to 18-29 N·m (13-21 lb-ft).
4. Install seat belt assembly. Refer to Section 41-50.
5. Install center pillar trim panel. Refer to Section 45-03.
6. Install scuff plate. Refer to Section 45-26.



N6618-A

**Door Hinge Check**

NOTE: The front door hinge check can be serviced without removing the complete hinge assembly. Perform the following procedure:

**Removal**

1. Open front door with broken hinge check.
2. Remove exposed hinge-to-body attaching bolt and retain.
3. Insert a chisel, 267mm (10-1/2 inches) long with a 19mm (3/4-inch) cutting blade, between hinge half on body and back side of hinge

check. Hammer until chisel unseats rivet securing hinge check-to-body side hinge.

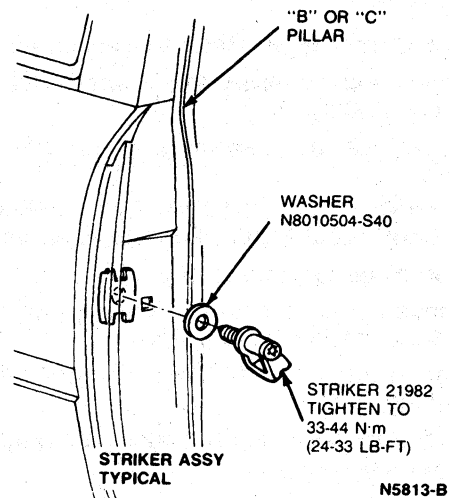
4. Remove broken hinge check and discard.

**Installation**

1. Loosely place new door check and elastomer reinforcement into body door hinge.
2. Install hinge-to-body attaching bolt to secure new hinge check and reinforcement-to-body side hinge. Tighten bolt to 18-29 N·m (13-21 lb-ft).

**REMOVAL AND INSTALLATION (Continued)****Door Striker****Removal and Installation**

1. Remove striker and washer using correct size bit from Torx Drive Bit Set D79P-2100-T or equivalent.
2. Install striker and washer.
3. Adjust striker as outlined.

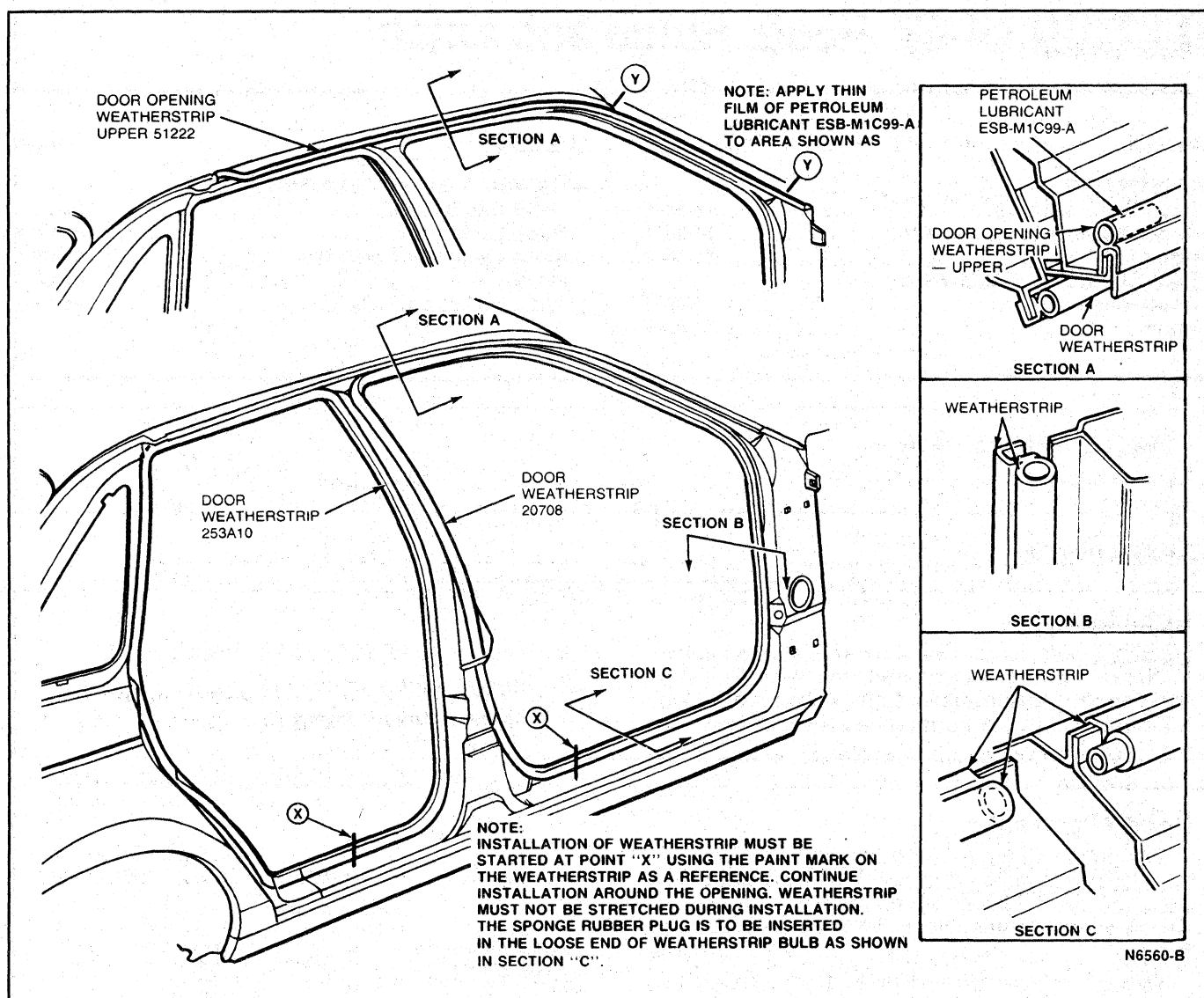
**Weatherstrips****Removal**

1. Remove interior garnish mouldings that cover weatherstrip.
2. Pull weatherstrip off weld flange around door opening.

**Installation**

1. Inspect weatherstrip mounting flange for distortion. Flatten any distortions by using vise grips or pair of hammers.
2. Begin installation at point X as shown.
3. Continue installing weatherstrip around door opening. Weatherstrip must not be stretched during installation.
4. Cut weatherstrip approximately 6.35-12.7mm (1/4-1/2 inch) longer than needed and butt ends together.
5. Apply Silicone Lubricant D7AZ-19553-A or equivalent to areas marked D. Wipe off excess.

## REMOVAL AND INSTALLATION (Continued)



## SPECIAL SERVICE TOOLS

Tool Number	Description
D79P-2100-T	Torx Drive Bit Set

CN5577-D

## ROTUNDA EQUIPMENT

Model	Description
047-00001	Bumper and Door Installer

CN6587-D

# SECTION 44-08 Hood, Hinge and Latch

SUBJECT	PAGE	SUBJECT	PAGE
<b>ADJUSTMENTS</b>		<b>REMOVAL AND INSTALLATION (Cont'd.)</b>	
Hood Alignment .....	44-08-1	Hood Gas Support .....	44-08-3
Hood Bumpers .....	44-08-1	Hood Latch .....	44-08-4
Hood Latch .....	44-08-2	Hood Latch Control Cable .....	44-08-2
<b>REMOVAL AND INSTALLATION</b>		Installation .....	44-08-4
Hood Hinge .....	44-08-3	<b>VEHICLE APPLICATION</b> .....	44-08-1
Hood .....	44-08-3		

## VEHICLE APPLICATION

Taurus/Sable.

## ADJUSTMENTS

### Hood Bumpers

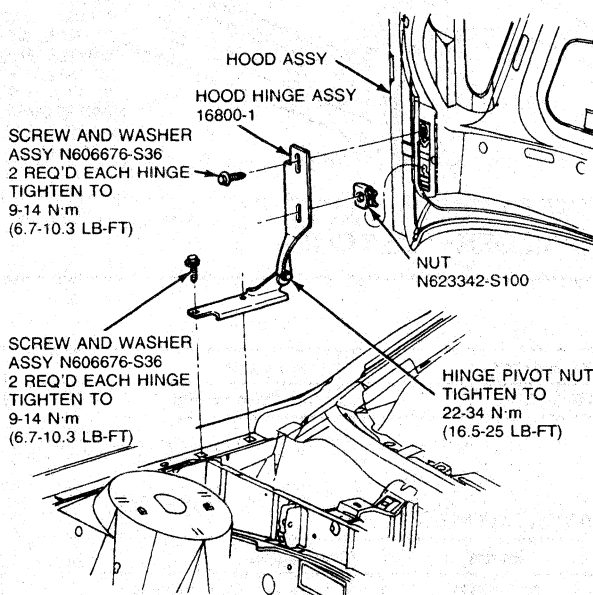
Hood bumpers, located on the top right and top left surfaces of the radiator support, can be adjusted up and down to provide a flush surface alignment of the hood panel with the front fenders as follows:

1. Loosen hood and hood bumper locknut.
2. Screw hood bumper in or out, as necessary.
3. Tighten bumper locknut.

### Hood Alignment

The hood can be adjusted fore-and-aft and side-to-side by loosening two hood-to-hinge attaching bolts at each hinge. Then, reposition hood as required and tighten the hood-to-hinge attaching bolts.

To raise or lower the rear of the hood, loosen the hood hinge pivot nut. The pivot can now move up or down. Raise or lower hood as necessary to obtain a flush condition at the rear of the hood with the fenders. Then, tighten the hood hinge pivot nut to 22-34 N·m (16.5-25 lb-ft).



N6596-B

## ADJUSTMENTS (Continued)

### Hood Latch

Before adjusting the hood latch mechanism, make certain that the hood is properly aligned. The hood latch can be moved from side-to-side to align with the opening in the hood inner panel.

Adjust latch up-and-down to obtain a flush fit with front fenders.

1. Loosen hood latch attaching bolts in radiator support until they are just loose enough to move latch from side-to-side.
2. Move latch from side-to-side to align it with opening in hood.

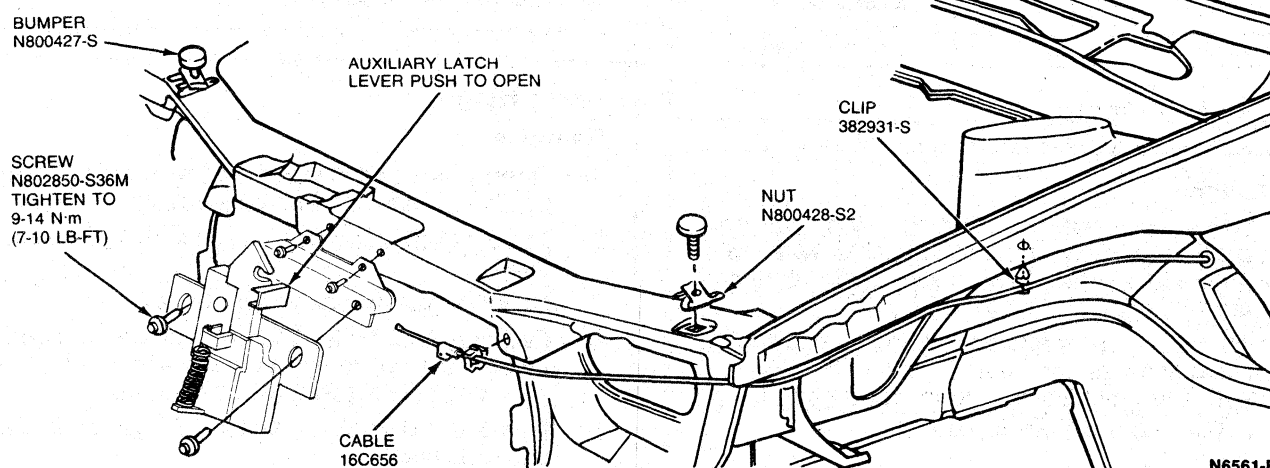
3. Loosen locknuts on two hood bumpers. Lower bumpers.
4. Move hood latch up or down as required to obtain flush fit between top of hood and fenders when upward pressure is applied to front of hood. Then, tighten hood latch attaching screws to 9-14 N·m (7-10 lb-ft).
5. Raise two hood bumpers to eliminate any looseness at front of hood when closed. Then, tighten hood bumper locknuts.
6. Open and close hood several times to check operation.

## REMOVAL AND INSTALLATION

### Hood Latch Control Cable

#### Removal

1. From inside vehicle, release hood.
2. Remove two bolts retaining latch to upper radiator support.

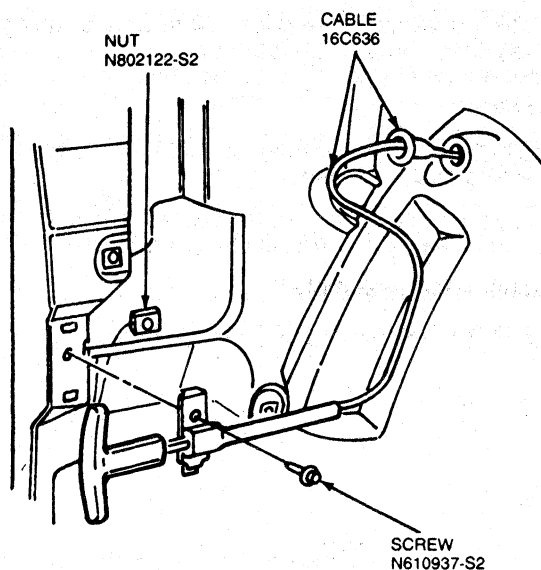


N6561-B

3. Remove screw retaining cable end retainer to latch assembly.
4. Disengage cable by rotating out of latch return spring.

## REMOVAL AND INSTALLATION (Continued)

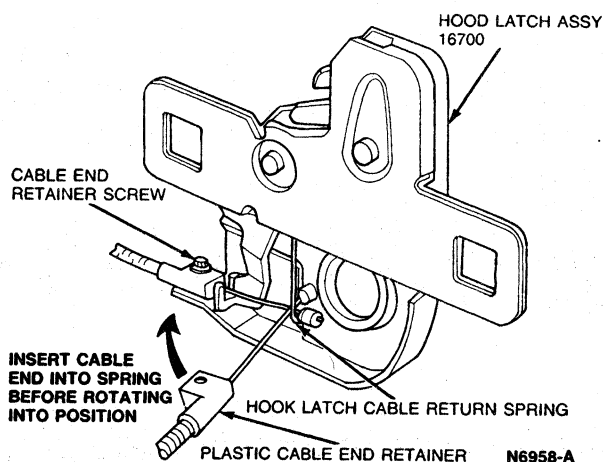
5. To facilitate installing cable, fasten a "fish line" about 2.5m (8 ft.) long to latch end of cable.
6. From inside vehicle, unseat sealing grommet from cowl side, remove cable mounting bracket attaching screws and carefully pull cable assembly out. **Do not** pull fish line out.



N6563-A

### Installation

1. Using previously installed fish line, pull new cable assembly through retaining wall, seat grommet securely, and install cable mounting bracket attaching screws.
2. Thread terminal end of cable into hood latch return spring.
3. Route cable through V-slot on latch and install cable end retaining screw.



N6958-A

4. Check hood latch cable release operation before closing hood. Adjust if necessary.

### Hood

#### Removal

1. Open hood and support in open position. Mark hood hinge locations on hood.
2. Protect body with covers to prevent damage to latch paint.
3. Disconnect gas cylinders from hood.
4. Remove two bolts attaching each hinge to hood, taking care not to let hood slip when bolts are removed.
5. Remove hood from vehicle.

#### Installation

1. Position hood-to-hood hinges. Install attaching bolts. Remove body covers.
2. Adjust hood for even fit between fenders and for flush fit with front of fenders.
3. Adjust hood for flush fit with top of cowl and fenders.
4. Adjust hood latch, if necessary.
5. Attach gas cylinders to hood.

### Hood Hinge

#### Removal

1. Open hood and support at the front in open position. Mark hood hinge locations on hood.
2. Protect body with covers to prevent damage to paint.
3. Remove gas cylinders from hood.
4. Remove two bolts attaching hinge to hood, taking care not to let hood slip when bolts are removed and support rear of hood.
5. Remove two bolts attaching hinge to body. Remove hinge.

#### Installation

1. Position hinge to body. Install two attaching bolts and tighten to 9-14 N·m (7-10 lb-ft).
2. Position hinge to hood. Install two attaching bolts and tighten to 10-13 N·m (7-10 lb-ft).
3. Engage gas lift cylinders.
4. Adjust hood as outlined.

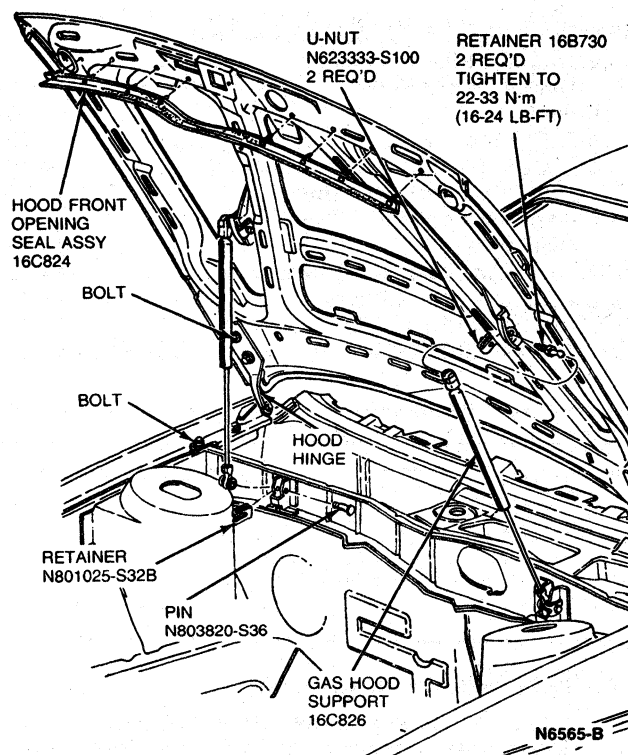
### Hood Gas Support

#### Removal

1. Open hood and temporarily support it.
2. Disengage gas support from retainer at top.
3. Remove retaining pin at bottom. Remove gas support.

**REMOVAL AND INSTALLATION (Continued)****Installation**

1. Position gas support. Install retaining pin at bottom.
2. Engage gas support to retainer at top.
3. Remove temporary support and close hood.

**Hood Latch****Removal**

Refer to the illustration under Hood Latch Control Cable Removal, Step 2.

1. Remove two bolts retaining latch assembly to upper radiator support.
2. Open hood and disengage cable and bushing away from hood latch assembly.

**Installation**

1. Position latch assembly to radiator support. Install attaching bolts.
2. Position hood latch control cable and bushing to latch assembly. Install retaining screw.
3. Adjust latch assembly.
4. Tighten bolts to 9-14 N·m (7-10 lb-ft).

# SECTION 44-10 Luggage, Glove Compartment Door, Hinge, Latch, Lock and Weatherstrip

SUBJECT	PAGE	SUBJECT	PAGE
<b>ADJUSTMENTS</b>		<b>REMOVAL AND INSTALLATION (Cont'd.)</b>	
Hinge, Liftgate .....	44-10-2	Latch and Striker, Liftgate .....	44-10-4
Latch, Liftgate .....	44-10-2	Striker Anchor Plate .....	44-10-4
Luggage Compartment Door .....	44-10-1	Liftgate .....	44-10-6
Striker, Liftgate Latch .....	44-10-2	Lock Cylinder .....	44-10-4
Torsion Bar, Deck Lid Hinge .....	44-10-1	Lock Cylinder, Glove Compartment .....	44-10-8
Torsion Bar Loading .....	44-10-2	Luggage Compartment Door .....	44-10-6
<b>LUBRICATION</b> .....	44-10-1	Luggage Compartment Door	
<b>REMOVAL AND INSTALLATION</b>		Weatherstrip .....	44-10-7
Hinge, Liftgate .....	44-10-5	Remote Rear Door Release .....	44-10-5
Latch, Glove Compartment .....	44-10-9	Support Cylinder, Liftgate .....	44-10-3
Latch and Lock, Luggage Compartment		<b>SPECIAL SERVICE TOOLS</b> .....	44-10-9
Door .....	44-10-3	<b>VEHICLE APPLICATION</b> .....	44-10-1

## VEHICLE APPLICATION

Taurus/Sable.

## LUBRICATION

Apply Polyethylene Grease D7AZ-19584-A or equivalent to all areas shown in the illustrations.

## ADJUSTMENTS

When performing the following adjustment procedures, refer to the appropriate illustration under Removal and Installation for component location and assembly.

### Luggage Compartment Door

#### Sedan

The luggage compartment door can be shifted fore and aft and from side to side on all models.

The luggage compartment door should be adjusted for an even and parallel fit with the door opening. The door should also be adjusted up and down for a flush fit with the surrounding panels. Care should be taken not to damage the luggage compartment door or surrounding body panel.

Fore-and-aft and up-and-down adjustment of the decklid is achieved by loosening the hinge-to-deck lid attaching screws, shifting the deck lid to the proper fit and tightening the attaching screws to 5-7 N·m (7-10 lb-ft).

### Torsion Bar, Deck Lid Hinge

1. Open the luggage compartment door and note the pop-up distance of the door. The door should have adequate finger clearance.
2. If the door does not have adequate finger clearance, the torsion bar tension should be increased.
3. If the door pops open with more force than is desired, the torsion bar tension can be decreased.

**WARNING: USE CARE WHEN ADJUSTING THE TORSION BAR AS IT IS UNDER TENSION AND COULD SPRING OUT OF CONTROL IF NOT HANDLED PROPERLY.**

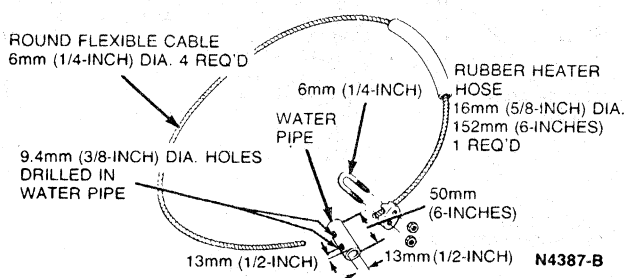
4. Support the door in the full open position before adjusting the torsion bar.
5. To adjust a torsion bar, use a suitable tool designed to safely perform the adjustment shown under Torsion Bar Loading. Move the torsion bar end to another position (notch) to increase or decrease the tension.
6. Adjust one torsion bar and check the adjustment before adjusting the other torsion bar.
7. After torsion bar adjustment, the difference of the position of the torsion bar ends, between the RH and LH side, must not be more than one slot.



## ADJUSTMENTS (Continued)

**Torsion Bar Loading****Sedan**

1. Locally obtain the following materials:
  - a. Round flexible cable; 6mm (1/4-inch) diameter by 1220mm (4 feet) long.
  - b. One 6mm (1/4-inch) cable clamp.
  - c. Water pipe: 13mm (1/2-inch) diameter by 50mm (2-inches) long.
  - d. Rubber Heater Hose: 16mm (5/8-inch) diameter by 152mm (6-inches) long.
2. Assemble materials above as shown.



**WARNING: SAFETY GLASSES MUST BE WORN WHEN PERFORMING THIS OPERATION.**

3. Install the torsion bar by inserting one end into the hole provided in the luggage compartment door hinge and nest the other end into the upper groove of the opposite hinge support.
4. Position the handmade tool on the end of the torsion bar to be loaded.
5. With the help of a second person, place a long flat-blade screwdriver over the top of the torsion bar to be loaded.
6. While pulling on the torsion bar (toward you) with the tool, with the second person holding the screwdriver, guide the torsion bar down along the rear edge of the support into the lower groove of the hinge support so the torsion bar can be locked in the lowest outboard adjustment notch.
7. Using the handmade tool, install the tool on the end of the torsion bar (if not already installed) and unlock the bar by pulling towards you with the tool and work the torsion bar up the hinge support to the second notch and release. If further adjustment is required, proceed to Step 8.
8. Using a 3/8-inch drive, 1/2-inch deep-well socket and 6-inch extension, position the socket over the end of the torsion bar and lift to unlock the bar. Reposition the torsion bar up the hinge support to the top notch and release.

**Hinge, Liftgate**

On wagon models, the liftgate can be adjusted up-and-down and side-to-side by loosening the header roof frame attaching screw and washer assembly. The liftgate can be adjusted in and out by shimming the hinges at the header roof frame.

The liftgate should be adjusted for an even parallel fit with liftgate opening and surrounding panels.

To adjust a hinge or hinges remove the weatherstrip and pull down headliner to gain access to the hinge attachment(s). Adjust the hinge(s) as necessary. Seal the hinge to body with Ford Clear Silicone Rubber Sealer D6AZ-19562-A or equivalent. Install headliner back into position and install weatherstrip.

**Striker, Liftgate Latch**

Before adjusting the striker, open and close the liftgate to double-check the striker alignment.

**NOTE:** Do not try to correct a poor liftgate alignment with a latch striker adjustment.

Loosen striker with correct bit from Torx Drive Bit Set D79P-2100-T or equivalent. Move striker fore or aft, or from side-to-side as necessary. Tighten striker to 27-36 N·m (20-28 lb-ft).

**Latch, Liftgate**

The wagon liftgate latch has double-bolt construction, designed to be equivalent in function and load capacity to side door latches. The latch is non-adjustable. All movement for adjustment is accomplished in the striker which has a 5.5mm (7/32-inch) radial range. This latch system has a two-position latching system. The closing latch cycle consists of a secondary position which latches the liftgate but does not seal the door to the liftgate weatherstrip. The primary position holds the liftgate door firmly into the weatherstrip. Water leaks and rattles may occur because the liftgate appears closed. However, it may only be closed to the secondary (first) position. Be sure that positive primary engagement of the liftgate latch is achieved upon closing. To check it, use the following procedure:

**Latch Function Test**

1. Close the liftgate to an assumed primary condition.
2. Insert key into key cylinder. Place left hand on liftgate glass above and left of key cylinder. Press firmly on glass with left hand and slowly turn the key until latch is released. Return key and release left hand pressure. The liftgate should be in secondary position.

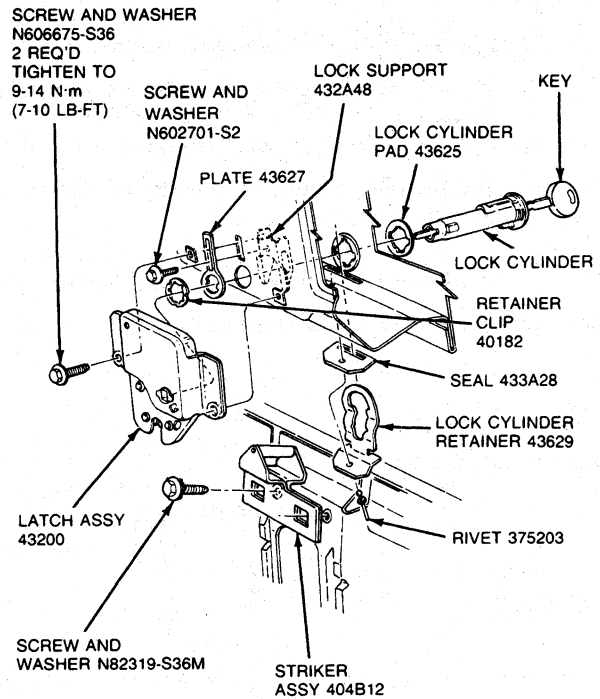
This test will assure that the latch function is OK in both primary and secondary positions.

3. If performing the above test shows that the liftgate will not close to primary position, adjust the striker rearward (to rear of vehicle) so that positive primary engagement is obtained upon closing liftgate.

## REMOVAL AND INSTALLATION

**Latch and Lock, Luggage Compartment Door****Sedan****Removal and Installation**

1. Open the luggage compartment door.
2. Remove the latch attaching screws. Disconnect the electric latch wire, if so equipped, and remove the latch.
3. Remove the support.
4. Remove the bracket.
5. Remove the retainer.
6. Remove the lock cylinder and the extension.
7. Reverse Steps 1 through 6 for installation.
8. Connect the electric latch wire, if so equipped. Position the latch to the luggage compartment door. Install the attaching screws and tighten to 9-14 N·m (7-10 lb-ft).
9. Adjust the latch as outlined under Adjustments.



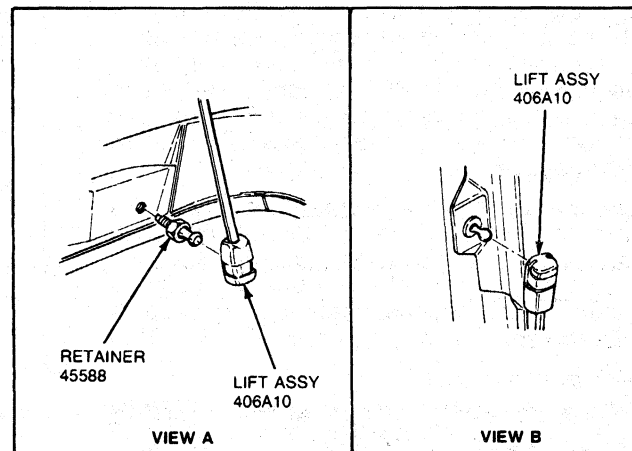
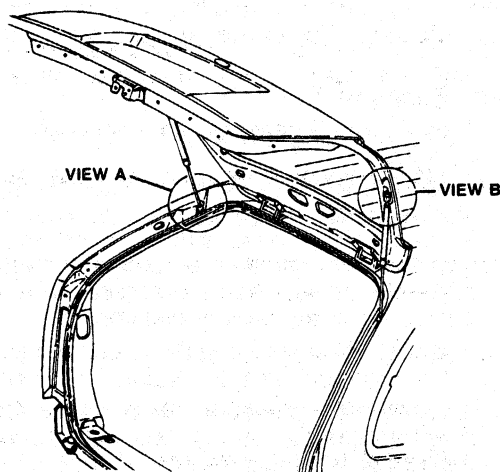
N6626-A

**Support Cylinder, Liftgate****Removal**

1. Open the liftgate and temporarily support it.
2. The lift cylinder end fitting is a spring-clip design and removal is accomplished by sliding a small screwdriver under it and prying up to remove from the ball stud.
3. Remove the support cylinder.

**Installation**

1. Install each cylinder to C-pillar and liftgate bracket ball socket by pushing the cylinder's locking wedge onto the socket.
2. Close liftgate. Check support cylinder operation.



N6628-A

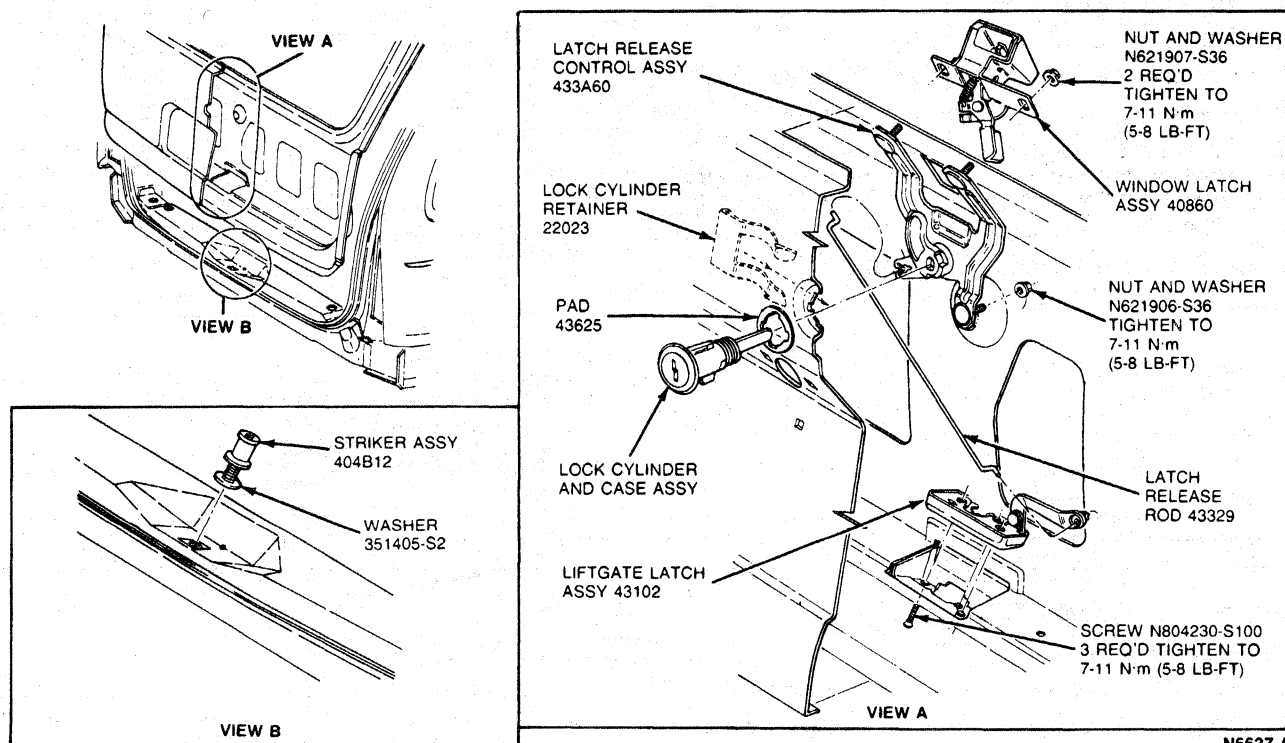
**REMOVAL AND INSTALLATION (Continued)****Latch and Striker, Liftgate****Removal**

1. Remove the liftgate interior trim panel. Refer to Section 45-03.
2. Remove latch rod from control assembly lever by pulling the rod towards LH side of liftgate with moderately heavy force.
3. Remove three screws attaching the latch assembly to liftgate.

4. Disengage lock cylinder rod at latch lever.
5. Remove the latch assembly from the liftgate.

**Installation**

To install, reverse the Removal procedure. Tighten the three liftgate latch attaching screws to 7-11 N·m (5-8 lb-ft).

**Striker Anchor Plate****Removal and Installation**

1. Remove striker assembly as outlined.
2. Locate the drill dimple in the outside lower back panel just below the striker. Using a 42mm (1 5/8-inch) hole saw, drill an access hole using the drill dimple as a center locator.
3. Remove anchor plate and replace with a new one.

NOTE: An M10 x 1.5 nut and washer assembly can be used if a new striker plate is not available.

4. Install and adjust striker as outlined.
5. Seal access hole with plug or body tape.

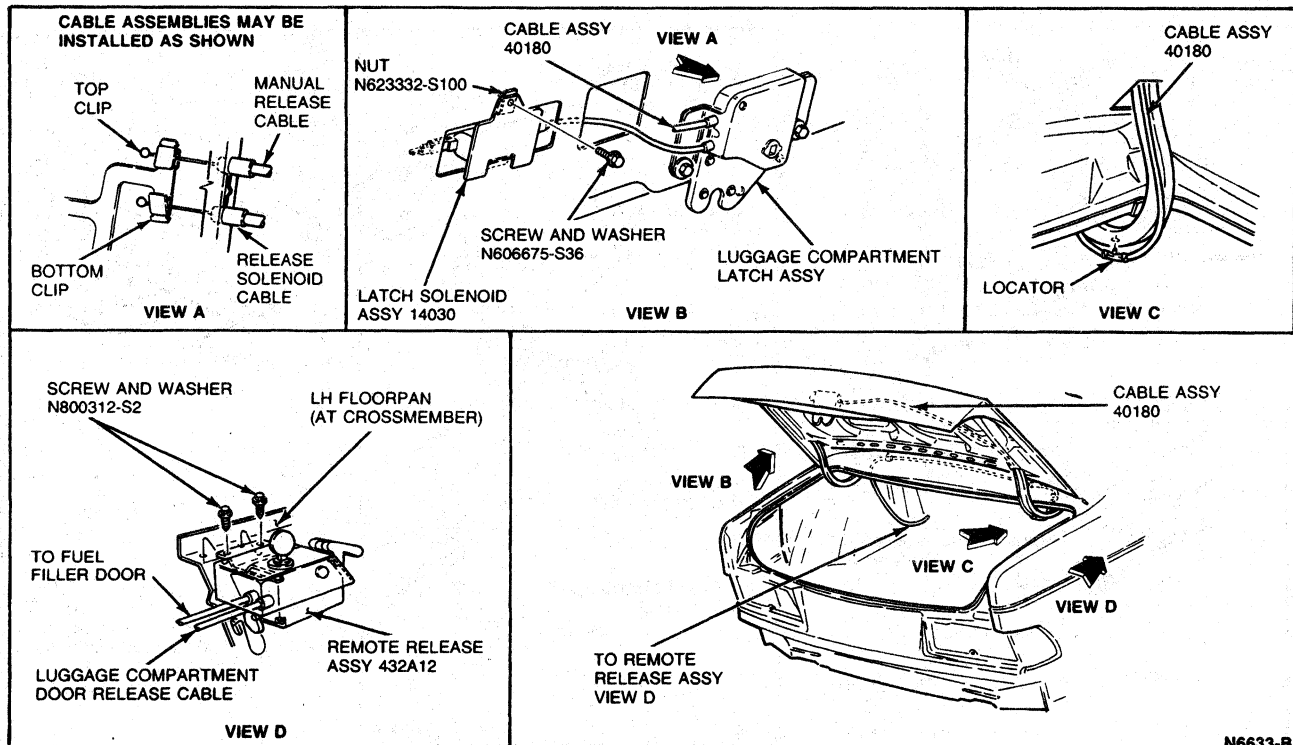
**Lock Cylinder****Removal and Installation**

Refer to the illustration under Latch and Striker, Liftgate Removal and Installation.

1. Remove the liftgate latch assembly as outlined.
2. Remove the retainer away from the lock cylinder (with the lock-to-latch rod still attached) from the liftgate.
3. To install, reverse Steps 1 and 2.

**REMOVAL AND INSTALLATION (Continued)****Remote Rear Door Release****Removal and Installation**

1. From inside luggage compartment, disengage retaining remote release cables to latch assembly.
2. Disconnect fasteners retaining cables to hinge and body.
3. Remove scuff plate/body center pillar trim panel. Refer to Section 45-03.
4. Pull floor covering back to expose two remote release retaining screws. Remove screws and remote release assembly.
5. To install, reverse Steps 1 through 4.



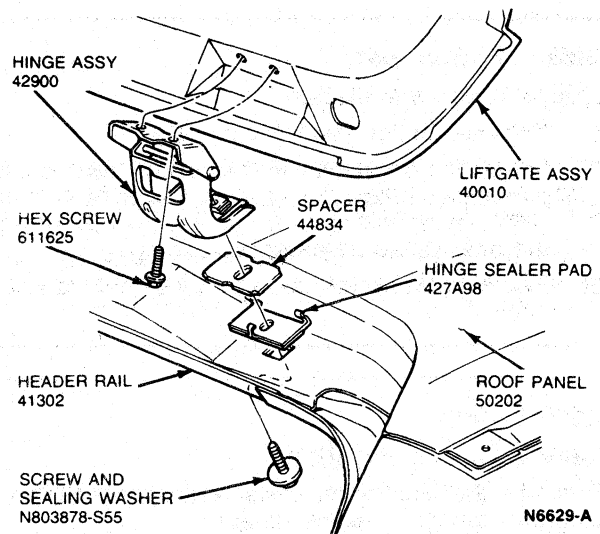
N6633-B

**Hinge, Liftgate****Removal**

1. Open hatchback assembly.
2. Remove weatherstrip along top of liftgate opening and remove headlining covering attaching screw.
3. Support liftgate in an open position and remove support cylinder as outlined.
4. Remove hinge-to-roof frame attaching screw and washer assembly.
5. Remove hinge-to-liftgate attaching bolts, and remove hinge assembly from liftgate.

**Installation**

1. To install, reverse the Removal procedure. Seal the hinge to body with Ford Clear Silicone Rubber Sealer D6AZ-19562-A or equivalent.
2. Tighten the hinge-to-roof frame screw and washer assembly to 17-27 N·m (12.5-20 lb-ft).
3. Tighten the hinge-to-liftgate bolts to 7-11 N·m (5-8 lb-ft).



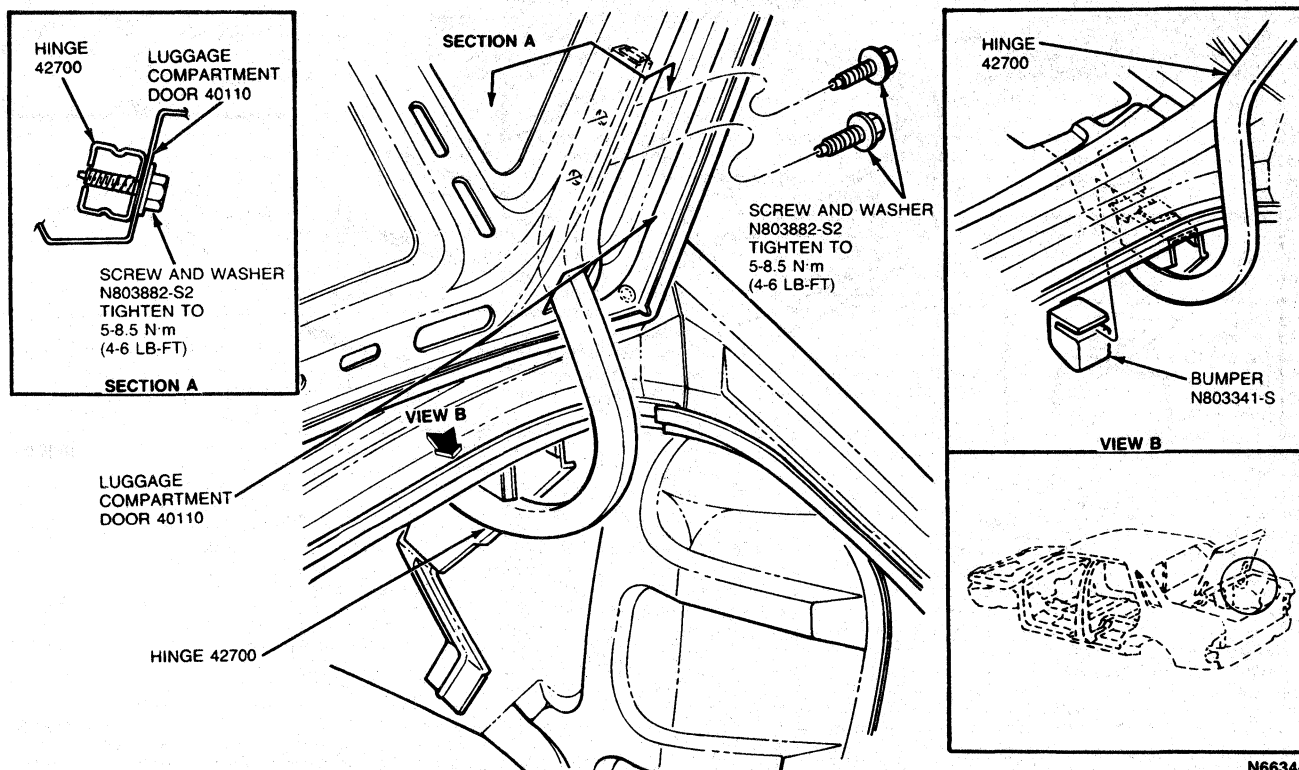
N6629-A

**REMOVAL AND INSTALLATION (Continued)****Luggage Compartment Door****Removal and Installation**

1. Remove four hinge-to-deck lid screws and remove deck lid.

NOTE: Removal of the deck lid is a two-person operation.

2. To install, position deck lid to hinges and install four hinge-to-deck lid retaining screws.
3. Adjust for fit as outlined.

**Liftgate****Removal and Installation**

Before removing hinge-to-roof frame attachments at both hinges, scribe the location of each hinge on roof frame.

Remove hinge-to-roof frame screw and washer assembly at each hinge as outlined. Remove liftgate from vehicle.

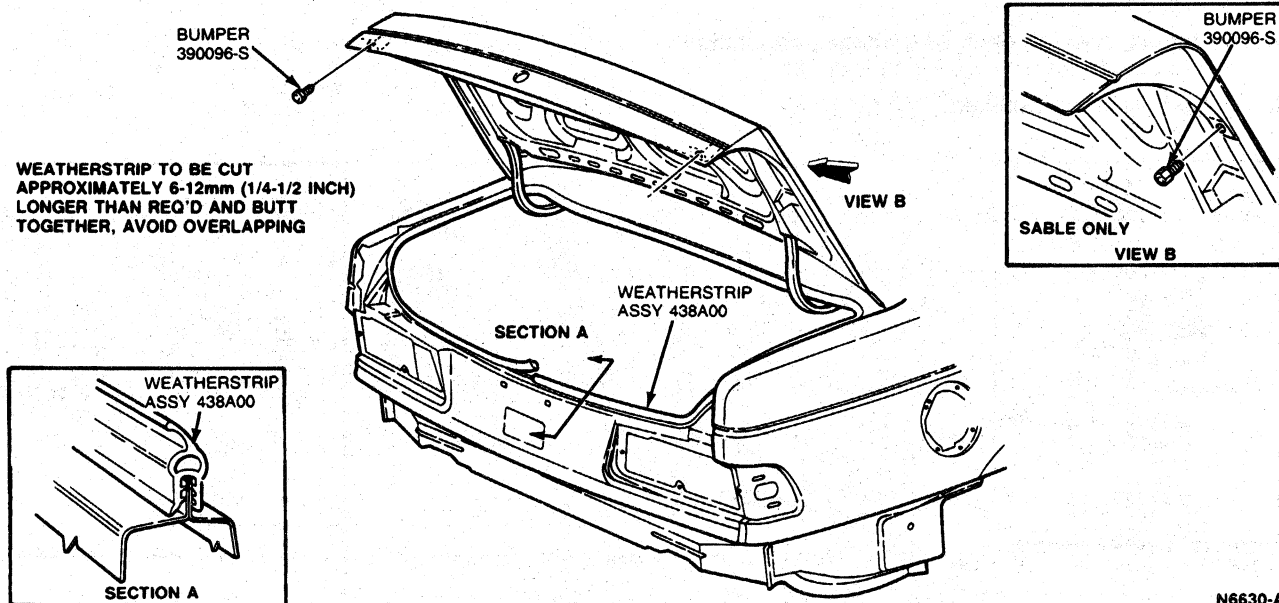
To install, position hinges to scribe marks on roof frame and reverse the removal procedure. Tighten hinge-to-roof frame screw and washer assemblies to specification.

NOTE: Liftgate removal and installation is a two-man operation.

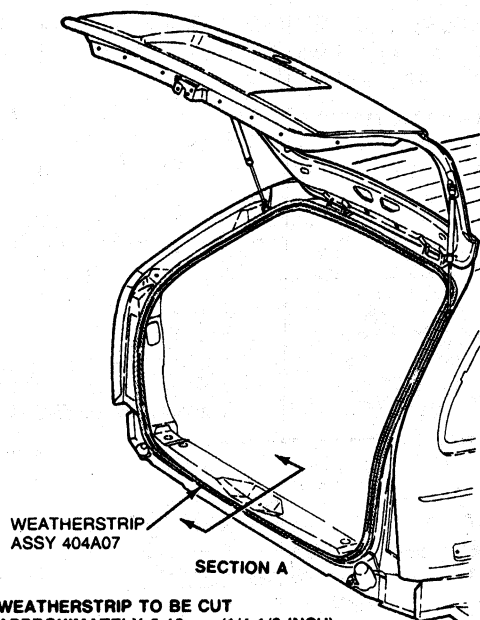
## REMOVAL AND INSTALLATION (Continued)

**Luggage Compartment Door Weatherstrip**

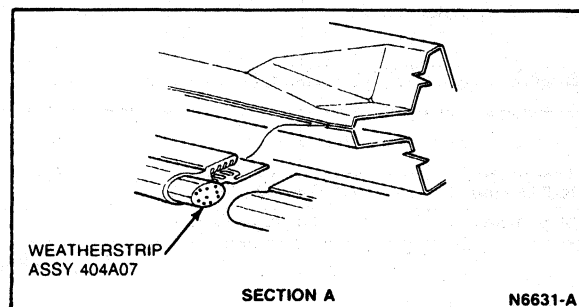
Weatherstrips are mechanically retained. No adhesive is required for retention.

**Sedan**

N6630-A

**REMOVAL AND INSTALLATION (Continued)****Wagon**

WEATHERSTRIP TO BE CUT  
APPROXIMATELY 6-12mm (1/4-1/2 INCH)  
LONGER THAN REQ'D AND BUTT  
TOGETHER, AVOID OVERLAPPING

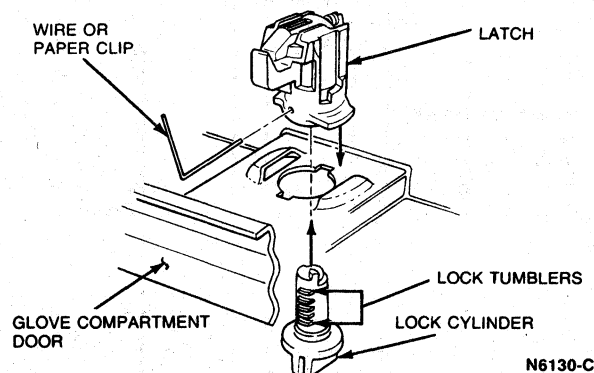
**Lock Cylinder, Glove Compartment****Taurus****Removal**

1. Insert key into lock cylinder.
2. Insert a wire or bent paper clip into the small hole in the latch. Push the wire or clip to depress the lock tab and release the lock cylinder and key.
3. Remove lock cylinder.

NOTE: If the compartment key is not available, press each lock tumbler lightly while gradually pulling lock cylinder out. Do not press tumblers too far, or cylinder cannot be removed.

**Installation**

1. Position lock cylinder with tumblers up.
2. Push lock cylinder all the way into latch.

**Sable****Removal**

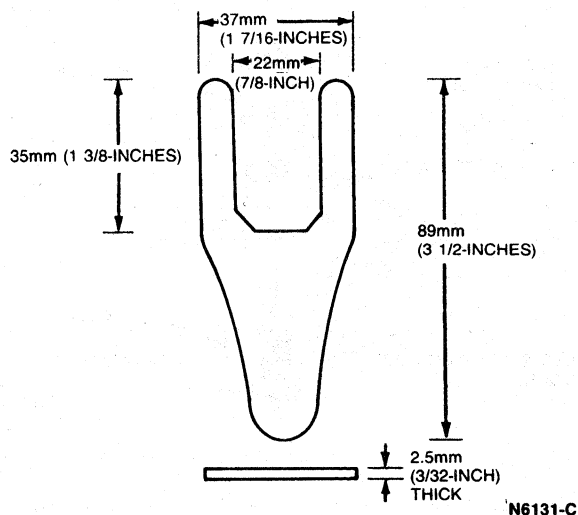
1. Insert key in cylinder and rotate cylinder approximately 45 degrees from the UNLOCK position.  
NOTE: If key is not available, use a small screwdriver to depress lock tumblers from rear and rotate cylinder.
2. Apply pressure to outside of key cylinder and pry two retaining fingers away from cylinder to release.
3. After releasing retaining fingers, pull cylinder outward approximately 10mm (3/8-inch). Rotate cylinder to UNLOCK position and remove key.
4. Remove cylinder from latch assembly.

**Installation**

1. Position cylinder into latch assembly rotated approximately 45 degrees from UNLOCK position.
2. Push cylinder in all the way until retaining fingers snap into place.
3. Rotate cylinder to UNLOCK position.

**REMOVAL AND INSTALLATION (Continued)****Latch, Glove Compartment****Taurus****Removal**

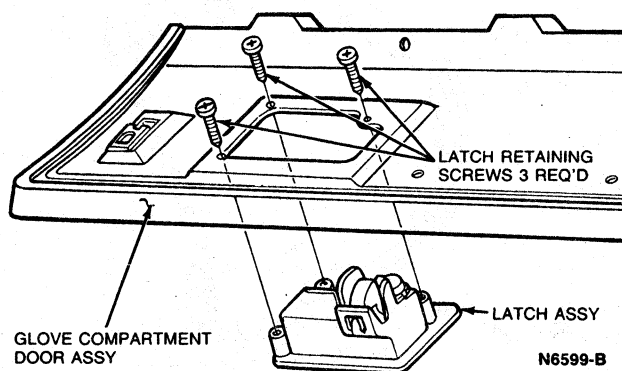
1. Fabricate tool shown.



2. Remove the lock cylinder as outlined.
3. Install fabricated tool in latch channels to depress plastic tabs on each side. Rotate latch tool clockwise to disengage latch from retainer slots and remove.

**Sable****Removal and Installation**

1. Remove three screws retaining latch and lock cylinder assembly to glove compartment door and remove assembly.
2. To install, reverse Step 1.

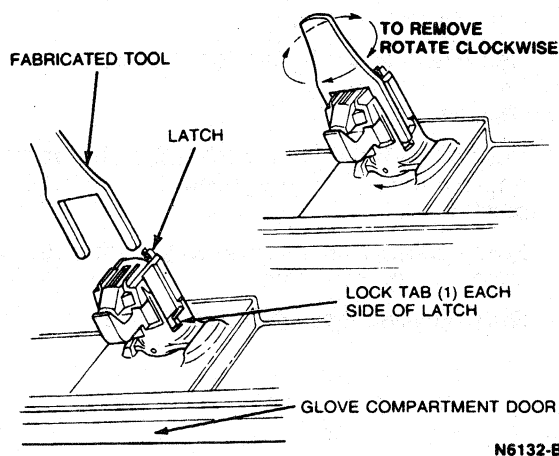
**SPECIAL SERVICE TOOLS**

Tool Number	Description
D79P-2100-T	Torx Drive Bit Set

CN6120-A

**Installation**

1. Insert the latch into the two key slots of the door retainer hole.
2. Turn latch counterclockwise so that striker is on top. A click will be heard when the latch is properly set in the retainer slots.

**CAUTION: Do not over rotate.**



# SECTION 44-16 Door Locks and Latches— Power and Mechanical

SUBJECT	PAGE	SUBJECT	PAGE
DESCRIPTION AND OPERATION		REMOVAL AND INSTALLATION (Cont'd.)	
Child Safety Lock .....	44-16-2	Door Lock Control Switch .....	44-16-6
DIAGNOSIS .....	44-16-7	Door Lock Cylinder .....	44-16-5
REMOVAL AND INSTALLATION		Door Outside Handle .....	44-16-5
Door Latch .....	44-16-2	TESTING	
Door Latch Bellcrank, Rear .....	44-16-5	Motor .....	44-16-6
Door Latch Remote Control—Front or		Switch .....	44-16-6
Rear .....	44-16-5	VEHICLE APPLICATION .....	44-16-1
Door Lock Actuator Motor, Power Locks ....	44-16-6		

## VEHICLE APPLICATION

Taurus/Sable.

## DESCRIPTION AND OPERATION

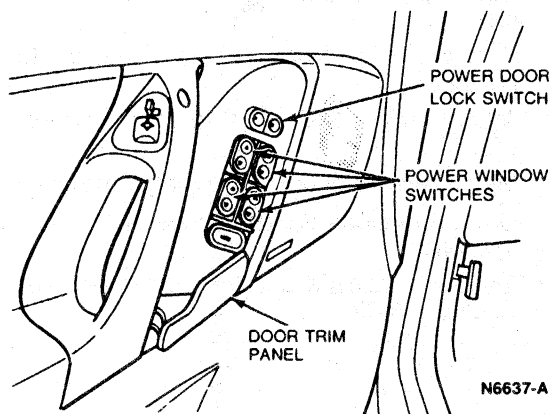
The power door lock control system uses electric switches mounted on the front door trim panels.

To lock doors, push down on the raised portion of the rocker switch (marked "L").

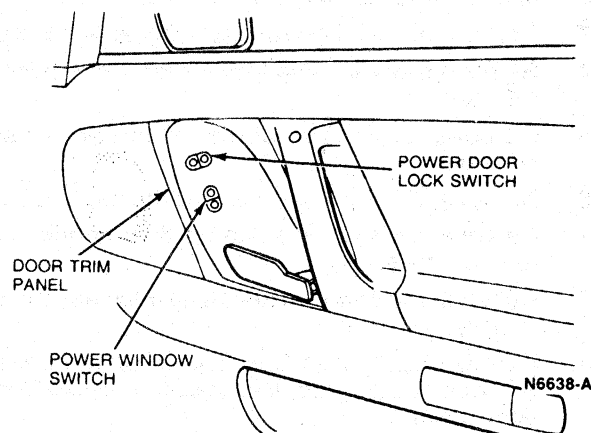
To unlock the doors, push the depressed portion of the rocker switch (marked "U").

The key lock will not lock or unlock all doors from outside the vehicle. The key inserted into the door lock can only be used to lock or unlock that individual door.

### Driver's Door

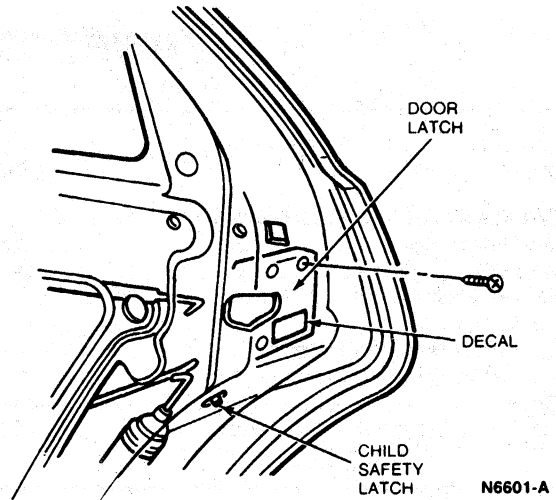


### Passenger's Door



**DESCRIPTION AND OPERATION (Continued)****Child Safety Lock**

The child safety lock, when activated, prevents the rear door from being opened from inside the vehicle regardless of the position of the door lock knob. The child safety lock has been designed into the door latch bellcrank levers and a decal has been located on the rear door lock face to indicate the location of the lever which is manually moved up to lock and down to unlock the system. Once the system is put into the locked position and the door is closed, the door can only be opened from outside the vehicle. The child safety lock does not lock the door from the outside; it is still necessary to push the door lock knob down to lock the door from outside.

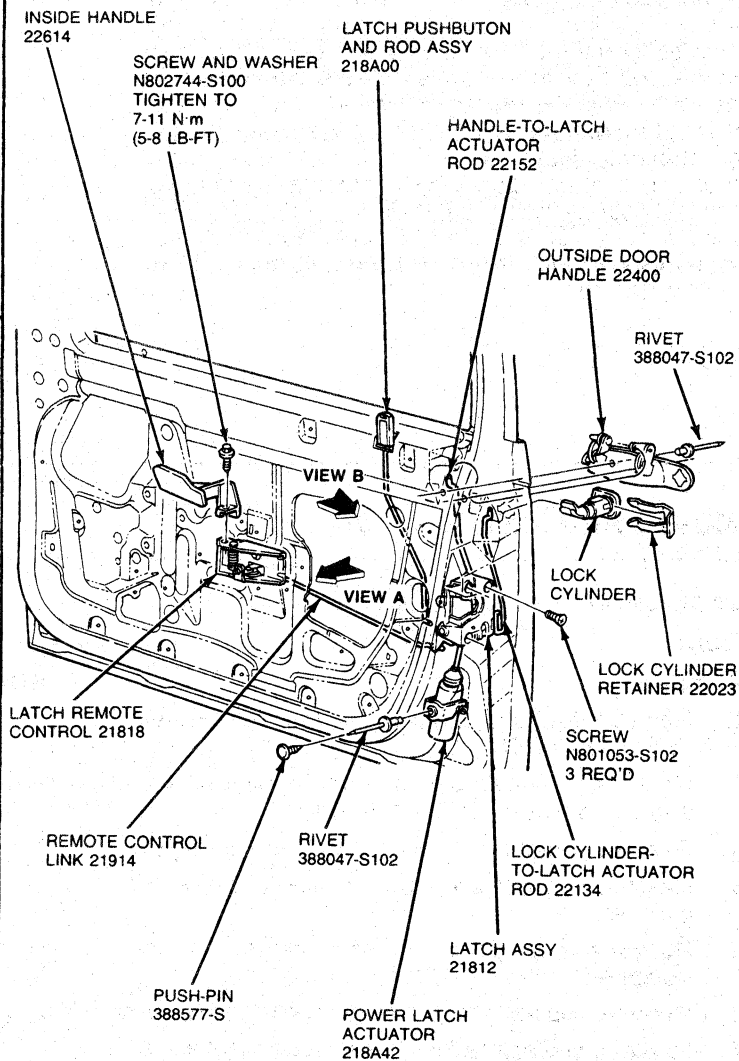
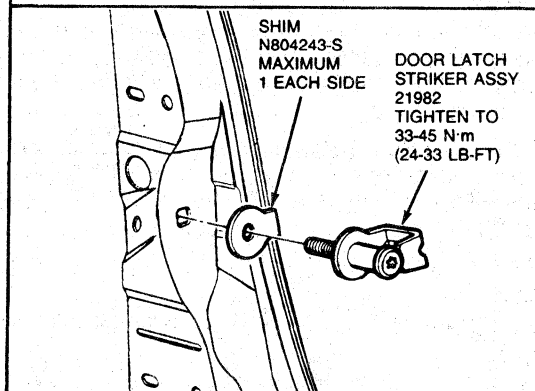
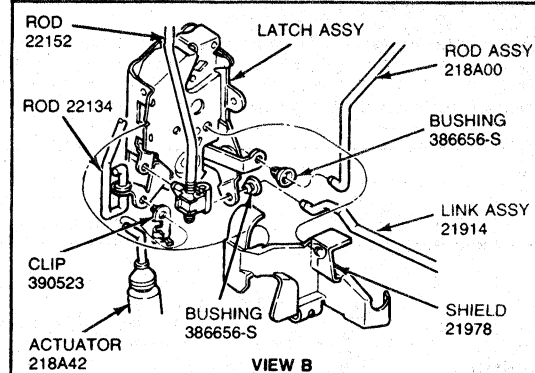
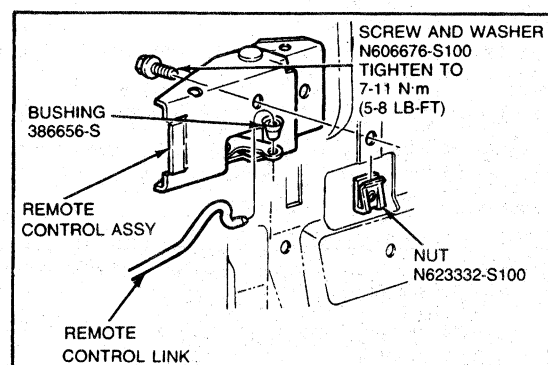
**REMOVAL AND INSTALLATION****Door Latch****Front****Removal**

1. Remove door trim panel and watershield. Refer to Section 45-03.
2. Check all connections of remote control link and rod and service if necessary.
3. Remove remote control assembly and link clip.
4. Remove clip attaching lock cylinder rod to lock cylinder.
5. Remove clip from actuator motor, if so equipped.
6. Remove clip attaching push-button rod to latch.
7. Remove clip attaching outside door handle rod to latch assembly.
8. Remove three screws attaching latch assembly to door.
9. Remove latch assembly (with remote control link lock cylinder rod) and anti-theft shield from door cavity.

**Installation**

1. Install new bushings and clips onto new latch assembly. Install anti-theft shield, remote control link and lock cylinder rod onto latch assembly levers.
2. Position latch (with link and rod) onto door cavity, aligning screw holes in latch and door. Install three screws and tighten to 4-8 N·m (3-6 lb-ft).
3. Attach outside door handle rod to latch with a clip.
4. Attach push-button rod to latch assembly with clip.
5. Remove clip from actuator motor (if so equipped).
6. Attach lock cylinder rod to lock cylinder with clip.
7. Install remote control assembly (and link clip).
8. Open and close door to check latch assembly operation.
9. Install watershield and door trim panel. Refer to Section 45-03.

## REMOVAL AND INSTALLATION (Continued)



N6635-B

## REMOVAL AND INSTALLATION (Continued)

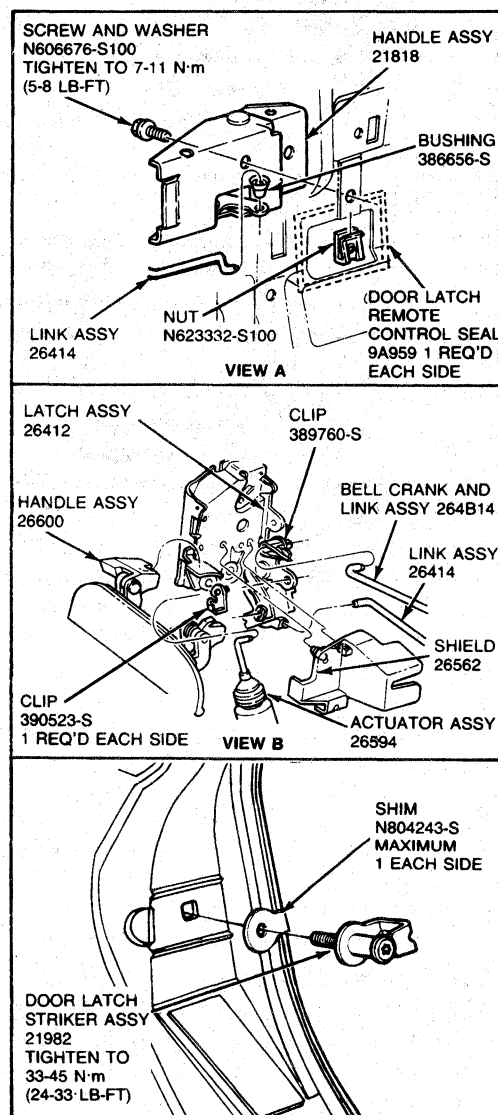
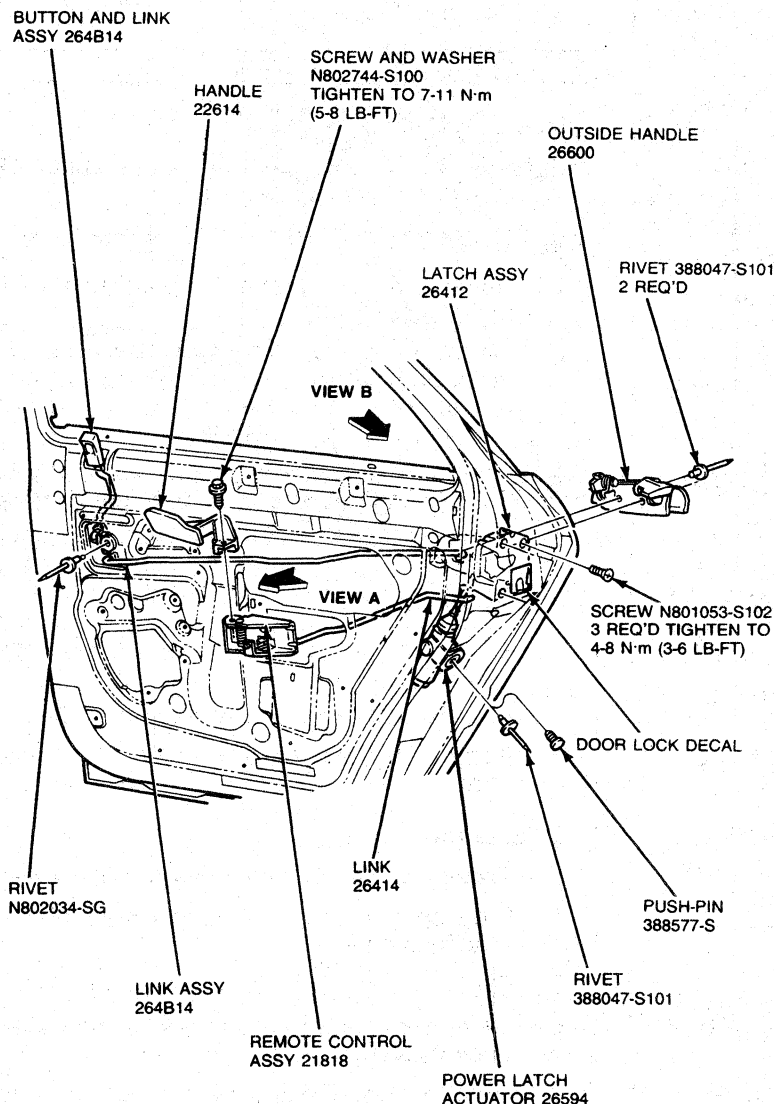
## Rear

## Removal

1. Remove door trim panel and watershield. Refer to Section 45-03.
2. Remove door latch shield from latch and check all connections of remote control links and rods. Service as necessary.
3. Remove remote control assembly (with link retaining clip).
4. Remove clip attaching rod from door latch bracket assembly from latch assembly.
5. Remove clip from actuator motor (if so equipped).

## Installation

1. Install new bushings and clip onto latch assembly.
2. Install clip on actuator motor (if so equipped).
3. Install remote control slide links onto latch assembly. Install latch with links into door cavity.
4. Position latch assembly to door, aligning screw holes in latch and door. Install three screws. Tighten to 4-8 N·m (3-6 lb-ft).
5. Install door latch shield.
6. Install bellcrank to inner door panel. Install bellcrank attaching rivet.
7. Open and close door to check latch component operation.
8. Install watershield and door trim panel. Refer to Section 45-03.



**REMOVAL AND INSTALLATION (Continued)****Door Latch Bellcrank, Rear**

Refer to the illustration under Rear Door Latch Removal and Installation.

**Removal**

1. Remove trim panel and watershield from door. Refer to Section 45-03.
2. Remove rivet attaching bellcrank to door inner panel. Disconnect bellcrank from lock control link by unclipping retainer or rotating it off the double 90 degree bend.
3. Remove push-button rod from bellcrank.

**Installation**

1. If bellcrank is to be replaced, install new rod retaining clips or bushings in new bellcrank.
2. Assemble push-button rod to bellcrank.
3. Assemble bellcrank to the lock control link by clipping retainer or rotating the bellcrank onto the link.
4. Position bellcrank to the door inner panel with the push-button rod inserted through the hole at the belt line. Then, install the bellcrank attaching rivet.
5. Check operation of bellcrank and associated linkage.
6. Install watershield and trim panel on door. Refer to Section 45-03.

**Door Latch Remote Control—Front or Rear**

Refer to the appropriate illustration under Door Latch Removal and Installation

**Removal**

1. Remove door trim panel and watershield. Refer to Section 45-03.
2. Remove screw retaining remote control to door inner panel.
3. Disengage remote control link from assembly and remove from door.

**Installation**

1. Position remote control on rod and push assembly into door panel.
2. Secure remote control with attaching screw.
3. Check remote control and latch operation.
4. Install watershield and door trim panel. Refer to Section 45-03.

**Door Lock Cylinder**

When a lock cylinder must be replaced, replace both in a set to avoid carrying an extra key which fits only one lock.

Refer to the illustration under Door Latch, Front, Removal and Installation.

**Removal**

1. Remove door trim panel and watershield. Refer to Section 45-03.
2. Remove clip attaching lock cylinder rod to lock cylinder.
3. Pry lock cylinder retainer out of slot in door.
4. Remove lock cylinder from door.

**Installation**

1. Work lock cylinder assembly into outer door panel.
2. Install cylinder retainer into its slot and push retainer onto lock cylinder.
3. Install lock cylinder retainer into its slot and push retainer onto lock cylinder.
4. Lock and unlock door to check lock cylinder operation.
5. Install watershield and door trim panel. Refer to Section 45-03.

**Door Outside Handle**

Refer to the appropriate illustration under Door Latch Removal and Installation.

**Removal**

1. Remove door trim panel and watershield. Refer to Section 45-03.
2. On front doors, remove attaching control rod (front outside door handle) to latch assembly. On rear door there are no rods to disconnect. The handle is direct drive.
3. Tape or otherwise protect area of door around door handle opening to prevent paint damage.
4. Using a piece of wood, prop open door handle.
5. Remove both rivets attaching outside door handle to door.
  - a. Use a drift punch to knock out center pin in each rivet.
  - b. Drill out remainder of each rivet.
6. Remove prop, and pull handle out of hole in door.

**Installation**

1. Install outside door handle into hole in door.
2. Prop open door handle and install two rivets attaching handle to door.
3. On front doors, clip control rod to latch lever.
4. Open and close door to check door handle and latch operation.
5. Install watershield and door trim panel. Refer to Section 45-03.

## REMOVAL AND INSTALLATION (Continued)

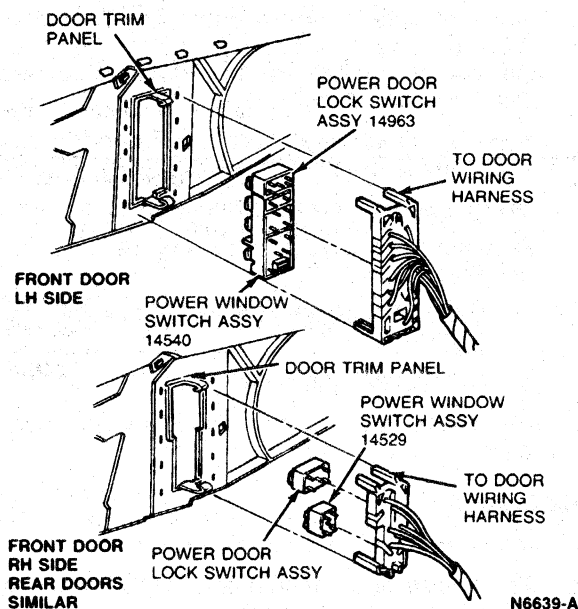
## Door Lock Control Switch

## Removal

1. Remove upper door pull handle retaining screw and remove pull handle by pulling top out and handle up. Refer to Section 45-03.
2. Remove two switch plate retaining screws.
3. Using a flat-blade screwdriver, carefully pry switch plate away from door panel.
4. Rotate switch plate and remove wiring connector by carefully spreading two retaining legs.

## Installation

1. Position switch to connector and firmly press switch into connector.  
NOTE: All the switches are keyed and can only be installed one way.
2. Position switch and connector assembly to switch plate and snap into place.
3. Install switch plate to door trim panel by inserting three studs into retaining clips, pressing firmly and installing two retaining screws.
4. Install door pull handle by inserting two studs into armrest opening and installing upper retaining screw. Refer to Section 45-03.



## Door Lock Actuator Motor, Power Locks

Refer to the appropriate illustration under Door Latch Removal and Installation.

## Removal

1. Remove door trim panel and watershields. Refer to Section 45-03.
2. Using a Letter 'X', and .250-inch diameter drill, remove pop-rievet attaching actuator motor to door. Disconnect wiring at connector.
3. Disconnect the actuator motor link from door latch and remove motor.

## Installation

1. Connect the actuator motor link to the door latch.
2. Connect wiring at connectors.
3. Install door lock actuator motor to door with pop-rievet.

**CAUTION: Make sure that the actuator boot is not twisted during installation. Pop-rievet must be installed with bracket base tight to the inner panel.**

4. Install watershed and door trim panel. Refer to Section 45-03.

## TESTING

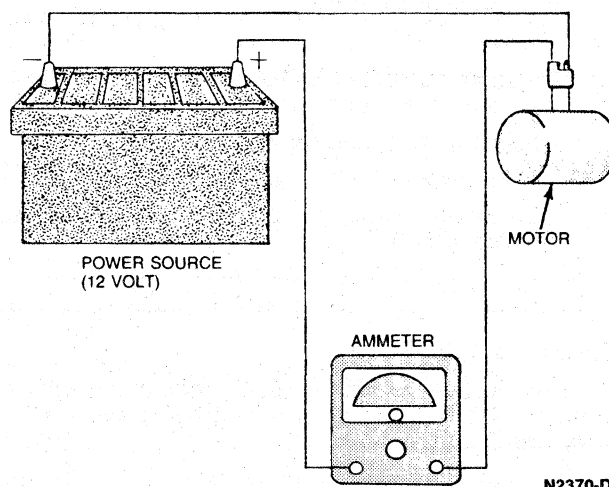
## Motor

Apply 12 volts directly to the motor terminals (reverse polarity for opposite direction). The motor (actuator) rod should finish its travel in less than one second.

Using an ammeter the motor current draw (stall test) should not exceed 6 amps. Reverse the polarity to the connector and test.

## Switch

Refer to Group 42 for testing of the power door lock switch.



**DIAGNOSIS**

Before starting electrical diagnosis, check for mechanical binds by manually operating door locks. Then operate lock system several times from each switch, while observing the operation of all door locks. Be sure battery is fully charged.

CONDITION	POSSIBLE SOURCE	ACTION
<ul style="list-style-type: none"> <li>One Door Lock Does Not Work</li> </ul>	<ul style="list-style-type: none"> <li>Latch or linkage binding.</li> <li>Open or shorted circuit.</li> <li>Malfunctioning actuator.</li> </ul>	<ul style="list-style-type: none"> <li>Using D7AZ-19584-A Lubricant or equivalent, spray into latch opening and manually cycle ten times. Check for interference around night latch and all linkage.</li> <li>Check for voltage at actuator connector, operating switch in both positions. Service circuit if necessary.</li> <li>Test actuator. (Refer to Testing in this Section.) Replace if necessary.</li> </ul>
<ul style="list-style-type: none"> <li>All Door Locks Do Not Work</li> </ul>	<ul style="list-style-type: none"> <li>Malfunctioning circuit breaker.</li> <li>Open or shorted circuit.</li> <li>Malfunctioning switch.</li> <li>Open ground circuit.</li> </ul>	<ul style="list-style-type: none"> <li>Check circuit breaker. (Refer to Fuses and Circuit Breakers Section 34-30 for location.) Replace if necessary.</li> <li>Check wiring and connections between circuit breaker and door lock switches. Service if necessary.</li> <li>Test switch. (Refer to Testing in this Section.) Replace if necessary.</li> <li>Check ground circuit from left hand switch. Service if necessary.</li> </ul>
<ul style="list-style-type: none"> <li>Door Locks Operate One Way Only</li> </ul>	<ul style="list-style-type: none"> <li>Open or short circuit.</li> <li>Open ground circuit.</li> </ul>	<ul style="list-style-type: none"> <li>Check wiring and connections between relays and door lock switches. Service if necessary.</li> <li>Check ground circuit from left hand switch. Service if necessary.</li> </ul>
<ul style="list-style-type: none"> <li>All Locks Work From One Switch Only</li> </ul>	<ul style="list-style-type: none"> <li>Open or shorted circuit.</li> <li>Malfunctioning switch.</li> </ul>	<ul style="list-style-type: none"> <li>Check wiring and connections between circuit breaker and inoperative switch. Service if necessary.</li> <li>Test switch. (Refer to Testing in this Section.) Replace if necessary.</li> </ul>

CN6610-B

## DIAGNOSIS (Continued)

CONDITION	POSSIBLE SOURCE	ACTION
<ul style="list-style-type: none"> <li>• Locks Work Intermittently</li> </ul>	<ul style="list-style-type: none"> <li>• Loose connections.</li> <li>• Poor ground at left hand switch.</li> <li>• Malfunctioning switch.</li> </ul>	<ul style="list-style-type: none"> <li>• Check connectors. Tighten if necessary.</li> <li>• Check ground circuit from left hand switch. Service if necessary.</li> <li>• Test switch. (Refer to Testing in this Section.) Replace if necessary.</li> </ul>
<ul style="list-style-type: none"> <li>• Door Locks Work With Engine Running Only</li> </ul>	<ul style="list-style-type: none"> <li>• Low charge in battery.</li> <li>• Loose or corroded connections.</li> <li>• Latch or linkage binding.</li> </ul>	<ul style="list-style-type: none"> <li>• Test battery. (Refer to Testing in this Section.) Replace if necessary.</li> <li>• Check wiring and connections. Service if necessary.</li> <li>• Using D7AZ-19584-A Lubricant or equivalent, spray into latch opening and manually cycle ten times. Check for interference around night latch and all linkage.</li> </ul>
<ul style="list-style-type: none"> <li>• Locks Do Not Work In Below-Freezing Weather</li> </ul>	<ul style="list-style-type: none"> <li>• Frozen door latch or linkage.</li> </ul>	<ul style="list-style-type: none"> <li>• Bring vehicle into heated garage to allow lock system to thaw. Verify that all locks now work. Using D7AZ-19584-A Lubricant or equivalent, spray into latch opening and manually cycle ten times. May be necessary to remove door trim panel to lubricate entire latch and linkage system.</li> </ul>

CN6611-A



# SECTION 44-18 Keyless Door Entry System

SUBJECT	PAGE	SUBJECT	PAGE
DESCRIPTION AND OPERATION		DIAGNOSIS .....	44-18-4
Code Input Keypad .....	44-18-2	REMOVAL AND INSTALLATION	
Entry Code .....	44-18-1	Keypad Actuator Assembly .....	44-18-3
Inputs to the System .....	44-18-2	Microprocessor/Relay Module .....	44-18-4
Keyless Entry Module .....	44-18-2	SPECIAL SERVICE TOOLS .....	44-18-30
Outputs from the System .....	44-18-2	VEHICLE APPLICATION .....	44-18-1
System Wiring .....	44-18-3		

## VEHICLE APPLICATION

Taurus/Sable.

## DESCRIPTION AND OPERATION

The keyless entry system has two main components:

- A five-button keypad on the outside panel of the driver's door.
- An electronic microprocess/relay module, located on the package tray in the luggage compartment.

The system has five functions:

- It unlocks the driver's door. A keypad code is programmed into the system at the factory. The factory-programmed code is permanently recorded on the owner's warranty card inside the luggage compartment deck lid and on a separate code card. Owners can also select and program their own personal code (a birthdate or part of a social security number, for example) by pressing a specified sequence of keypad buttons. (Refer to procedure in the Owner Guide). When either the factory-programmed code or the owner's code is entered, the driver's door unlocks.
- It unlocks the other doors of the vehicle if the second keypad button (3/4) is pressed within five seconds of the driver's door unlocking.
- It turns on the interior lamps and the illuminated key hole on the driver's door. All functions of the illuminated entry system are included in the keyless entry system. The lamps are turned on by pressing any keypad button or lifting the door handle.
- It unlocks the luggage compartment deck lid when the third keypad button (5/6) is pressed within five seconds after the driver's door is unlocked.

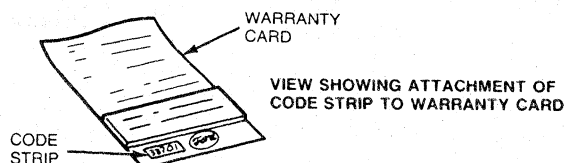
- It locks all the doors automatically when:

1. The driver's seat is occupied.
2. All the doors are fully closed.
3. The ignition switch is turned to RUN.
4. The transmission selector passes through R position.

- It locks all the doors from outside the vehicle when the last two keypad buttons (7/8 and 9/0 are pressed at the same time.

## Entry Code

- The keypad code is located on the owner's warranty card, a sticker affixed to the inside of the luggage compartment deck lid and the owner's code card.
- Modules are programmed at the factory and have a 5-digit code printed on them.
- This 5-digit code refers to button number.
- Replacement modules include stickers which are to be placed on the owner's warranty card and on the inside of the luggage compartment deck lid. An owner's code card will also be included.



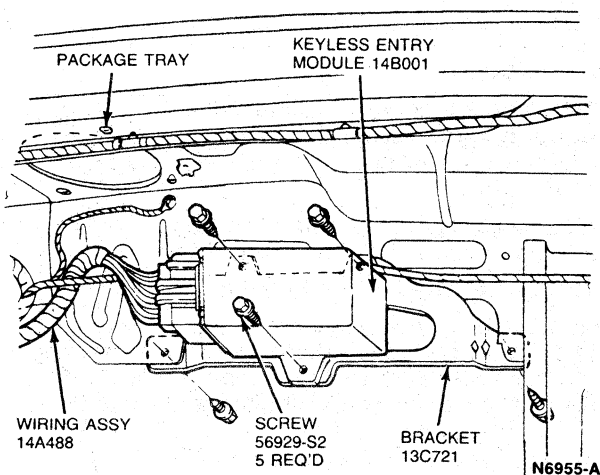
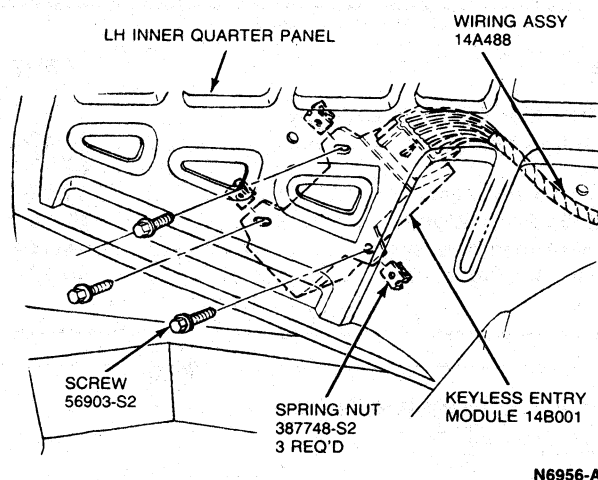
N6954-A

**DESCRIPTION AND OPERATION (Continued)****Keyless Entry Module**

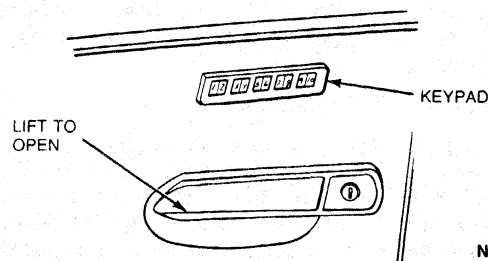
This is a microcomputer programmed to control the functions of keyless entry and automatic locking systems. It is attached to various sensors, lamps and solenoids by two 14-pin connectors, one Green and the other Brown. It is also connected to the input keypad, and performs the following functions in response to keypad input codes:

- Unlocking driver's door.
- Unlocking all doors.
- Unlocking luggage compartment deck lid.
- Locking of doors.
- Automatic locking of doors when ignition is in RUN, someone is seated in the driver's seat, and the transmission is shifted through REVERSE.
- Automatic relocking of the doors after they have been opened and closed, the vehicle is in DRIVE and someone is in the driver's seat.
- Turning on keypad lamps, keyhole lamps and vehicle interior lamps after any button on the keypad is pressed or either door handle is lifted.
- Acceptance and storage of owner specified alternate entry code.

The keyless entry module is on the package tray in the luggage compartment for sedans, or the LH inner quarter panel for wagons.

**Sedan****Wagon****Code Input Keypad**

This is a set of five calculator-type push-button switches used to input codes to the keyless entry module. It is located on the outer panel of the driver's door.

**Inputs to the System**

The keyless entry module has inputs from the following sensors:

- Door handles
- Driver's seat sensor
- Transmission backup lamp switch
- Ignition switch
- Electric door lock/unlock switches
- Code keypad buttons
- Courtesy lamp switch
- Door ajar switch

**Outputs from the System**

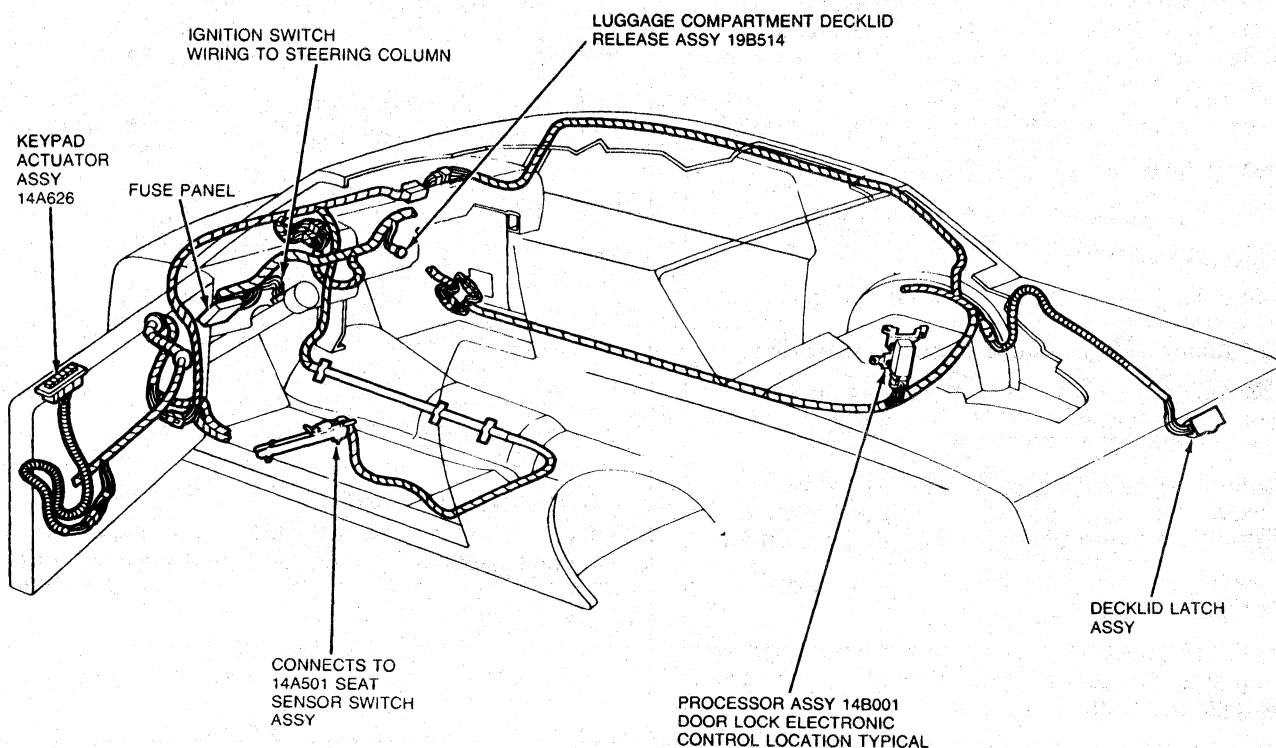
This keyless entry module outputs signals to the following:

- Keypad lamps
- Door lock LED's
- Door actuating solenoids
- Luggage compartment release solenoid
- Interior courtesy lamps

## DESCRIPTION AND OPERATION (Continued)

## System Wiring

Typical system wiring is shown in the following illustration. Refer to the appropriate Section in Group 34 for individual wiring harness installations.



N4990-E

## REMOVAL AND INSTALLATION

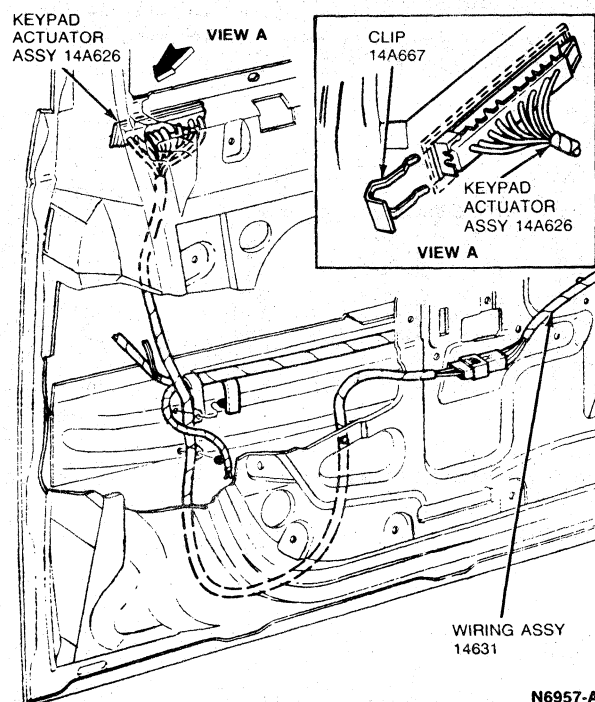
## Keypad Actuator Assembly

## Removal

1. Remove interior door trim panel. Refer to Section 45-03.
2. Disconnect actuator wiring harness electrical connector.
3. Remove retaining clip.
4. Remove actuator and wiring harness assembly. Remove wiring harness locators from retaining holes.

## Installation

1. Position wiring harness and actuator assembly in door.
2. Install clip retaining actuator to door and install locators in retaining holes.
3. Connect actuator wiring harness connector.
4. Install interior door trim panel. Refer to Section 45-03.



N6957-A

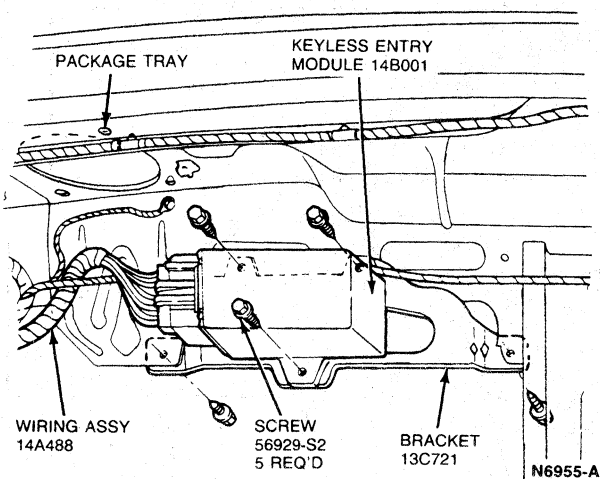
## REMOVAL AND INSTALLATION (Continued)

## Microprocessor/Relay Module

## Removal and Installation

1. Remove three retaining screws and lower module.

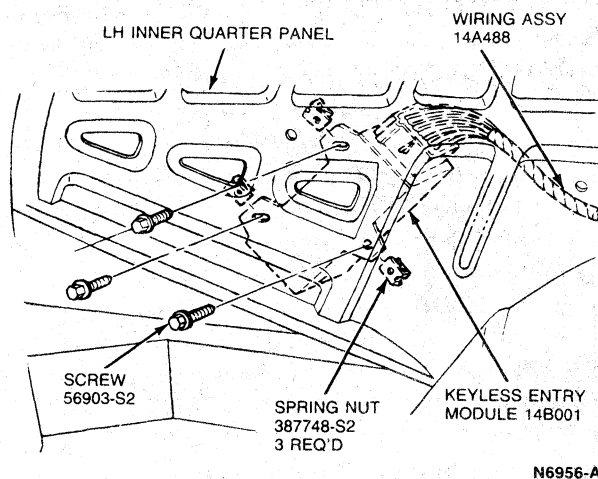
## Sedan



2. Disconnect two connectors.

3. To install, reverse Steps 1 and 2.

## Wagon

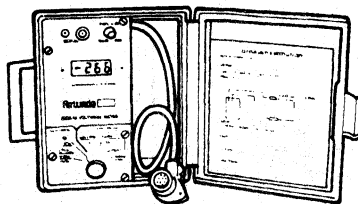


## DIAGNOSIS

Before proceeding with diagnosis and service of the keyless entry electrical operation, check for mechanical binds in the door locks. Operate all door locks several times and check lock operation. Also be sure the battery is fully charged. A voltmeter, ohmmeter and a jumper wire are required for testing. The following diagnosis procedures begin with an explanation page on how to use the procedures.

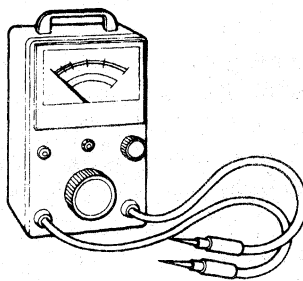
Read this carefully before beginning Diagnosis. Refer to the following diagrams and charts for additional information when performing the diagnostic tests.

NOTE: Voltage and resistance readings can be obtained using Rotunda Digital Volt/Ohmmeter 014-00407 or equivalent.

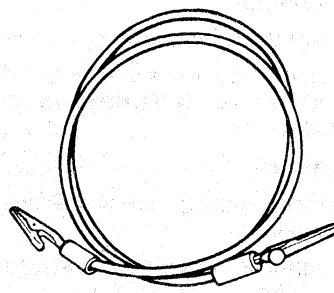


ROTUNDA DVOM 014-00407

OR



ROTUNDA VOM 059-00010

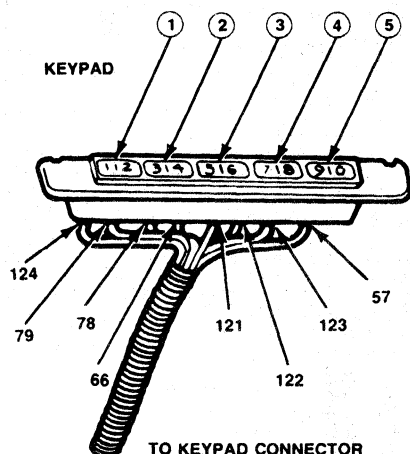


JUMPER WIRE

N4958-B

## DIAGNOSIS (Continued)

## Keyless Entry Keypad Connector



CIRCUIT NO.	COLOR	KEYPAD BUTTON SWITCH NO.	CIRCUIT DESCRIPTION
124	BROWN	—	KEYLESS DOOR LOCK SWITCH INPUT.
78	LIGHT BLUE-YELLOW	1	KEYLESS DOOR LOCK SWITCH; 1/2 TO MODULE.
79	LIGHT GREEN-RED	2	KEYLESS DOOR LOCK SWITCH; 3/4 TO MODULE.
121	YELLOW-BLACK	3	KEYLESS DOOR LOCK SWITCH; 5/6 TO MODULE.
122	YELLOW	4	KEYLESS DOOR LOCK SWITCH; 7/8 TO MODULE.
123	RED	5	KEYLESS DOOR LOCK SWITCH; 9/0 TO MODULE.
66	LIGHT BLUE	—	KEYLESS DOOR LOCK SWITCH ILLUMINATION FEED
57	BLACK	—	GROUND CIRCUIT.

N4961-C

## Keyless Entry Module Connectors

THERE ARE TWO CONNECTORS TO THE MODULE: BROWN (P2) AND GREEN (P1). BOTH CONNECTORS HAVE THE PINS LAYED OUT AS SHOWN HERE. THE CONNECTIONS ARE AS FOLLOWS:

## PIN NO. WIRE NO. AND COLOR

## CONNECTS TO

## GREEN CONNECTOR (P1)

1	163 RED, ORANGE
2	54 LIGHT GREEN, YELLOW
3 AND 4	118 PINK, ORANGE
5 AND 6	57 BLACK
7	84 PURPLE, YELLOW
8 AND 9	117 PINK, BLACK
10	119 PINK, YELLOW
11	120 PINK, LIGHT GREEN
12	53 BLACK, LIGHT BLUE
	464 AND BLACK WITH PINK
13	171E BLACK, WHITE
14	171F BLACK, WHITE

UNLOCK DRIVER'S DOOR  
BATTERY (FUSED)  
UNLOCK ALL DOORS  
GROUND  
UNLOCK LUGGAGE COMPARTMENT DECK LID  
LOCK ALL DOORS  
LOCK INPUT FROM DOOR SWITCHES  
UNLOCK INPUT FROM DOOR SWITCHES  
COURTESY LAMPS AND DOOR LED

BATTERY  
BATTERY

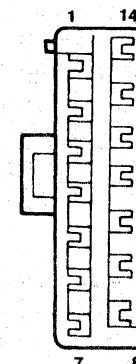
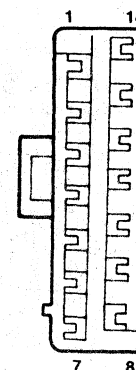
## BROWN CONNECTOR (P2)

1	66 LIGHT BLUE
2	57E BLACK
3	78 LIGHT BLUE, YELLOW
4	79 LIGHT GREEN, RED
5	121 YELLOW, BLACK
6	122 YELLOW
7	123 RED
8	194B PINK
9	177 WHITE
10	140 BLACK, PINK
11	465 WHITE, LIGHT BLUE
	465A
12	124 BROWN
13	54B LIGHT GREEN, YELLOW
	54C
14	627 BLACK, ORANGE

OUTPUT: KEYPAD ILLUMINATION  
GROUND  
INPUT KEYPAD BUTTON 1/2  
INPUT KEYPAD BUTTON 3/4  
INPUT KEYPAD BUTTON 5/6  
INPUT KEYPAD BUTTON 7/8  
INPUT KEYPAD BUTTON 9/0  
INPUT IGNITION SWITCH  
INPUT DRIVER'S SEAT SWITCH  
INPUT TRANSMISSION LEVER  
INPUT DOOR HANDLE

OUTPUT POWER FOR KEYPAD INPUT

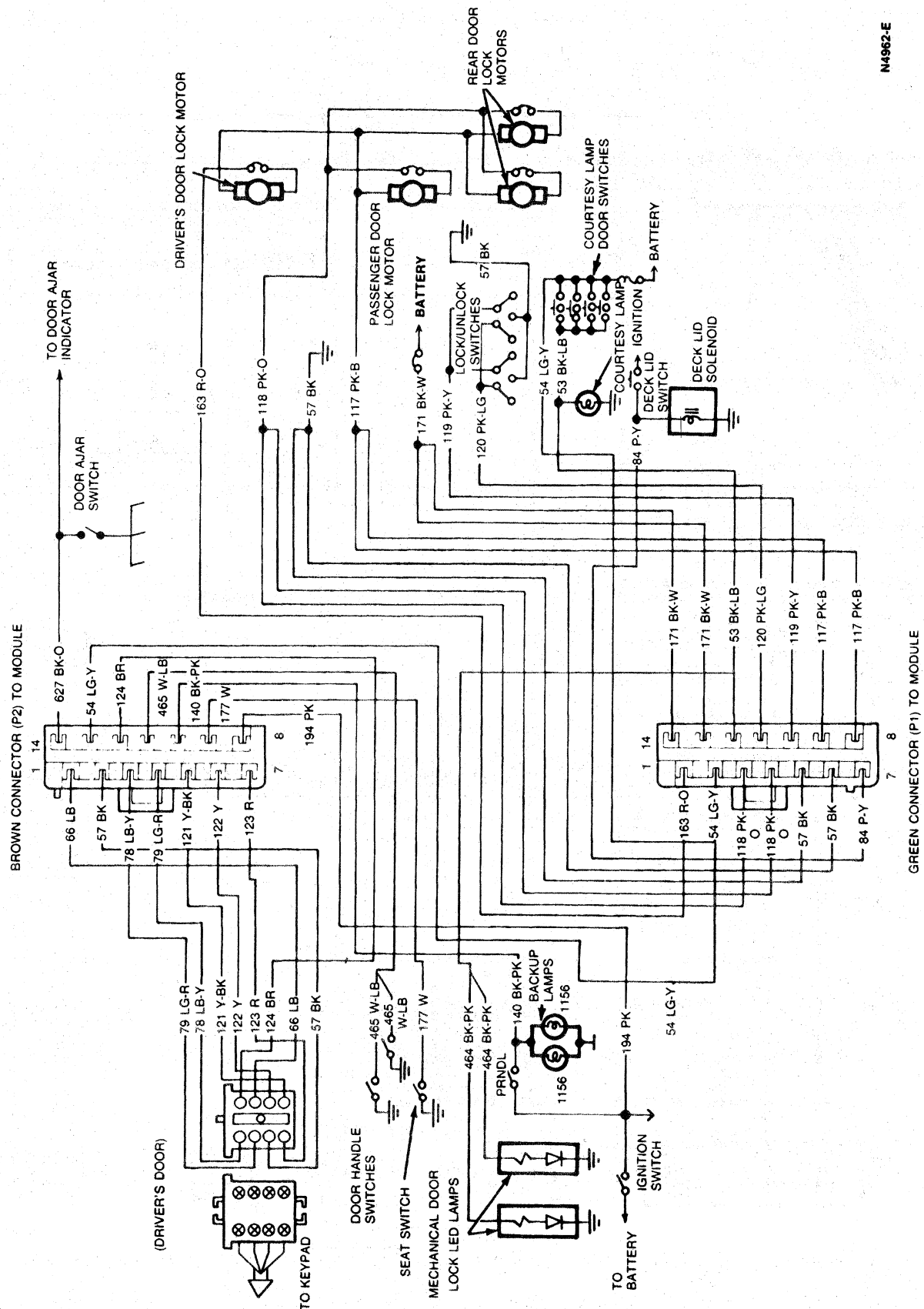
DOOR AJAR SWITCH AND INDICATOR



N4960-E

## DIAGNOSIS (Continued)

## Keyless Entry Wiring Diagram



N4962-E





## DIAGNOSIS (Continued)



## HOW TO USE DIAGNOSIS PROCEDURES






JUST THESE brief descriptions will guide you through the Test once you have some experience with them.

FOR MORE HELP when the brief instructions are not enough, follow the detailed instructions (and the Background Information in this Section). Read all of the TEST STEP box before moving to the RESULT column.

**IMPORTANT NOTE:**

 This symbol means that the item being checked within a step is OKAY () or the reading is within acceptable specifications or range.

 This means NOT . The item being checked is NOT producing acceptable output.

	TEST STEP	RESULT	ACTION TO TAKE
1	OPERATE LOCKS FROM DOOR SWITCHES		
	<ul style="list-style-type: none"> <li>For the Door Lock Switch in each door:               <ul style="list-style-type: none"> <li>LOCK and UNLOCK the doors several times using the switch. Check that all the doors lock/unlock properly.</li> </ul> </li> </ul>	All doors lock/unlock properly from each switch 	GO to 2.
		Any problems 	GO to 23. PINPOINT TEST E Power Locks.
2	ILLUMINATE KEYPAD PRESSING KEYPAD BUTTONS		
	<ul style="list-style-type: none"> <li>For each Button on the keyless entry Keypad:               <ul style="list-style-type: none"> <li>Press button.</li> <li>Check that the Keypad lights up.</li> <li>Wait until the Keypad light goes out (about 5 seconds) before pressing the next button.</li> </ul> </li> </ul>	Keypad lights for each button 	GO to 3.
		None of the buttons light the Keypad 	GO to 13. PINPOINT TEST B Keypad Illumination.
		One or more of the buttons fail to light the Keypad 	GO to 15. PINPOINT TEST C Keypad Input.

## TO TEST AND SERVICE KEYLESS ENTRY SYSTEM

- RUN the QUICK TEST.
- RUN PINPOINT TESTS (if any) specified by the QUICK TEST. (ONLY run them when a step of the QUICK TEST has failed!)
- MAKE services ONLY as specified in the Tests.
- REPEAT the entry QUICK TEST to make sure the system works.

CN4928-D



## DIAGNOSIS (Continued)

## QUICK TEST

## QUICK TEST STARTS HERE

- CHECK THAT BATTERY IS FULLY CHARGED (If not, it may be causing the problems.)
- DISCONNECT AND RECONNECT BATTERY TO ENSURE SYSTEM IS RESET.
- FOR THIS SPECIFIC COMPLAINT ..... GO to
  - Locks bind when manually operated ..... E1
  - System does not operate in freezing weather ..... E7
  - Locks only work when engine is running ..... E8
  - Locks work intermittently ..... E6
  - Illuminated entry does not work when door is opened by hand but does work with Keyless Entry ..... D1

☒ IF NOT, Go to 1 below.

☒ IF ANY of above problems are found: Service and test to see if problem is solved.

TEST STEP		RESULT	ACTION TO TAKE
1	OPERATE LOCKS FROM DOOR SWITCHES		
	<ul style="list-style-type: none"> <li>For the Door Lock Switch in each door:               <ul style="list-style-type: none"> <li>LOCK and UNLOCK the doors several times using the switch. Check that all the doors lock/unlock properly.</li> </ul> </li> </ul>	All doors lock/unlock properly <input checked="" type="radio"/>	GO to 2.
		Any problems <input checked="" type="radio"/>	GO to PINPOINT TEST E.
2	ILLUMINATE KEYPAD BY PRESSING KEYPAD BUTTONS		
	<ul style="list-style-type: none"> <li>For each Button on the keyless entry Keypad:               <ul style="list-style-type: none"> <li>Press button.</li> <li>Check that the Keypad lights up.</li> <li>Wait until the Keypad lamp goes out (about 5 seconds) before pressing the next button.</li> </ul> </li> </ul>	Keypad lights for each button <input checked="" type="radio"/>	GO to 3.
		None of the buttons light the Keypad <input checked="" type="radio"/>	GO to PINPOINT TEST B.
		One or more of the buttons fail to light the Keypad <input checked="" type="radio"/>	GO to PINPOINT TEST C.
3	LOCK DOORS USING KEYPAD		
	<ul style="list-style-type: none"> <li>Ignition switch OFF (key out of ignition).</li> <li>Close all doors and luggage compartment deck lid.               <ul style="list-style-type: none"> <li>Make sure all doors are unlocked.</li> </ul> </li> <li>Simultaneously press buttons 7/8 and 9/0 on the Keypad.</li> </ul>	All doors lock <input checked="" type="radio"/>	GO to 4.
		Some doors fail to lock <input checked="" type="radio"/>	REPLACE Module.
		No doors lock <input checked="" type="radio"/>	GO to C1.

CN4929-E

## DIAGNOSIS (Continued)

## QUICK TEST — Continued

TEST STEP		RESULT	ACTION TO TAKE
4	UNLOCK DRIVER'S DOOR USING PERMANENT CODE		
<ul style="list-style-type: none"><li>Enter the Permanent Code by pressing the buttons on the Keypad in the proper sequence. Use the code sequence that appears on the module.</li></ul>		Driver's door unlocks (OK) ➡	GO to 5.
		Driver's door fails to unlock (X) ➡	GO to C1.
5	UNLOCK PASSENGER DOOR(S) USING BUTTON 3/4		
<ul style="list-style-type: none"><li>If more than 5 seconds have elapsed since Step 4 (if the lamp on the Keypad has gone out) re-enter the permanent code.</li><li>Press button 3/4 on the Keypad (must be done within 5 seconds of entering the permanent code).</li></ul>		Passenger's door(s) unlock (OK) ➡	GO to 6.
		Passenger's door(s) fails to unlock (X) ➡	GO to C1. REPEAT QUICK TEST.
6	UNLOCK LUGGAGE COMPARTMENT DECK LID USING BUTTON 5/6		
<ul style="list-style-type: none"><li>If more than 5 seconds have elapsed since Step 4 (if the lamp on the keypad has gone out) re-enter the permanent code.</li><li>Press Button 5/6 (must be done within 5 seconds of entering the permanent code).</li></ul>		Luggage compartment deck lid unlocks (OK) ➡	GO to 7.
		Luggage compartment deck lid does not unlock (X) ➡	GO to PINPOINT TEST F.
		Trunk Lid always OPEN or in UNLOCKED position (X) ➡	GO to STEP F5.
7	DOORS LOCK WHEN SEATED DRIVER SHIFTS TRANSMISSION PARK/REVERSE/DRIVE		
<ul style="list-style-type: none"><li>Sit in the driver's seat.</li><li>Assure that transmission lever is in PARK.</li><li>Close driver's door.<ul style="list-style-type: none"><li>All doors unlocked.</li><li>All doors fully closed.</li><li>Interior lamps off.</li></ul></li><li>Key to ON.</li><li>Shift the Transmission lever:<ul style="list-style-type: none"><li>To REVERSE.</li><li>Then to DRIVE.</li></ul></li></ul>		All doors lock (OK) ➡	GO to 8.
		One or more doors fail to lock (X) ➡	GO to PINPOINT TEST A.
8	AUTOMATIC RELOCK OF DRIVER'S DOOR		
<ul style="list-style-type: none"><li>Still seated in driver's seat.<ul style="list-style-type: none"><li>Transmission still in DRIVE.</li><li>Key still ON.</li></ul></li><li>Open driver's door.</li><li>Close driver's door.</li></ul>		Driver's door automatically locks when closed (OK) ➡	GO to 9.
		Driver's door does not lock automatically (X) ➡	GO to PINPOINT TEST A.













## DIAGNOSIS (Continued)

## QUICK TEST — Continued

TEST STEP		RESULT	ACTION TO TAKE
9	CHECK DOOR AJAR SWITCH		
	<ul style="list-style-type: none"> <li>• Still seated in driver's seat. — Transmission still in DRIVE. — Key still ON.</li> <li>• Open driver's door.</li> <li>• Turn off interior lamps by depressing courtesy lamp switch with left foot.</li> </ul>	Driver's door does not lock automatically (OK) →	GO to 10.
		Driver's door automatically locks when interior lamps turn off (X) →	GO to A15.
10	PRESS KEYPAD TO TURN ON ILLUMINATED ENTRY		
	<ul style="list-style-type: none"> <li>• Key to OFF and out of ignition switch.</li> <li>• Transmission in Park.</li> <li>• Get out of the vehicle, close door.</li> <li>• Press any of the Keypad buttons.</li> </ul>	Interior lamps and illuminated entry keyhole lamps of both doors come on (OK) →	GO to 10.
		Interior lamps or illuminated entry keyhole lamps do not come on (X) →	GO to PINPOINT TEST.
11	PRESS BUTTONS 7/8 AND 9/0 TO TURN OFF ILLUMINATED ENTRY		
	<ul style="list-style-type: none"> <li>• If the interior lamps have gone off (if more than 25 seconds since Step 9) press the Keypad to turn on the interior lamps and illuminated entry keyhole lamps.</li> <li>• Press Buttons 7/8 and 9/0 simultaneously (this should be done within 5 seconds of turning on the Illuminated Entry system).</li> </ul>	Interior lamps and illuminated entry keyhole lamp(s) go off (OK) →	GO to 11.
		Interior lamps or keyhole lamps stay off (X) →	GO to PINPOINT TEST.
12	LIFTING DOOR HANDLE TO TURN ON ILLUMINATED ENTRY		
	<ul style="list-style-type: none"> <li>• Key to OFF.</li> <li>• Transmission in PARK.</li> <li>• Door closed.</li> <li>• Lift handle to open door.</li> <li>• Within 25 seconds, get inside car and turn ignition ON.</li> </ul>	Interior lamps illuminated with door handle and go Off when ignition is turned ON (OK) →	GO to 12.
		Interior lamps illuminate and do not go off when ignition is turned On (X) →	REPLACE Module. REPEAT Quick Test.
		Interior lamps do not illuminate (X) →	GO to PINPOINT TEST.

## DIAGNOSIS (Continued)

## QUICK TEST — Continued

TEST STEP	RESULT	ACTION TO TAKE
<b>13</b> SEE IF ALTERNATE CODE IS ACCEPTED  NOTE: In the following, no more than 5 seconds should elapse between successive key presses. <ul style="list-style-type: none"> <li>• Enter the permanent code on the Keypad.</li> <li>• Press button 1/2 (this alerts system to accept an alternate code).</li> <li>• Press (in sequence) buttons 9/0, 7/8, 5/6, 3/4, 1/2.</li> </ul>	Keypad lamps go out    Keypad lamps stay on  	GO to 14.  REPLACE Module. REPEAT Quick Test.
<b>14</b> UNLOCK DOOR USING ALTERNATE CODE <ul style="list-style-type: none"> <li>• Close and lock doors.</li> <li>• Press (in sequence) buttons 9/0, 7/8, 5/6, 3/4, 1/2 on the Keypad.</li> </ul>	Driver's door unlocks    Driver's door remains locked  	GO to 15.  REPEAT 12 and 13. If still not OK, REPLACE Module. REPEAT Quick Test.
<b>15</b> DISABLE ALTERNATE CODE <ul style="list-style-type: none"> <li>• Starting with the Keypad lamp out, enter the permanent code on the Keypad.</li> <li>• Press button 1/2 (within 5 seconds of entering the permanent code).</li> <li>• Wait until Keypad lamp goes out. — This removes the Alternate Code.</li> <li>• Close and lock driver's door.</li> <li>• Press (in sequence) buttons 9/0, 7/8, 5/6, 3/4, 1/2 on the Keypad.</li> </ul>	Doors remain locked    Some doors unlock  	End of the Quick Test. Keyless entry system is OK.  REPLACE Module. REPEAT Quick Test.

CN4932-D

**DIAGNOSIS (Continued)****PINPOINT TESTS**

Do NOT run any of the following PINPOINT TESTS UNLESS SO instructed by the QUICK TEST.

Doing so is a waste of time, and may produce incorrect results and services.

WHEN YOU COMPLETE any PINPOINT TEST Service, RETURN to the QUICK TEST.

— Do NOT continue with other PINPOINT TESTS.

**DO NOT REPLACE PARTS UNLESS TEST RESULTS SAY THEY SHOULD BE REPLACED!**

<u>PINPOINT TEST</u>	<u>SUBJECT</u>	<u>PINPOINT TEST</u>	<u>SUBJECT</u>
A	AUTOMATIC LOCKING SYSTEM	D	ILLUMINATED ENTRY
B	KEYPAD ILLUMINATION	E	POWER LOCKS
C	KEYPAD INPUT	F	TRUNK UNLOCK

**CN4934-E**

## DIAGNOSIS (Continued)

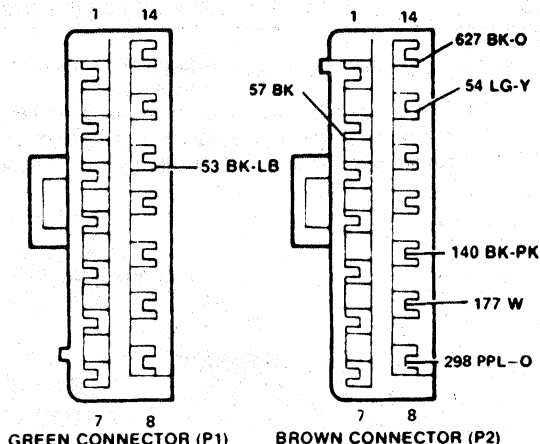
## PINPOINT TEST A

## AUTOMATIC LOCKING SYSTEM

Perform Test **ONLY** If Instructed To Do So

This PINPOINT TEST Checks:

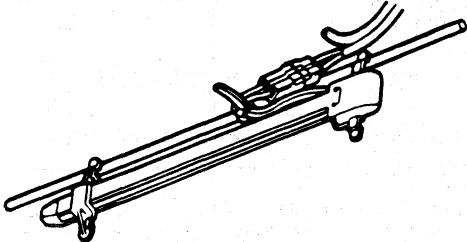




















- Driver's Seat Switch
- Courtesy Lamp Switches and Circuits
- Back-Up Lamp Switch (transmission lever)
- Keyless Entry Module
- Circuits 177, 57E, 54, 53, 298, 140
- Door Ajar Switch



TEST STEP		RESULT	ACTION TO TAKE
<b>A1</b>	CHECK MODULE GROUND AT PIN 2		
	<ul style="list-style-type: none"> <li>• Check for continuity between Ground at Pin 2 of brown connector and chassis ground.</li> </ul>	Continuity No continuity	GO to <b>A2</b> . SERVICE Circuit 57 to Module.
<b>A2</b>	SEAT SWITCH OPEN WHEN DRIVER'S SEAT EMPTY		
	<ul style="list-style-type: none"> <li>• Key off.</li> <li>• Disconnect brown connector from the Module.</li> <li>• Check for continuity between Pins 9 and 2 of the brown connector.               <ul style="list-style-type: none"> <li>— Driver's Seat unoccupied.</li> </ul> </li> </ul>	No continuity Continuity	GO to <b>A4</b> . GO to <b>A3</b> .
<b>A3</b>	CHECK CIRCUIT 177 FOR SHORT		
	<ul style="list-style-type: none"> <li>• Disconnect driver's seat switch.</li> <li>• Test for short between Pin 9 of the brown connector and ground.</li> </ul>	No short Short	SERVICE driver's seat switch (Section 44-16). REPEAT Quick Test. SERVICE Circuit 177. REPEAT Quick Test.
<b>A4</b>	SEAT SWITCH CLOSED WHEN DRIVER IS IN SEAT		
	<ul style="list-style-type: none"> <li>• Sit in driver's seat.</li> <li>• Check for continuity between Pins 9 and 2 of the brown connector (with someone in driver's seat).</li> </ul>	Continuity No continuity	GO to <b>A6</b> . GO to <b>A5</b> .















## DIAGNOSIS (Continued)

**PINPOINT TEST A**  
**AUTOMATIC LOCKING SYSTEM (Continued)**

TEST STEP		RESULT	ACTION TO TAKE
<b>A5</b>	<b>CHECK CONTINUITY IN SEAT SWITCH CIRCUITS</b>		
<ul style="list-style-type: none"> <li>With driver's seat occupied.</li> <li>Check for continuity between pin 9 of the brown connector and seat switch connector of the Driver's Seat Switch (circuit 177).</li> </ul> 		Continuity   SERVICE Driver's Seat Switch (Section 44-16). REPEAT Quick Test.  No continuity   SERVICE open in circuit 177. Switch to ground or switch to Module. REPEAT Quick Test.	
<b>A6</b>	<b>VOLTAGE OK BETWEEN PINS 2 AND 13</b>	VOM Reading:	
<ul style="list-style-type: none"> <li>Check the Voltage between Pins 2 and 13 of the brown connector.</li> </ul>		10V or more   GO to <b>A7</b> .  Under 10V   SERVICE open or short in circuits 54B and 54C. REPEAT Quick Test.	
<b>A7</b>	<b>OPERATE COURTESY LAMP SWITCHES</b>		
<ul style="list-style-type: none"> <li>Check that each Courtesy Lamp Switch turns on the Courtesy Lamps.</li> </ul>		Courtesy Lamps come on   GO to <b>A8</b> .  Courtesy lamps don't come on   SERVICE Switch or wire. REPEAT Quick Test.	
<b>A8</b>	<b>VERIFY NO INPUT TO MODULE WHEN ALL DOORS ARE CLOSED</b>	VOM Reading:	
<ul style="list-style-type: none"> <li>Disconnect green connector from Module.</li> <li>Close all doors.</li> <li>Check voltage at pin 12 of green connector to ground.</li> </ul>		0 Volts   GO to <b>A9</b> .  More than 0 Volts   SERVICE short to V Batt or replace door switch that is shorted to V Batt. REPEAT Quick Test.	
<b>A9</b>	<b>CHECK INPUT WITH ONE DOOR OPEN</b>	VOM Reading	
<ul style="list-style-type: none"> <li>For each Door:               <ul style="list-style-type: none"> <li>Open Door</li> <li>All other Doors must be closed</li> <li>Check voltage at pin 12 of green connector</li> </ul> </li> </ul>		10V or more when any door is opened   GO to <b>A10</b> .  10V or less for some door(s)   SERVICE open or short in circuit 53. REPEAT Quick Test.	

## DIAGNOSIS (Continued)

**PINPOINT TEST A**  
**AUTOMATIC LOCKING SYSTEM — Continued**

TEST STEP		RESULT	ACTION TO TAKE
<b>A10</b>	VERIFY NO INPUT TO MODULE WHEN IGNITION OFF	VOM Reading:	
	<ul style="list-style-type: none"> <li>• Key Off.</li> <li>• Check voltage at Pin 8 of brown connector to ground.</li> </ul>	0 Volts  Over 0 Volts 	GO to A11. SERVICE or REPLACE ignition switch. REPEAT Quick Test.
<b>A11</b>	INPUT TO MODULE WHEN IGNITION ON	VOM Reading	
	<ul style="list-style-type: none"> <li>• Key to Run.</li> <li>• Check voltage at Pin 8 of brown connector to ground.</li> </ul>	10V or more  Under 10V 	GO to A13. GO to A12.
<b>A12</b>	BREAK OR SHORT IN CIRCUIT 194B		
	<ul style="list-style-type: none"> <li>• Key to Off.</li> <li>• Check for a short between Pin 8 of the brown connector and ground.</li> <li>• Check continuity between Pin 8 of the brown connector and Circuit 298 of the ignition switch.</li> </ul>	Continuity and no short-to-ground  Short-to-ground or open in Circuit 298 	GO to A13. SERVICE Circuit 298 or CHECK ignition switch. REPEAT Quick Test.
<b>A13</b>	CHECK TRANSMISSION SENSOR INPUT AT PIN 10	VOM Reading	
	<ul style="list-style-type: none"> <li>• Key to Run.</li> <li>• Check voltage at Pin 10 of the brown connector to ground.</li> <li>• Transmission lever in REVERSE. — Then try all other positions.</li> </ul>	10V or more in Reverse  0V (0 volts) in all other gears  Less than 10V in Reverse or more than 0V (0 volts) in other gears 	REPLACE the module. REPEAT Quick Test. GO to A14.
<b>A14</b>	CHECK BACKUP LAMP SWITCH		
	<ul style="list-style-type: none"> <li>• Test Switch function. — Refer to Group 32.</li> </ul>	 	SERVICE open or short in Circuit 140. REPLACE or SERVICE Backup Lamp Switch. REPEAT Quick Test.
<b>A15</b>	CHECK DOOR AJAR SWITCH		
	<ul style="list-style-type: none"> <li>• Connect Ohmmeter between Pin 14 of brown connector and ground.</li> <li>• Lift door handle to open latch.</li> <li>• Observe ohmmeter.</li> <li>• Use screwdriver to completely close latch.</li> </ul>	Resistance greater than 10,000 ohms with latch closed and less than 10 ohms with latch open  Resistance less than 10,000 ohms with latch closed or Resistance greater than 10 ohms with latch open  	REPLACE module. REPEAT Quick Test. CHECK and SERVICE door ajar switch circuit. REPEAT Quick Test.



## DIAGNOSIS (Continued)

## PINPOINT TEST B

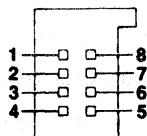
## KEYPAD ILLUMINATION

Perform Test ONLY If Instructed To Do So

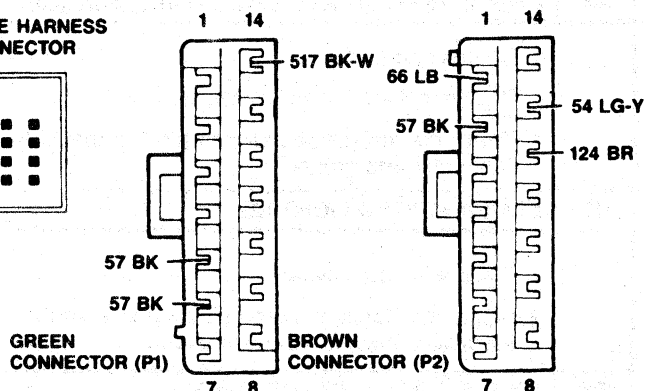
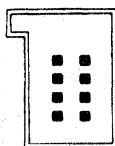
This PINPOINT TEST Checks:

- Keyless Entry Module
- Keypad
- Circuits 54B, 54C, 54E, 57, 57E, 66, 124, 171

KEYPAD CONNECTOR



VEHICLE HARNESS CONNECTOR















TEST STEP		RESULT	ACTION TO TAKE
<b>B1</b>	CHECK POWER INPUTS TO MODULE	VOM Reading:	
<ul style="list-style-type: none"> <li>• Check the voltage levels (to ground) at the following pins: <ul style="list-style-type: none"> <li>— Pin 13, brown connector (circuit 54B &amp; 54C, fuse No. 8)</li> <li>— Pin 13, green connector (circuit 171E, circuit breaker No. 14)</li> <li>— Pin 14, green connector (circuit 171F, circuit breaker No. 14)</li> </ul> </li> </ul>		10V or more	GO to B2.
		Under 10V	SERVICE open or short in corresponding circuit(s). REPLACE burned fuse(s). REPEAT Quick Test.
<b>B2</b>	CHECK MODULE GROUND PINS		
<ul style="list-style-type: none"> <li>• Check for continuity to Ground at the following Pins: <ul style="list-style-type: none"> <li>— Pin 2, brown connector (circuit 57 E)</li> <li>— Pin 5, green connector (circuit 57)</li> <li>— Pin 6, green connector (circuit 57)</li> </ul> </li> </ul>		Continuity to Ground	GO to B3.
		No continuity to Ground	SERVICE open in corresponding circuit(s). REPEAT Quick Test.
<b>B3</b>	CHECK FOR SHORT IN CIRCUIT 66		
<ul style="list-style-type: none"> <li>• Disconnect the keypad and brown Module connectors.</li> <li>• Check continuity between pin 1 of the brown connector and ground.</li> </ul>		No continuity	GO to B3.
		Continuity to ground	SERVICE Short in Circuit 66. REPEAT Quick Test.

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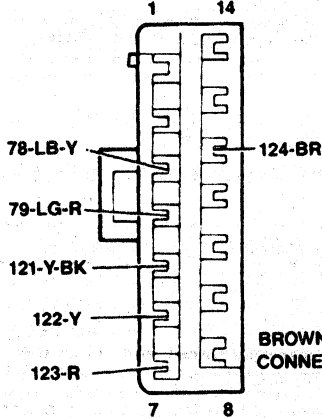
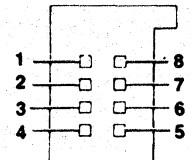
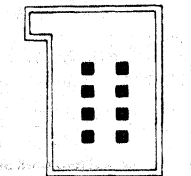








## DIAGNOSIS (Continued)

**PINPOINT TEST B**  
**KEYPAD ILLUMINATION (Continued)**

TEST STEP		RESULT	ACTION TO TAKE
<b>B4</b>	<b>CHECK KEYPAD LAMP CIRCUIT RESISTANCE</b>	VOM Reading	
	<ul style="list-style-type: none"> <li>Connect keypad.</li> <li>Disconnect the brown connector.</li> <li>Check the resistance between pin 1 of the brown connector and ground.</li> </ul>	10 ohms or less  Over 10 ohms 	GO to PINPOINT TEST C. keypad input. GO to <b>B5</b> .
<b>B5</b>	<b>CHECK KEYPAD LIGHTING</b>		
	<ul style="list-style-type: none"> <li>Disconnect the keypad.</li> <li>Check resistance between pins 8 and 11 of the keypad connector in driver's door.</li> </ul>	10 ohms or more  Under 10 ohms 	REPLACE keypad. REPEAT Quick Test. GO to <b>B6</b> .
<b>B6</b>	<b>CHECK CIRCUIT 66 FOR OPEN</b>		
	<ul style="list-style-type: none"> <li>Disconnect the brown and keypad connector.</li> <li>Check for continuity from pins 1 of the brown connector and pin 8 of the keypad harness connector.</li> </ul>	Continuity  No continuity 	GO to <b>B7</b> . SERVICE open in circuit 66. REPEAT Quick Test.
<b>B7</b>	<b>CHECK FOR GROUND AT KEYPAD</b>		
	<ul style="list-style-type: none"> <li>Disconnect the keypad connector.</li> <li>Check for continuity between pin 11 of the keypad harness connector and ground.</li> </ul>	Continuity  No continuity 	GO to <b>B8</b> . SERVICE open in ground circuit to keypad. REPEAT Quick Test.
<b>B8</b>	<b>CHECK CIRCUIT 124 FOR SHORT</b>		
	<ul style="list-style-type: none"> <li>Check for a Short between pin 12 of the brown connector and ground.</li> </ul>	No short  Short 	GO to <b>B9</b> . SERVICE short in circuit 124. REPEAT Quick Test.
<b>B9</b>	<b>CHECK CIRCUIT 124 CONTINUITY</b>		
	<ul style="list-style-type: none"> <li>Check continuity between pin 12 of the brown connector and pin 10 of the keypad connector.</li> </ul>	Continuity  No continuity 	REPLACE keyless entry module. REPEAT Quick Test. SERVICE circuit 124. REPEAT Quick Test.









## DIAGNOSIS (Continued)

## PINPOINT TEST C

KEYPAD INPUT																					
<p><b>Perform Test ONLY If Instructed To Do So</b></p> <p>This PINPOINT TEST Checks:</p> <ul style="list-style-type: none"> <li>• Keypad</li> <li>• Keyless Entry Module</li> <li>• Circuits</li> </ul> <p>Keypad/brown connector circuits</p> <table border="1"> <thead> <tr> <th>KEY</th> <th>PIN</th> <th>CIRCUIT NO.</th> </tr> </thead> <tbody> <tr> <td>1/2</td> <td>3</td> <td>78</td> </tr> <tr> <td>3/4</td> <td>4</td> <td>79</td> </tr> <tr> <td>5/6</td> <td>5</td> <td>121</td> </tr> <tr> <td>7/8</td> <td>6</td> <td>122</td> </tr> <tr> <td>9/0</td> <td>7</td> <td>123</td> </tr> </tbody> </table> <div style="display: flex; justify-content: space-around; align-items: center;">  <div style="text-align: center;"> <p><b>KEYPAD CONNECTOR</b></p>  <p><b>BROWN CONNECTOR</b></p>  <p><b>VEHICLE HARNESS CONNECTOR</b></p> </div> </div>				KEY	PIN	CIRCUIT NO.	1/2	3	78	3/4	4	79	5/6	5	121	7/8	6	122	9/0	7	123
KEY	PIN	CIRCUIT NO.																			
1/2	3	78																			
3/4	4	79																			
5/6	5	121																			
7/8	6	122																			
9/0	7	123																			
TEST STEP	RESULT	ACTION TO TAKE																			
<b>C1</b> CHECK KEYPAD FAILING BUTTON CIRCUIT AT MODULE CONNECTOR	No short-to-ground 	GO to C2.																			
<ul style="list-style-type: none"> <li>• Disconnect brown Module connector and Keypad connector.</li> <li>• Using chart above, check circuit that corresponds to the Failing Button, for short-to-ground (100 kΩ or less) between brown Module connector and ground.</li> </ul>	Shorted-to-ground 	GO to C3. REPEAT QUICK TEST.																			
<b>C2</b> CHECK KEYPAD CIRCUITS FOR SHORT	No short to 124 	GO to C4.																			
<ul style="list-style-type: none"> <li>• Disconnect brown module connector.</li> <li>• Check for Short between button failing and circuit 124.</li> </ul>	Short to 124 	REPLACE Keypad. REPEAT QUICK TEST.																			
<b>C3</b> CHECK KEYPAD FAILING BUTTON CIRCUIT AT KEYPAD CONNECTOR	No low resistance to ground or circuit 124 	SERVICE harness between Module connector and Keypad connector. REPEAT QUICK TEST.																			
<ul style="list-style-type: none"> <li>• Remove Door trim panel (Section 45-03).</li> <li>• Disconnect Keypad connector.</li> <li>• Using above chart, check circuits that correspond to the failing button for resistance less than 100 kΩ between Keypad connector and ground or circuit 124.</li> </ul>	Low resistance to ground or circuit 124 	REPLACE Switch.																			
<b>C4</b> CHECK SWITCH INPUT	Not short-to-ground or open 	GO to C5.																			
<ul style="list-style-type: none"> <li>• Verify circuit 124 is not shorted-to-ground or open from pin 3 to pin 12 of brown connector with 1/2 button depressed.</li> </ul>	Shorted-to-ground or open 	SERVICE open or shorted wire. REPEAT QUICK TEST.																			

## DIAGNOSIS (Continued)

**PINPOINT TEST C**  
**(KEYPAD CHECKOUT — Continued)**

TEST STEP		RESULT	ACTION TO TAKE
<b>C5</b>	<b>CHECK MODULE OUTPUT WITH SIMULATED INPUT</b>	VOM Reading:	
	<ul style="list-style-type: none"> <li>Connect meter between pin 1 of the brown connector and ground.               <ul style="list-style-type: none"> <li>Do not disconnect the connector from the Module.</li> </ul> </li> <li>For each button that failed to light the keypad:               <ul style="list-style-type: none"> <li>Watch the meter as you momentarily connect a jumper between pin 12 of the brown connector and pin 3 through pin 7. (Wait at least 5 seconds between jumper connections).</li> </ul> </li> </ul>	5V or more for 5 seconds for each test 	GO to <b>C6</b> .
		Below 5V or less than 5 seconds for any test 	REPLACE Module. REPEAT QUICK TEST.
<b>C6</b>	<b>CONTINUITY OK BETWEEN KEYPAD PINS 1 AND 8</b>	VOM Reading:	
	<ul style="list-style-type: none"> <li>Remove door trim.</li> <li>Disconnect Keypad from its connector.</li> <li>Check for 10 ohms or less between pins 1 and 8 of the Keypad.</li> </ul>	Under 10 Ohms 	GO to <b>C7</b> .
		10 Ohms or more 	REPLACE Keypad. REPEAT QUICK TEST.
<b>C7</b>	<b>CHECK FOR SHORTS BETWEEN ALL REMAINING PINS</b>		
	<ul style="list-style-type: none"> <li>Check for continuity between pin 5 and every pin of the keypad               <ul style="list-style-type: none"> <li>then between pin 4 and every pin, etc., until all pin pairs have been checked.</li> </ul> </li> </ul>	All open circuits (except between pins 1 and 8) 	GO to <b>C8</b> .
		Short found (other than between pins 1 and 8) 	REPLACE Keypad. REPEAT QUICK TEST.
<b>C8</b>	<b>CHECK CONTINUITY TO PIN 10 WITH KEY PRESSED</b>		
	<ul style="list-style-type: none"> <li>Check for Continuity between pin 5 and pin 2 of keypad connector.</li> <li>Repeat for each Key in turn, checking Continuity between the corresponding pin in the table at the start of PINPOINT TEST C, and pin 2 of keypad connector.</li> </ul>	Continuity 	SERVICE open or short in circuit of non-functional buttons. REPEAT QUICK TEST.
		No Continuity 	REPLACE Keypad. REPEAT QUICK TEST.

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## DIAGNOSIS (Continued)

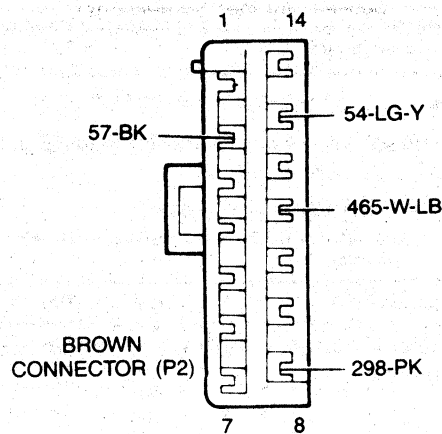
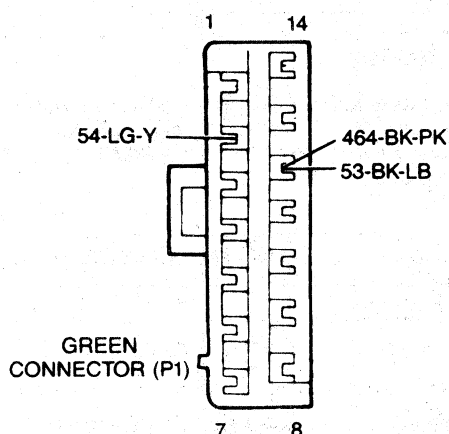
## PINPOINT TEST D





## ILLUMINATED ENTRY

*Perform Test ONLY If Instructed To Do So*

This PINPOINT TEST Checks:

- Lock Cylinder LED's
- Door Handle Switches
- Keyless Entry Module
- Circuits 464, 54, 298, 465, 53, 57



TEST STEP		RESULT	ACTION TO TAKE
<b>D1</b>	CHECK MODULE GROUND AT PIN 2		
<ul style="list-style-type: none"> <li>• Check continuity to Ground at Pin 2 of the brown connector.</li> </ul>		Continuity 	GO to <b>D2</b> .
		No continuity 	SERVICE open in circuit 57. REPEAT Quick Test.
<b>D2</b>	TURN ON KEYHOLE LAMPS FROM KEYPAD		
<ul style="list-style-type: none"> <li>• Key Off.</li> <li>• Press any of the buttons on the Keypad.</li> </ul>		Both Keyholes light up 	GO to <b>D5</b> .
		One or both Keyholes doesn't light 	GO to <b>D3</b> .











## DIAGNOSIS (Continued)

**PINPOINT TEST D**  
**ILLUMINATED ENTRY — Continued**

TEST STEP		RESULT	ACTION TO TAKE
<b>D3</b>	<b>CHECK CIRCUIT 464 FOR CONTINUITY AND SHORT</b>		
	<ul style="list-style-type: none"> <li>Disconnect green connector from module.</li> <li>Check for short between Pin 12 and Pin 6 of green connector.</li> <li>Check for continuity between Pin 12 of the green connector and the lock cylinder connector in door.</li> </ul>	<p>No short between Pin 12 and Pin 6. Continuity between Pin 12 and lock connector (OK) →</p> <p>Short between Pin 12 and Pin 6. No continuity between Pin 12 and lock connector (X) →</p>	<p>GO to D4.</p> <p>SERVICE open or short in Circuit(s) 464. REPEAT Quick Test.</p>
<b>D4</b>	<b>CHECK MODULE OUTPUT WHEN DOOR HANDLE IS ACTUATED</b>		
	<ul style="list-style-type: none"> <li>Reconnect green connector to module.</li> <li>Attach voltmeter between terminal 12 of the brown connector and ground.</li> <li>For each front door handle:               <ul style="list-style-type: none"> <li>Lift up the handle (to actuate the door handle switch).</li> </ul> </li> </ul>	<p>VOM Reading:</p> <p>10V or more within 15 seconds of actuating handle, for each handle (OK) →</p> <p>Under 10V (X) →</p>	<p>REPLACE non-functional lock cylinder. REPEAT Quick Test.</p> <p>GO to D5.</p>
<b>D5</b>	<b>CHECK POWER TO MODULE AT PIN 13</b>		
	<ul style="list-style-type: none"> <li>Check voltage at Pin 13 of the brown connector to ground.</li> </ul>	<p>VOM Reading:</p> <p>10V or more (OK) →</p> <p>Under 10V (X) →</p>	<p>GO to D6.</p> <p>CHECK and REPLACE fuse. SERVICE open or short in Circuit 54B or 54C. REPEAT Quick Test.</p>
<b>D6</b>	<b>CHECK IGNITION SWITCH INPUT TO MODULE</b>		
	<ul style="list-style-type: none"> <li>Check voltage at Pin 8 of the brown connector with Ignition Switch at RUN and OFF positions.</li> </ul>	<p>VOM Reading:</p> <p>10V or more at RUN (OK) →</p> <p>Above 0V at OFF or below 10V at RUN (X) →</p>	<p>GO to D7.</p> <p>SERVICE break or short in Circuit 298. REPEAT Quick Test.</p>
<b>D7</b>	<b>CHECK INPUT TO MODULE FROM DOOR HANDLE SWITCH</b>		
	<ul style="list-style-type: none"> <li>For each front Door Handle: Check continuity between Pin 11 of the brown connector and ground. When you lift up the Door Handle and no continuity when Handle is in normal position.</li> </ul>	<p>Continuity with Handles lifted and no continuity when Handle is in normal position (OK) →</p> <p>No continuity when either Handle lifted up (X) →</p> <p>Continuity with Handle in normal position (X) →</p>	<p>GO to D10.</p> <p>GO to D9.</p> <p>GO to D8.</p>

## DIAGNOSIS (Continued)

**PINPOINT TEST D**  
**(ILLUMINATED ENTRY — Continued)**

TEST STEP		RESULT	ACTION TO TAKE
<b>D8</b>	<b>CHECK CIRCUIT 465 FOR SHORT-TO-GROUND</b>		
	<ul style="list-style-type: none"> <li>• Disconnect brown module connector and both door handle switches.</li> <li>• Check for Short-to-Ground between pin 11 of the brown connector and ground.</li> </ul>	No continuity 	REPLACE door handle switch. REPEAT Quick Test.
		Continuity 	SERVICE Short-to-Ground in Circuit 465. REPEAT Quick Test.
<b>D9</b>	<b>CHECK CIRCUIT 465 CONTINUITY</b>		
	<ul style="list-style-type: none"> <li>• Check continuity between pin 11 of the brown connector and circuit 465 connection to door handle switch of the handle(s) which failed Step D7.</li> </ul>	Continuity 	SERVICE door handle switch. REPEAT Quick Test.
		Open Circuit 	SERVICE break in circuit 465. REPEAT Quick Test.
<b>D10</b>	<b>CHECK MODULE RESPONSE TO DOOR HANDLES</b>	VOM Reading:	
	<ul style="list-style-type: none"> <li>• Reconnect the brown and green connectors to the module.</li> <li>• Key to Off.</li> <li>• Check voltage between pin 12 of the green connector and ground when you lift up the door handle.</li> </ul>	10V or more (may be delayed up to 15-30 seconds) 	GO to D11.
		Under 10V 	REPLACE module. REPEAT Quick Test.
<b>D11</b>	<b>TURN ON INTERIOR LAMPS BY JUMPING ACROSS MODULE</b>		
	<ul style="list-style-type: none"> <li>• Momentarily connect a jumper between pin 2 and pin 12 of the green connector.</li> </ul>	Interior lamps go on 	GO to D12.
		Interior lamps don't go on 	SERVICE short or open in circuits 53 or 54. REPEAT Quick Test.
<b>D12</b>	<b>CONNECTORS OK</b>		
	<ul style="list-style-type: none"> <li>• Inspect the green and brown connectors for loose or corroded pins.</li> </ul>	No loose or corroded pins 	REPLACE module. REPEAT Quick Test.
		Loose or corroded pins 	SERVICE as required. REPEAT Quick Test.

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## DIAGNOSIS (Continued)

## PINPOINT TEST E

## POWER LOCKS

*Perform Test ONLY if Instructed To Do So*

This section contains a number of sub-sections, for handling different types of problems found with the power locks reported by the customer.

For further information on the power lock system, refer to Section 44-16.

**BEFORE PERFORMING ANY OF THE TESTS IN THIS SECTION, THE BATTERY MUST BE FULLY CHARGED.**





Find the specific problem in the list below, and go to the Step specified.

## STEP

- E1** LUBRICATING THE LINKAGE
- E2** NONE OF THE DOOR LOCKS WORK
- E3** ONE OR MORE LOCKS DO NOT WORK
- E4** ONE OR MORE SWITCHES DO NOT WORK
- E5** LOCKS WILL ONLY LOCK OR UNLOCK
- E6** LOCKS WORK INTERMITTENTLY
- E7** LOCKS DO NOT WORK IN FREEZING WEATHER
- E8** LOCKS ONLY WORK WITH ENGINE RUNNING

**E1** LUBRICATING THE LINKAGE











- Use Polyethylene Grease D7AZ-19584-A (or equivalent).
- SPRAY into latch opening
  - it may be necessary to remove the door trim panel to lubricate the entire latch and linkage system.
- MANUALLY CYCLE the lock 10 times.
  - CHECK for interference around night latch and all linkages.

TEST STEP		RESULT	ACTION TO TAKE
<b>E2</b>	NONE OF THE DOOR LOCKS WORK		
<b>E2a</b>	OPEN CIRCUIT BREAKER		
	<ul style="list-style-type: none"> <li>• Check circuit breaker 14.</li> </ul>	<div style="text-align: center;">  → GO to <b>E2b</b>.   → REPLACE breaker.         </div>	
<b>E2b</b>	POWER TO MODULE AT PIN 4		
	<ul style="list-style-type: none"> <li>• Key off.</li> <li>• Disconnect green connector from the Module.</li> <li>• Key to RUN.</li> <li>• Check the voltage between Pin 13 of green connector and ground while activating lock switch.</li> </ul>	VOM Reading:  10V or more <div style="text-align: center;"> → GO to <b>E2c</b>.</div>  Under 10V <div style="text-align: center;"> → SERVICE open or short in Circuit 517 or charge battery. REPEAT Quick Test.</div>	












## DIAGNOSIS (Continued)

**PINPOINT TEST E**  
**POWER LOCKS — Continued**

TEST STEP		RESULT	ACTION TO TAKE
<b>E2c</b>	<b>DOES CIRCUIT BREAKER BLOW WHEN SWITCH ACTIVATES</b>	VOM Reading:	
	<ul style="list-style-type: none"> <li>With system connected and voltmeter connected to Pin 13 of the green connector and ground.</li> <li>Does meter read 10V or more when door lock and unlock switches are activated.</li> </ul>	10V or more 	GO to <b>E2d</b> .
		Under 10V caused by blown breaker 	CHECK for short-to-ground in Circuits 163, 118, 117, or shorted lock actuator. REPEAT Quick Test.
<b>E2d</b>	<b>CHECK MODULE GROUNDS AT PINS 5 AND 6</b>		
	<ul style="list-style-type: none"> <li>Check continuity between Pin 5 of the green connector and ground.</li> <li>Check continuity between Pin 6 of the green connector and ground.</li> </ul>	Continuity 	GO to <b>E2e</b> .
		No continuity 	SERVICE open in Circuit 57. REPEAT Quick Test.
<b>E2e</b>	<b>CHECK CONTINUITY BETWEEN PINS 8 AND 3, AND 8 AND 1</b>		
	<ul style="list-style-type: none"> <li>Manually lock all doors.</li> <li>Connect a jumper between Pin 8 and ground of green module connector, with connector disconnected.</li> <li>With a second jumper, momentarily connect together Pins 14 and 3.</li> <li>Relock driver's door.</li> <li>Momentarily connect together Pins 13 and 1.</li> </ul>	All doors unlock 	GO to <b>E2f</b> .
		Only driver's door unlocks 	SERVICE Circuit(s) 163, 117 or 118 or door lock motor(s). REPEAT Quick Test.
<b>E2f</b>	<b>CHECK LOCK SWITCHES</b>		
	<ul style="list-style-type: none"> <li>Test for Lock Switch stuck in LOCK or UNLOCK position.</li> </ul> <p><b>NOTE:</b> May be mechanically stuck, check Switch using meter.</p>		REPLACE Switch. REPEAT Quick Test.
			GO to <b>E2g</b> .
<b>E2g</b>	<b>CHECK CIRCUITS 119 and 120 FOR SHORT-TO-GROUND</b>		
	<ul style="list-style-type: none"> <li>Disconnect green module connector.</li> <li>Check for Short-to-Ground between Pin 10 and ground, also between Pin 11 and ground.</li> </ul>	No short 	REPLACE Module. REPEAT Quick Test.
		Short 	SERVICE Short-to-Ground in Circuit 119 or 120. REPEAT Quick Test.

## DIAGNOSIS (Continued)










**PINPOINT TEST E**  
**POWER LOCKS — Continued**

TEST STEP		RESULT	ACTION TO TAKE
<b>E3</b>	<b>ONE OR MORE LOCKS DO NOT WORK</b>		
<b>E3a</b>	<b>MECHANICAL FUNCTION OK</b>		
	<ul style="list-style-type: none"> <li>Manually cycle the lock several times to check for latch or linkage binding.</li> </ul>	<p align="center">  → GO to E3b.   → LUBRICATE lock and linkage, as in Step E1.         </p>	
<b>E3b</b>	<b>CHECK POWER TO ACTUATOR WITH DOOR SWITCH</b>	VOM Reading:	
	<ul style="list-style-type: none"> <li>Remove trim panel on the door.</li> <li>Check voltage between the faulty lock actuator and ground while pressing the lock of the door switch.</li> </ul>	<p>10V or more  → GO to E3d.</p> <p>Under 10V  → GO to E3c.</p>	
<b>E3c</b>	<b>CHECK MODULE OUTPUT</b>	VOM Reading:	
	<ul style="list-style-type: none"> <li>With green connector connected, depress lock button and measure voltage at Pins 1 and 8 to ground.</li> <li>With lock button released there should be 0V at Pin 1 and 8.</li> </ul>	<p>10V or more when depressed and 0V when released  → SERVICE Circuit 163, 117 or 118 for open or short.</p> <p>Under 10V when depressed  → REPLACE Module. REPEAT Quick Test.</p> <p>More than 10V when not depressed  → REPLACE Module. REPEAT Quick Test.</p>	
<b>E3d</b>	<b>CHECK POWER TO ACTUATOR WITH DOOR SWITCH UNLOCK</b>	VOM Reading:	
	<ul style="list-style-type: none"> <li>Check voltage between the lock actuator Circuit 118 and ground while pressing the UNLOCK position of the door switch.</li> </ul>	<p>10V or more  → REPLACE actuator — Refer to Section 44-16. REPEAT Quick Test.</p> <p>Under 10V  → SERVICE open or short in Circuit 120 or 118. REPEAT Quick Test.</p>	

CN5605-C



## DIAGNOSIS (Continued)

**PINPOINT TEST E**  
**POWER LOCKS — Continued**

TEST STEP		RESULT	ACTION TO TAKE
<b>E4</b>	<b>ONE OR MORE SWITCHES DO NOT WORK. CHECK CIRCUIT CONTINUITY</b>		
<ul style="list-style-type: none"> <li>• Key Off.</li> <li>• Disconnect green connector from module.</li> <li>• Remove trim panel of the door with the faulty switch.</li> <li>• Check continuity between pin 10 of the green connector and lock position terminal of the door switch (locking circuit 119).</li> <li>• Check continuity between pin 11 of the green connector and unlock position terminal of the door switch (unlocking circuit 120).</li> <li>• Check continuity between ground terminal of the door switch and ground (circuit 57).</li> </ul>		Continuity all circuit 	REPLACE door switch — Refer to Section 44-16. REPEAT Quick Test.
		No continuity any circuits 	SERVICE open in Circuit(s) 119, 120 and/or 57. REPEAT Quick Test.
<b>E5</b>	<b>LOCK WILL ONLY LOCK OR UNLOCK</b>		
<b>E5a</b>	<b>CHECK INPUT CIRCUIT</b>		
<ul style="list-style-type: none"> <li>• Key Off.</li> <li>• Disconnect green connector.</li> <li>• Check circuit 57, ground to switches.</li> <li>• Check continuity between pin 10 (pin 11 if door's won't unlock) of the green connector and ground while pressing the lock (unlock) position of one of the door switches.</li> </ul>		Continuity 	GO to E5b.
		Open circuit from pin 10 or 11 to ground only 	GO to E5c.
		Open circuit for 57 	SERVICE open in wire 57. REPEAT Quick Test.
<b>E5b</b>	<b>CHECK OUTPUT FROM MODULE</b>	VOM Reading:	
<ul style="list-style-type: none"> <li>• Check voltage between pin 8 of the connector (3 for unlock) and ground while pressing the lock (unlock) position of one of the door switches.</li> </ul>		10V or more 	SERVICE open or short in Circuit 117 (118 for unlock). REPEAT Quick Test.
		Under 10V 	REPLACE module. REPEAT Quick Test.
<b>E5c</b>	<b>CHECK DOOR SWITCH FUNCTION</b>		
<ul style="list-style-type: none"> <li>• Check continuity between ground and Circuit 119 for lock (120 for unlock) connection to door locking switch while pressing the lock (unlock) position of the switch.</li> </ul>		Continuity 	SERVICE break in Circuit 119 (120 for unlock problem). REPEAT Quick Test.
		No continuity 	SERVICE door switch — Refer to Section 44-16. REPEAT Quick Test.

## DIAGNOSIS (Continued)

**PINPOINT TEST E**  
**POWER LOCKS — Continued**

TEST STEP		RESULT	ACTION TO TAKE
E6	LOCKS WORK INTERMITTANTLY. CHECK GROUND TO MODULE		
<ul style="list-style-type: none"><li>● Key Off.</li><li>● Disconnect green connector.</li><li>● Check continuity to Ground at pins 5 and 6 of the green connector.</li></ul>		Continuity 	CHECK and SERVICE loose connections. REPEAT Quick Test.
		No continuity 	SERVICE Circuit 57. REPEAT Quick Test.
E7	LOCKS DO NOT WORK IN FREEZING WEATHER		
<ul style="list-style-type: none"><li>● Bring vehicle into heated garage to thaw.</li><li>● Lubricate locks as directed in Step E1.</li><li>● GO to Quick Test to identify further problems.</li></ul>			
E8	LOCKS ONLY WORK WITH ENGINE RUNNING		
<p>Double check the following:</p> <ul style="list-style-type: none"><li>● Battery fully charged.</li><li>● Any latch or linkage binding (See Quick Test).</li><li>● Loose or corroded connections to actuators, switches, keyless entry Module connectors.</li><li>● GO to Quick Test to check for other problems.</li></ul>			

CN5495-B

## DIAGNOSIS (Continued)

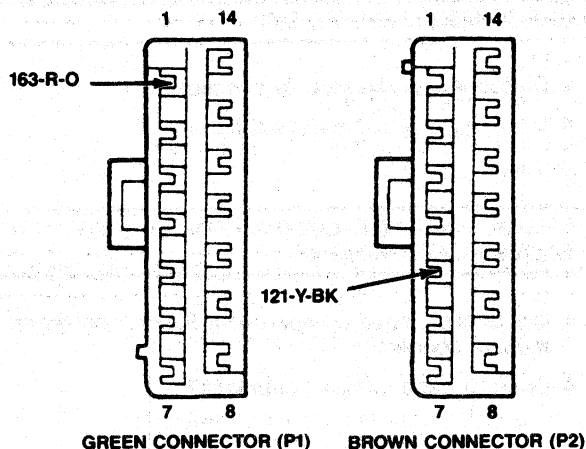
## PINPOINT TEST F

## TRUNK UNLOCK

Perform Test **ONLY** If Instructed To Do So

This PINPOINT TEST Checks:





- Keyless Entry Module
- Luggage Compartment Release Solenoid
- Circuits 121, 163



TEST STEP		RESULT	ACTION TO TAKE
<b>F1</b>	<b>UNLOCK LUGGAGE COMPARTMENT WITH GLOVE COMPARTMENT RELEASE</b>		
	<ul style="list-style-type: none"> <li>• Key on.</li> <li>• Press the Trunk Release Switch in the Glove Compartment.</li> </ul>	Luggage Compartment unlocks (OK) → Luggage Compartment doesn't unlock (X) → Luggage Compartment always unlocked (X) →	GO to F2. GO to F3. GO to F5.
<b>F2</b>	<b>CHECK CIRCUIT 84 CONTINUITY</b>		
	<ul style="list-style-type: none"> <li>• Disconnect the green connector from the module.</li> <li>• Test for continuity between Pin 7 of the green connector and the luggage compartment release solenoid.</li> </ul>	Continuity (OK) → No continuity (X) →	REPLACE module. REPEAT Quick Test. SERVICE Circuit 84. REPEAT Quick Test.
<b>F3</b>	<b>CHECK LUGGAGE COMPARTMENT RELEASE SOLENOID</b>		
	<ul style="list-style-type: none"> <li>• Check luggage compartment release solenoid. — Refer to Group 44.</li> </ul>	(OK) → (X) →	GO to F4. REPLACE solenoid. REPEAT Quick Test.
<b>F4</b>	<b>CHECK CIRCUIT BREAKER NO. 12</b>		
	<ul style="list-style-type: none"> <li>• Examine circuit breaker No. 12.</li> </ul>	(OK) → (X) →	SERVICE open or short in Circuit 84. REPEAT Quick Test. REPLACE circuit breaker. REPEAT Quick Test.

## DIAGNOSIS (Continued)

**PINPOINT TEST F**  
**LUGGAGE COMPARTMENT UNLOCK — Continued**

TEST STEP		RESULT	ACTION TO TAKE
<b>F5</b>	<b>CHECK FOR SHORTED MODULE</b>		
<ul style="list-style-type: none"> <li>• Disconnect green module connector.</li> <li>• Does luggage compartment lock?</li> </ul>		YES	 REPLACE module. REPEAT Quick Test.
		NO	 GO to F6.
<b>F6</b>	<b>CHECK LUGGAGE COMPARTMENT SWITCH IN GLOVE COMPARTMENT</b>		
<ul style="list-style-type: none"> <li>• Disconnect Glove Compartment Switch and green module connector.</li> <li>• Does luggage compartment lock?</li> </ul>		YES	 REPLACE Glove Compartment Switch. REPEAT Quick Test.
		NO	 SERVICE short to battery in Circuit 84. REPEAT Quick Test.

CN5606-C

## SPECIAL SERVICE TOOLS

ROTUNDA EQUIPMENT	
Model	Description
Rotunda 014-00407	DVOM

CK7276-B

# **TRIM, INTERIOR**

# **GROUP 45**

(70000)

SECTION TITLE	PAGE	SECTION TITLE	PAGE
CARPETS AND FLOOR MATS .....	45-26-1	INSTRUMENT PANEL .....	45-61-1
CONSOLE—FLOOR .....	45-31-1	MOULDINGS .....	45-16-1
CONSOLE—ROOF .....	45-35-1	PACKAGE TRAY .....	45-21-1
HEADLINING .....	45-41-1	TRIM PANELS, INTERIOR .....	45-03-1

## SECTION 45-03 Trim Panels, Interior

SUBJECT	PAGE	SUBJECT	PAGE
<b>REMOVAL AND INSTALLATION</b>		<b>REMOVAL AND INSTALLATION (Cont'd.)</b>	
Trim Panel, Liftgate .....	45-03-14	Trim Panels, Door .....	45-03-2
Trim Panel, Lower Rear Corner, LH .....	45-03-13	Trim Panels, Scuff Plate/Lower Body	
Trim Panel, Quarter .....	45-03-8	Center Pillar .....	45-03-6
Trim Panel, Roof Side Rear .....	45-03-8	<b>SPECIAL SERVICE TOOLS</b> .....	45-03-14
Trim Panels, Cowl Side .....	45-03-6	<b>VEHICLE APPLICATION</b> .....	45-03-1

### VEHICLE APPLICATION

Taurus/Sable.

### REMOVAL AND INSTALLATION

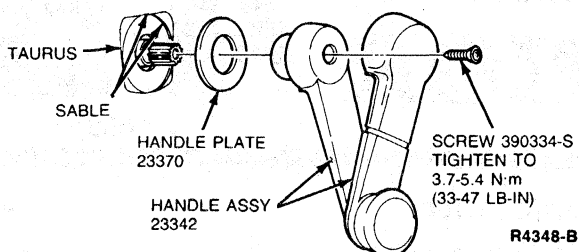
The trim panel Removal and Installation procedures generally apply to all models. If some of the Steps do not apply to the particular model being serviced, proceed to the next Step.

## REMOVAL AND INSTALLATION (Continued)

## Trim Panels, Door

## Removal and Installation

1. Remove window regulator handle by unsnapping handle cover from base to expose attaching screw. Remove screw, handle and wearplate.

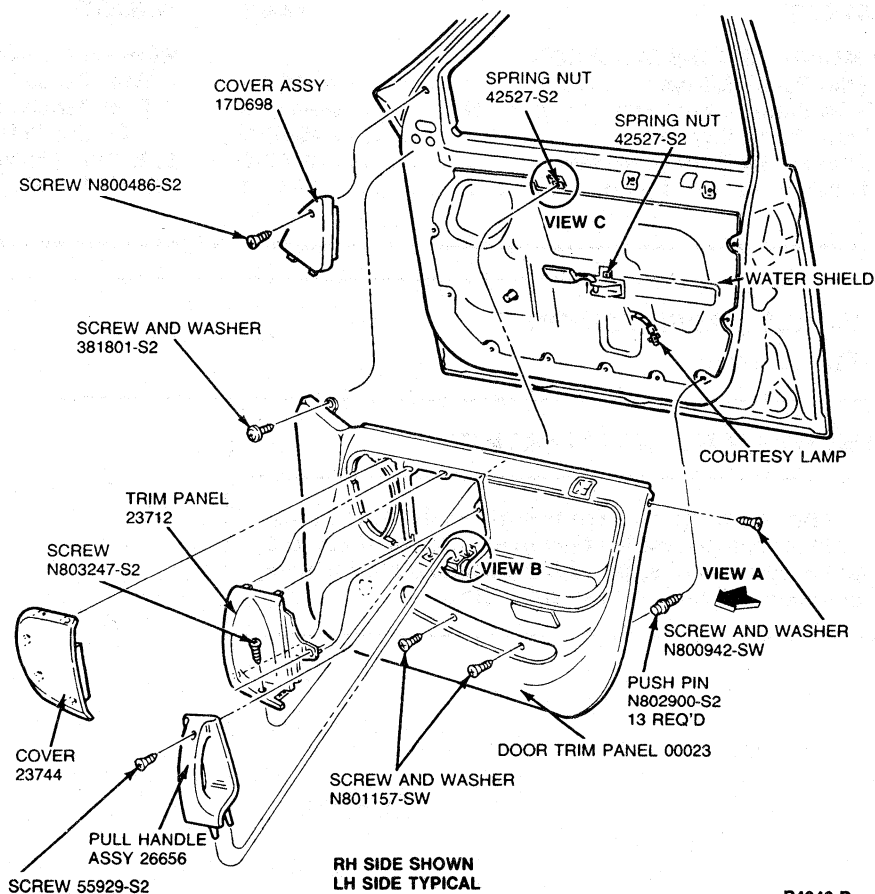
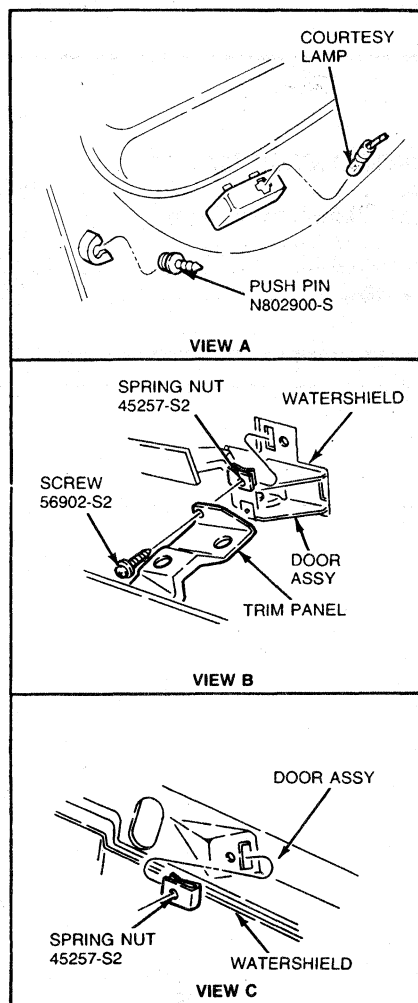


2. Remove door pull handle retaining screws and handle.

3. Remove upper trim panel retaining screws and remove panel.
4. On Taurus vehicles, remove trim panel opening cover.
5. Remove exterior rearview mirror mounting hole cover retaining screw and cover.
6. Remove all screws retaining door trim panel to door, and using a Trim Pad Removing Tool from Rotunda Moulding/Trim Kit 062-00004 or equivalent, pry trim panel retaining push pins from door inner panel.
7. If trim panel is to be replaced, transfer all push pins to new panel. Replace any bent, broken or missing push pins.
8. To install, reverse the Removal procedures.

## Door, Front

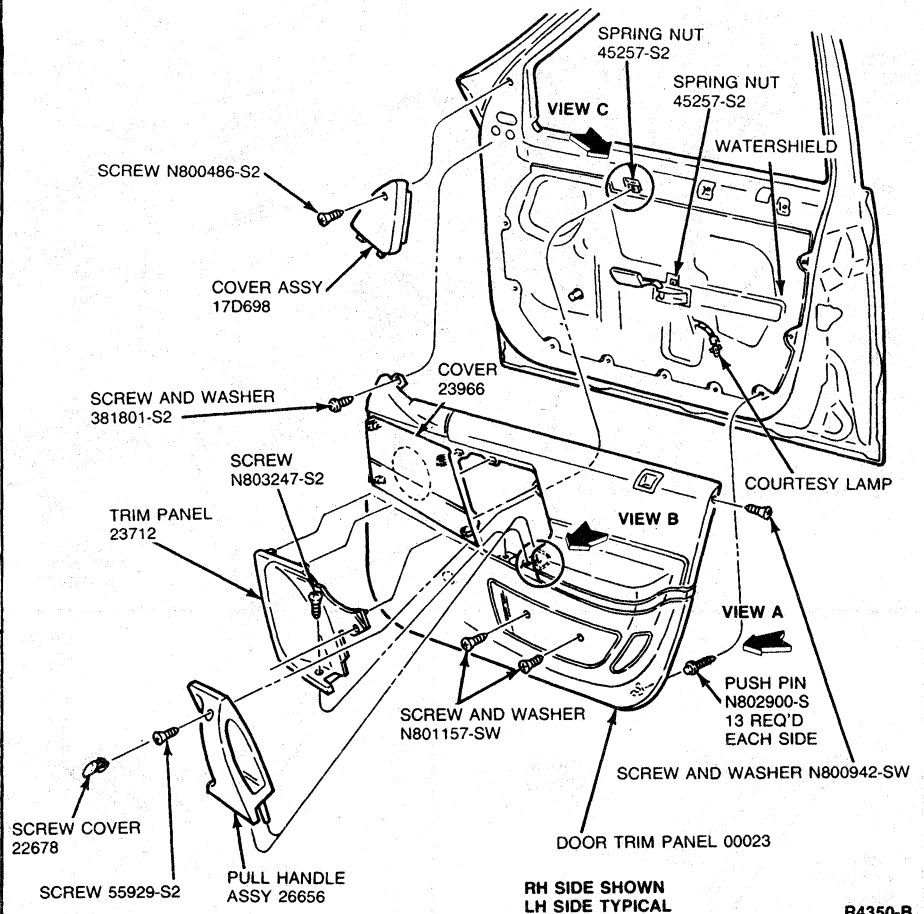
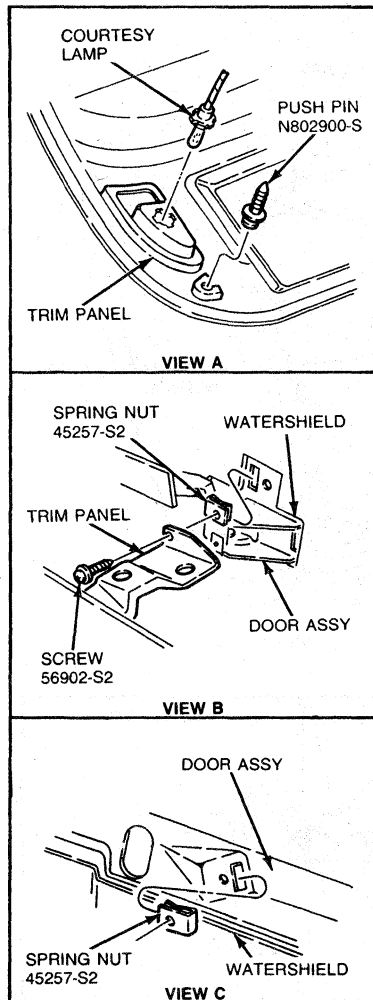
## Taurus





## REMOVAL AND INSTALLATION (Continued)

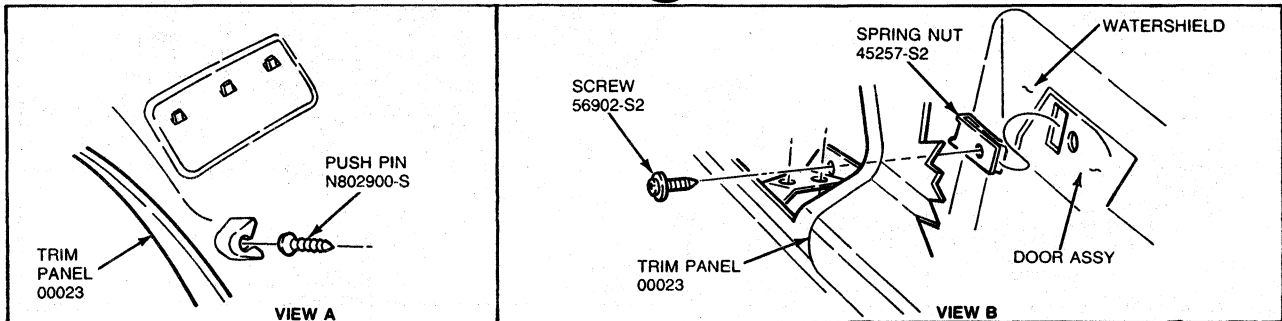
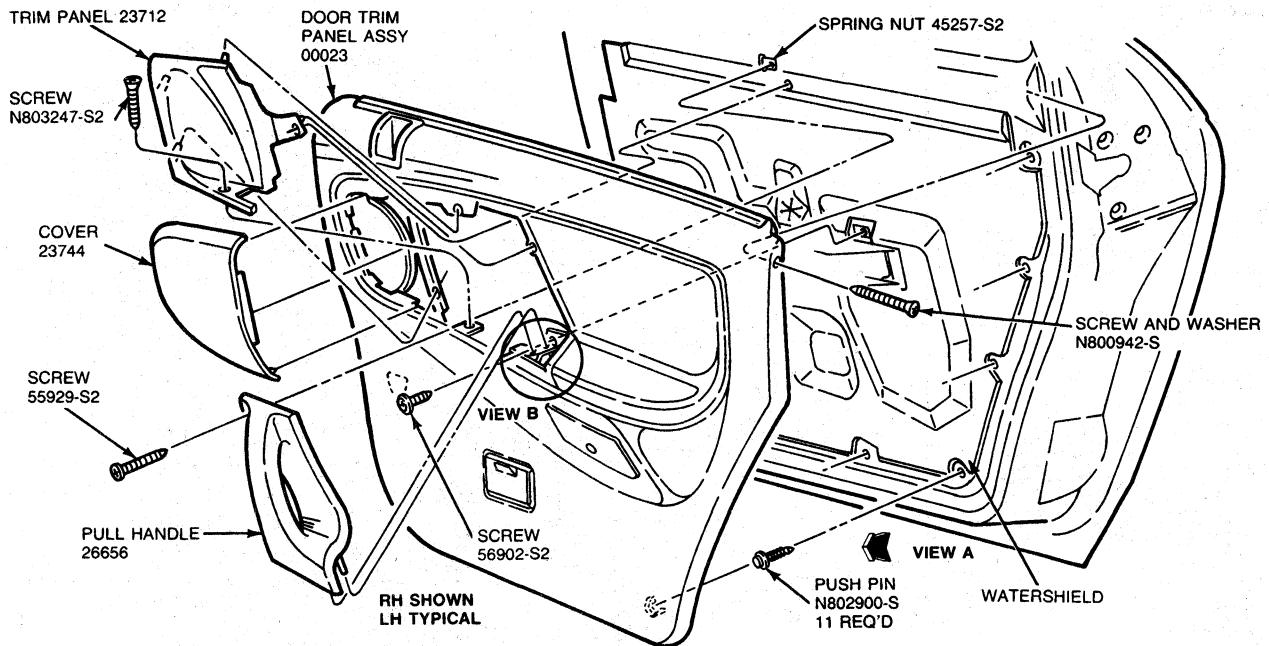
## Sable



## REMOVAL AND INSTALLATION (Continued)

## Door, Rear

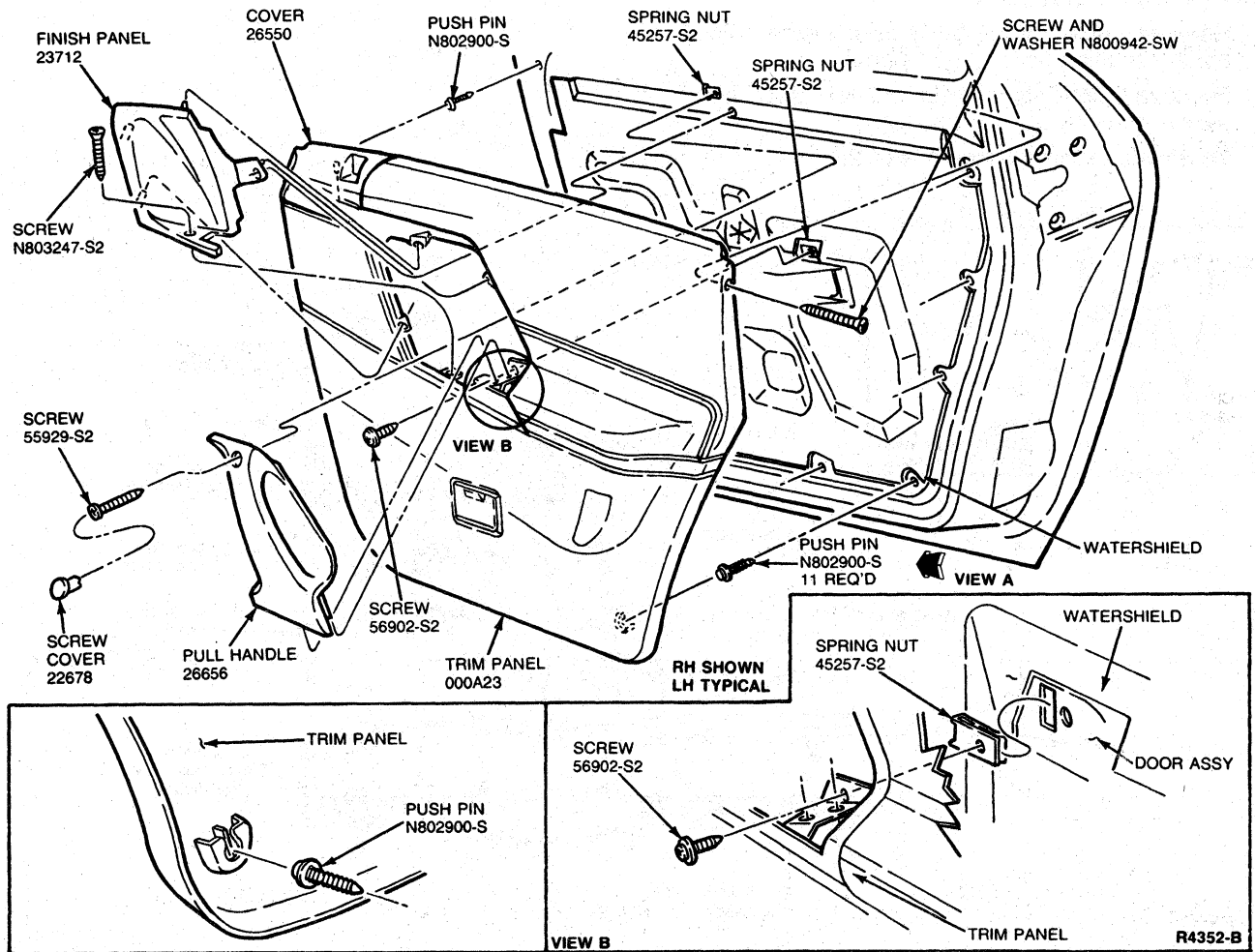
## Taurus



R4351-B

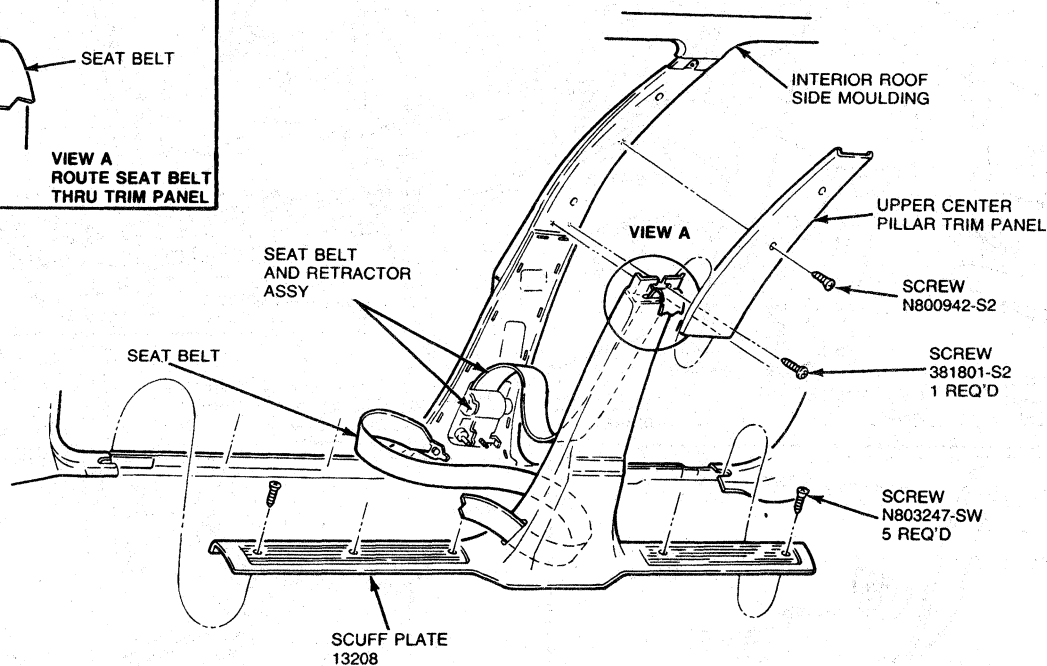
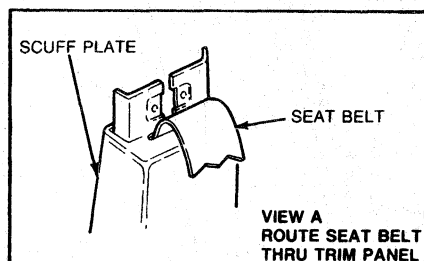
## REMOVAL AND INSTALLATION (Continued)

## Sable



**REMOVAL AND INSTALLATION (Continued)****Trim Panels, Scuff Plate/Lower Body Center Pillar****Removal and Installation**

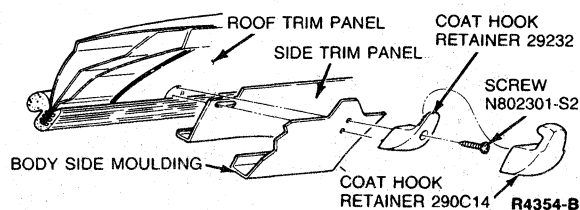
1. Remove upper center body pillar inside finish panel retaining screws and panel.
2. Remove scuff plate/lower center pillar trim panel retaining screws and panel.
3. To install, reverse Steps 1 and 2.



R4353-B

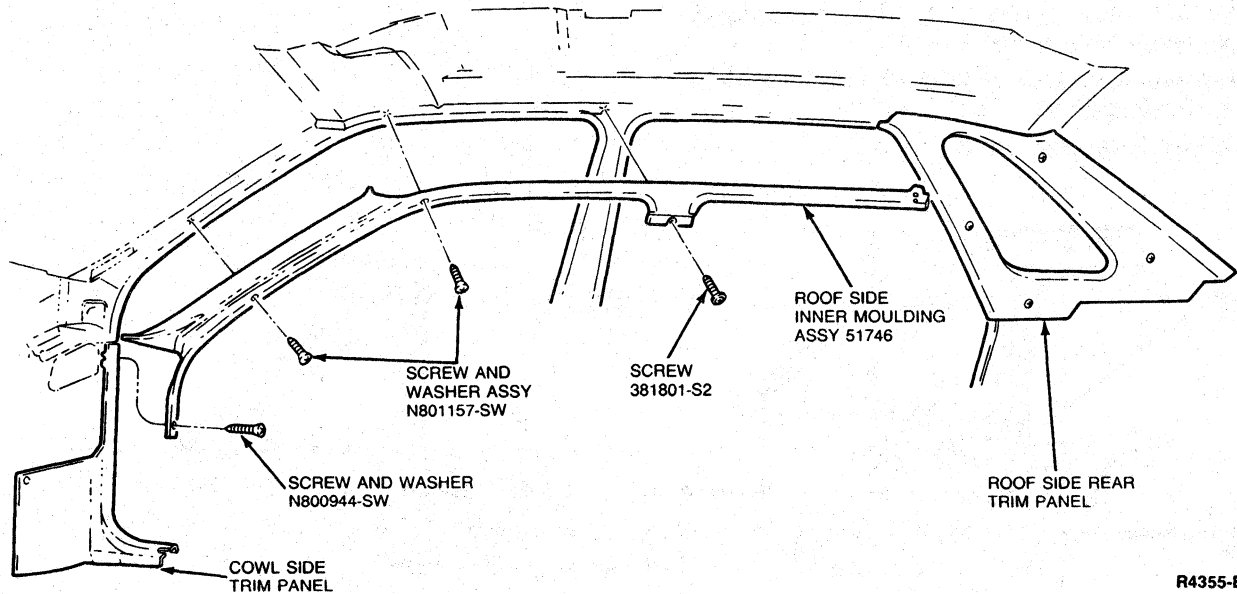
**Trim Panels, Cowl Side****Removal and Installation**

1. Remove center body pillar finish panels as outlined.
2. Remove coat hook and coat hook retainer screws.



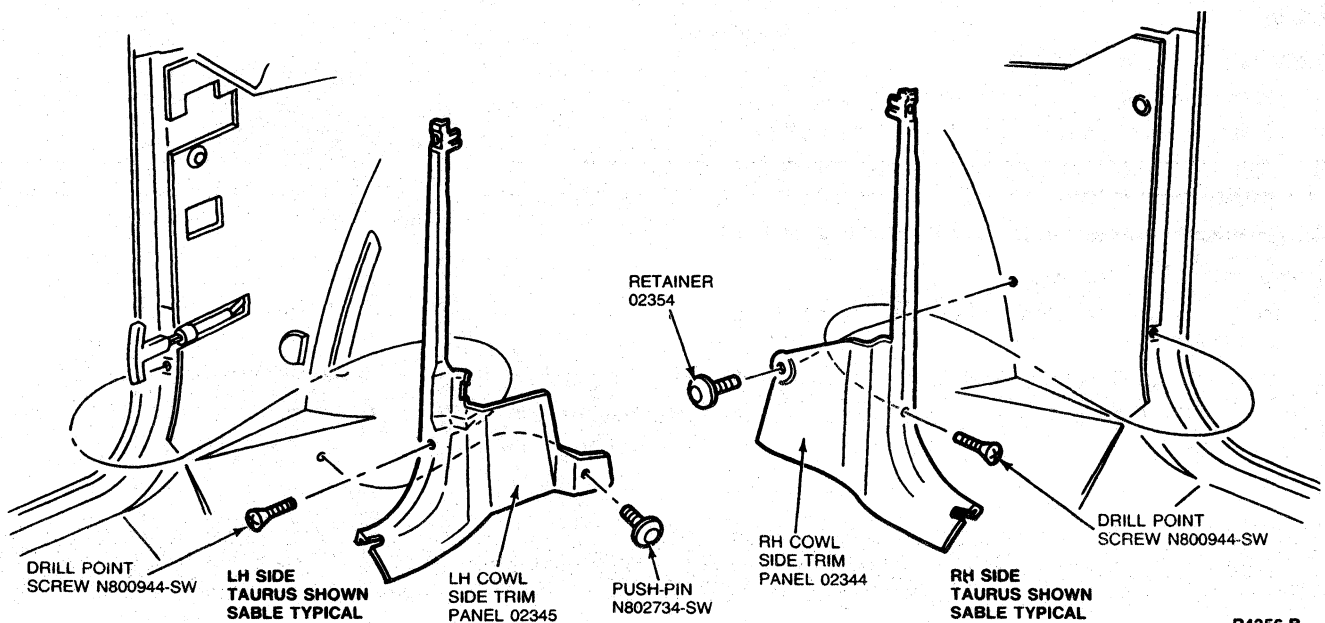
**REMOVAL AND INSTALLATION (Continued)**

3. Remove interior roof side moulding retaining screws and moulding.



R4355-B

4. Remove cowl side trim panel retaining screws and panel.
5. To install, reverse Steps 1 through 4.



R4356-B

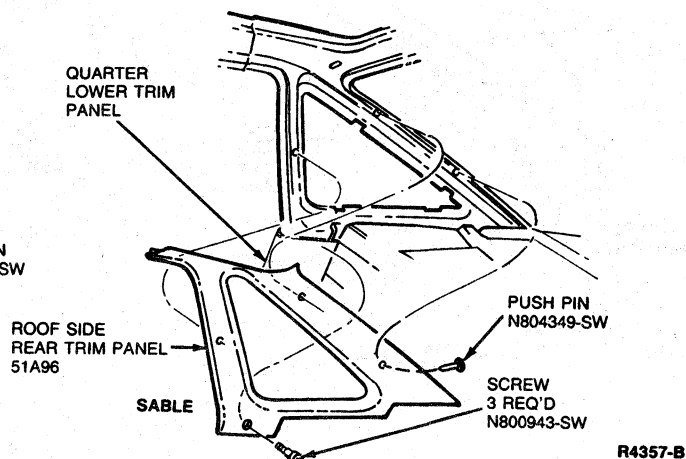
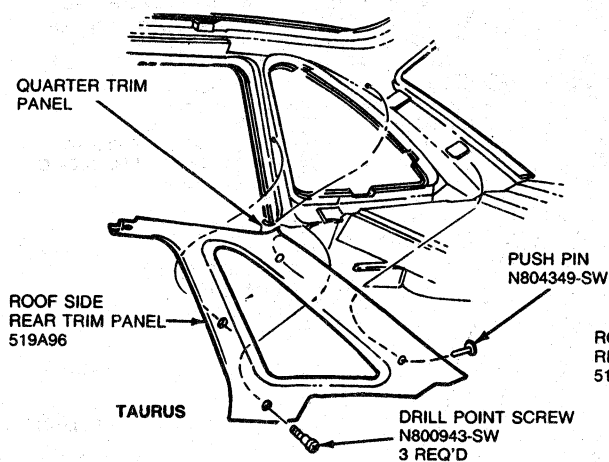
## REMOVAL AND INSTALLATION (Continued)

## Trim Panel, Roof Side Rear

## Sedan

## Removal and Installation

1. Remove coat hooks and interior roof side mouldings as outlined.
2. Remove roof side rear trim panel retaining screws and panel.
3. To install, reverse Steps 1 and 2.

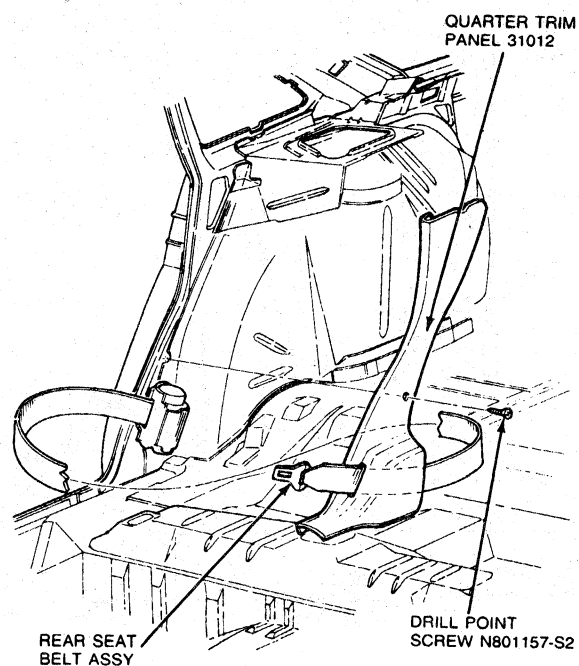


## Trim Panel, Quarter

## Sedan

## Removal and Installation

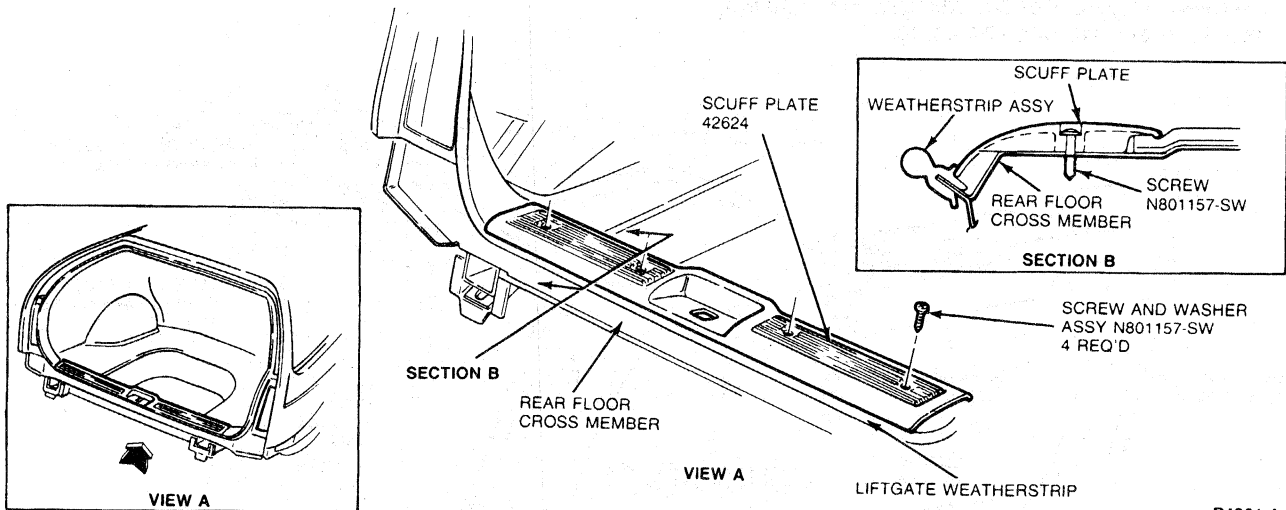
1. Remove rear seat. Refer to Section 41-14.
2. Remove roof side rear trim panel as outlined.
3. Remove scuff plate/lower center pillar trim panel as outlined.
4. Remove quarter trim panel retaining screws and panel.
5. To install, reverse Steps 1 through 4.





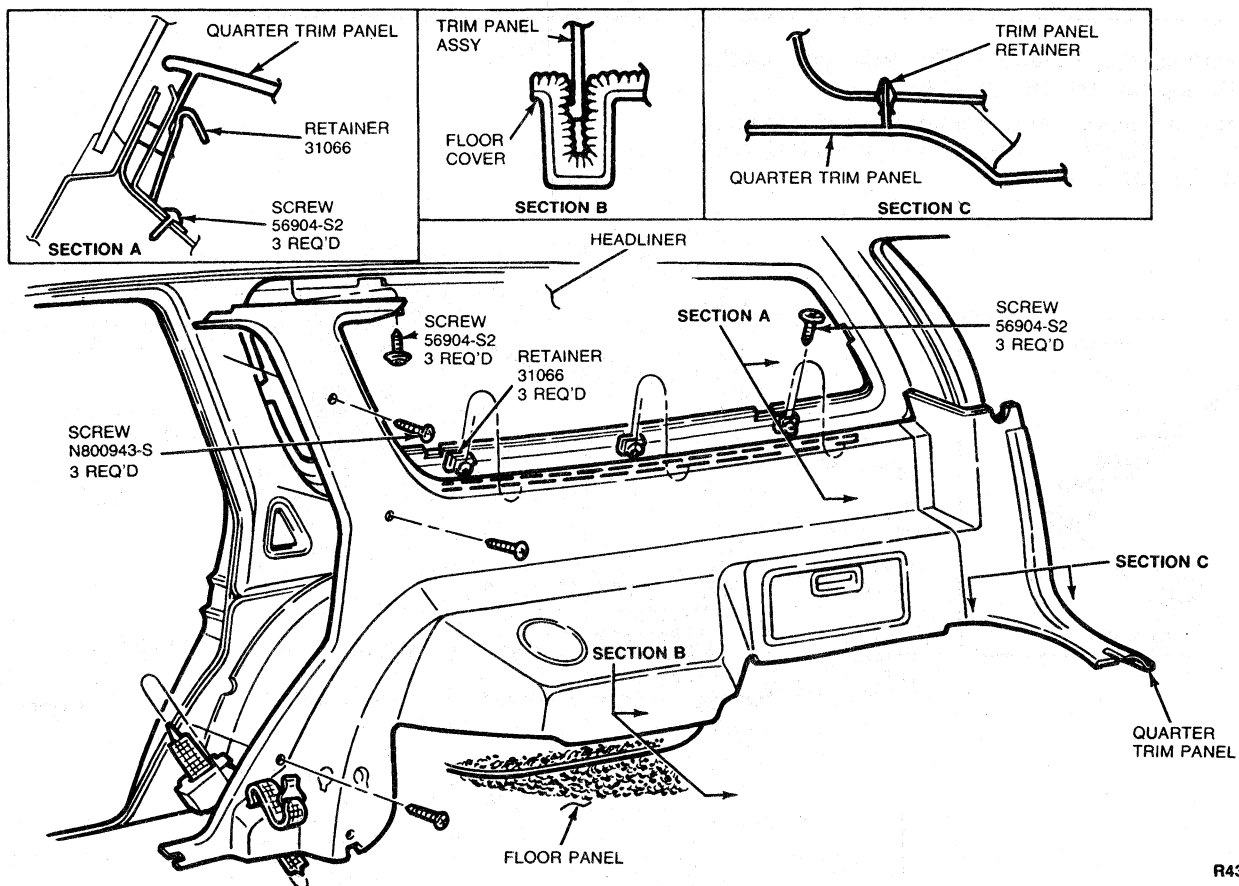
## REMOVAL AND INSTALLATION (Continued)

6. Remove center body pillar mouldings and roof side mouldings as outlined.
7. Remove liftgate scuff plate retaining screws and scuff plate.
8. Remove spare wheelcover retaining screws and cover (LH side, if so equipped).
9. Remove quarter trim panel retaining screws and panel.
10. To install, reverse Steps 1 through 9.



R4361-A

RH

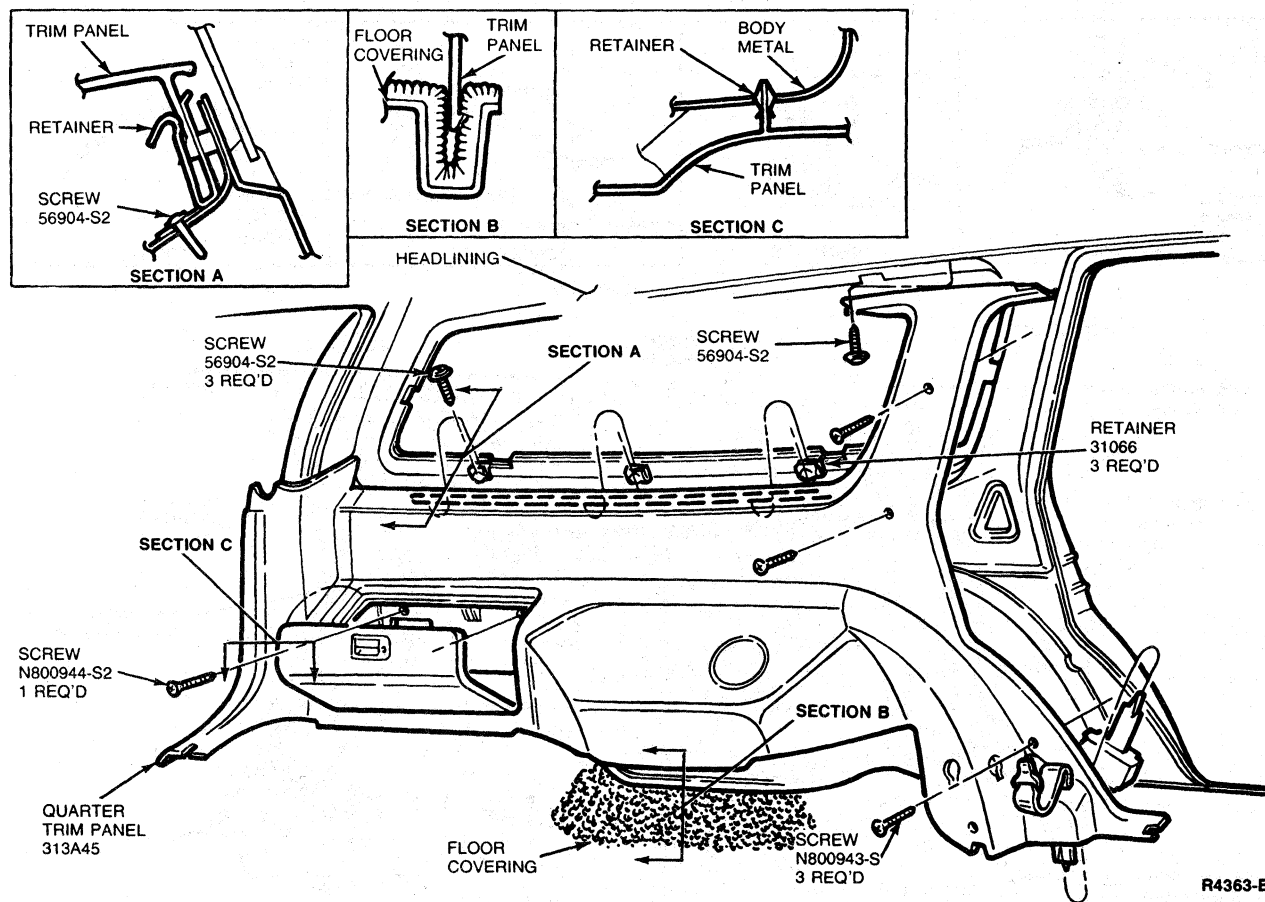


R4362-B



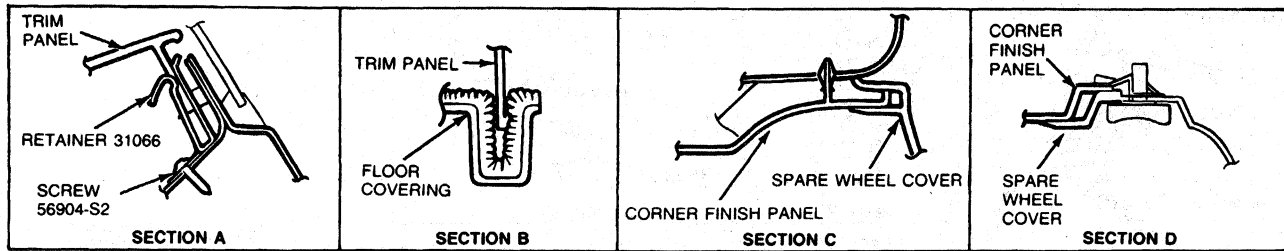
## REMOVAL AND INSTALLATION (Continued)

LH

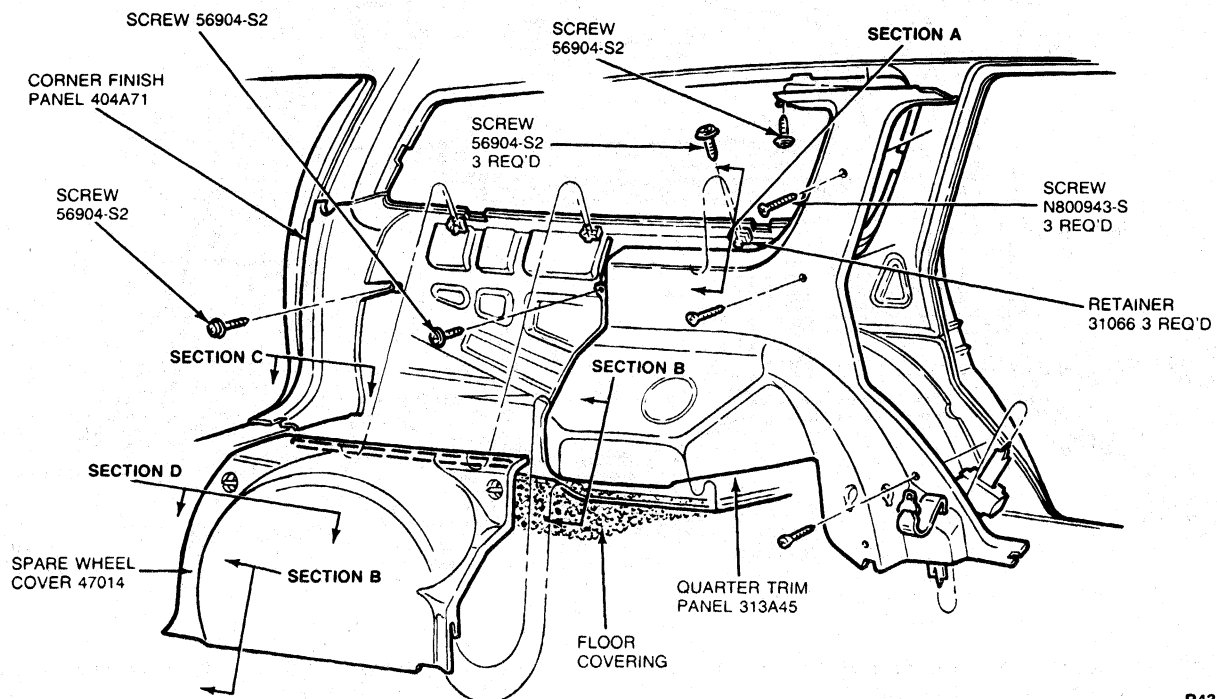


## REMOVAL AND INSTALLATION (Continued)

## LH, Optional



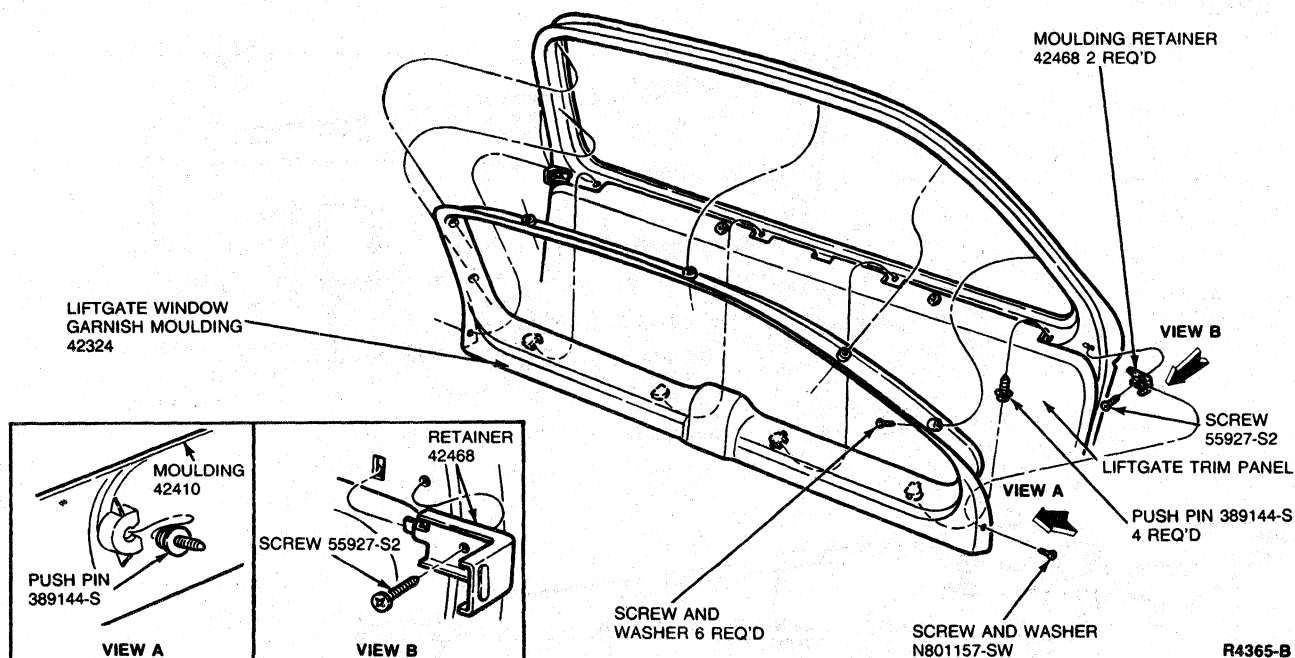
## HEADLINING



R4364-A

**REMOVAL AND INSTALLATION (Continued)****Trim Panel, Lower Rear Corner, LH****Wagon****Removal and Installation**

1. Remove roof side inner rear moulding retaining screws and moulding as outlined.
2. Remove liftgate header rail garnish moulding retaining screws and moulding.

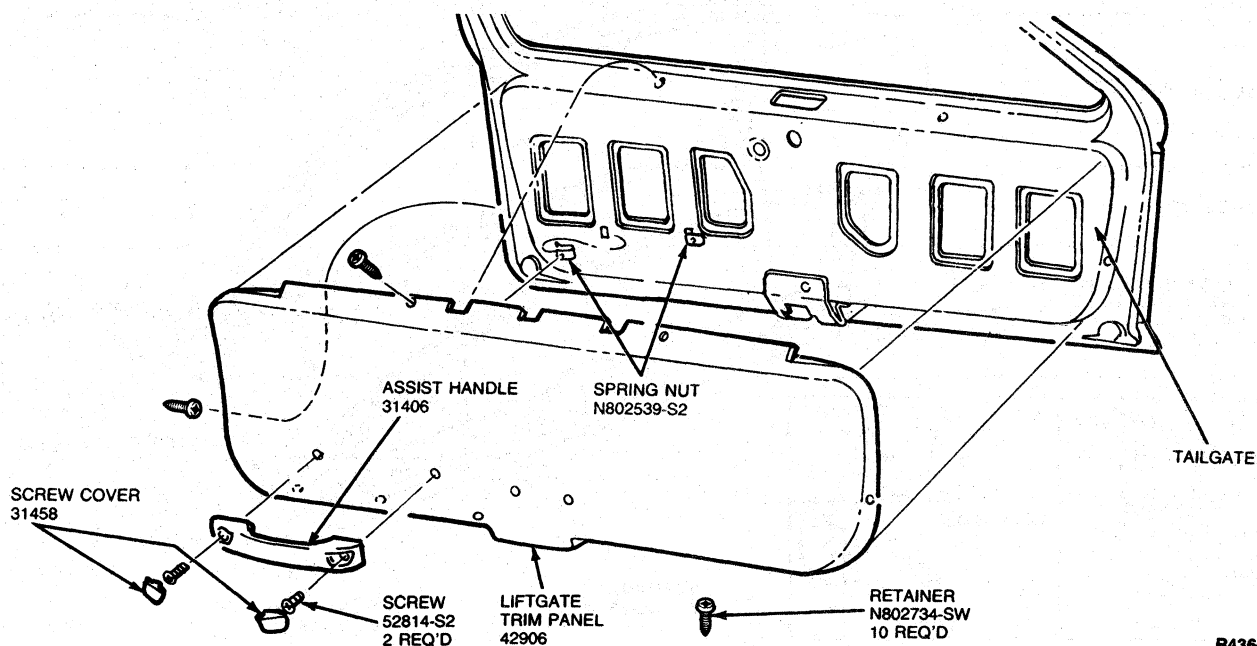


R4365-B

3. Remove rear corner upper finish panel retaining screws and panel as outlined.
4. Remove spare wheelcover retaining screws and cover as outlined.
5. Remove quarter trim panel retaining screws and panel as outlined.
6. Remove liftgate scuff plate retaining screws and plate as outlined.
7. Remove rear corner inner lower finish panel retaining screws and panel.
8. To install, reverse Steps 1 through 7.

**REMOVAL AND INSTALLATION (Continued)****Trim Panel, Liftgate****Removal and Installation**

1. Disconnect rear defroster wires (RH and LH).
2. Remove liftgate window garnish moulding retaining screws and moulding as shown under Lower Rear Corner Trim Panel, Removal and Installation, Step 2.
3. Remove liftgate assist handle retaining screws and handle.
4. Using the Trim Pad Removing Tool from Rotunda Moulding/Trim Kit 062-00004 or equivalent, pry out ten push pins retaining liftgate trim panel. Remove panel.
5. To install, reverse Steps 1 through 4. Replace any bent or damaged push pins.



R4366-B

**SPECIAL SERVICE TOOLS****ROTUNDA EQUIPMENT**

Model	Description
062-00004	Moulding/Trim Kit

CR4558-A

# SECTION 45-16 Mouldings

SUBJECT	PAGE	SUBJECT	PAGE
DESCRIPTION .....	45-16-1	REMOVAL AND INSTALLATION (Cont'd.)	
REMOVAL AND INSTALLATION		Moulding, Scuff Plate/Body Center Pillar ....	45-16-1
Finish Panel, Upper Rear Corner .....	45-16-3	Trim Panel, Roof Side Rear .....	45-16-2
Moulding, A-Pillar/Roof Side Rail .....	45-16-2	VEHICLE APPLICATION .....	45-16-1

## VEHICLE APPLICATION

Taurus/Sable.

## DESCRIPTION

This Section covers removal and installation of interior mouldings. In most instances, one moulding overlaps another moulding. When this occurs, it will

be necessary to loosen or remove the overlapping moulding before removal of the desired moulding.

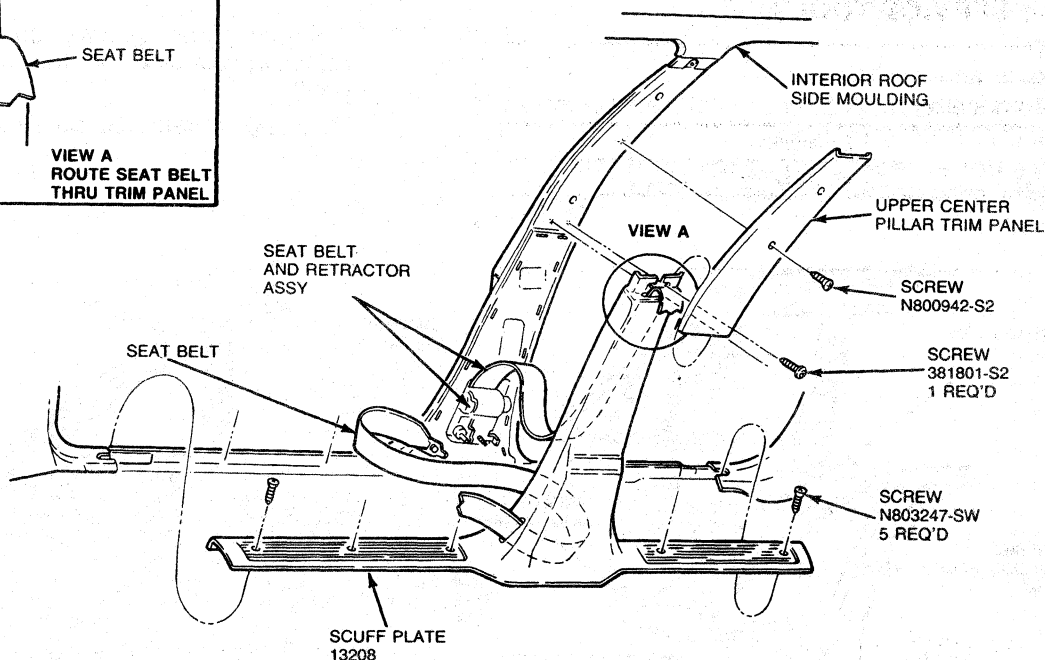
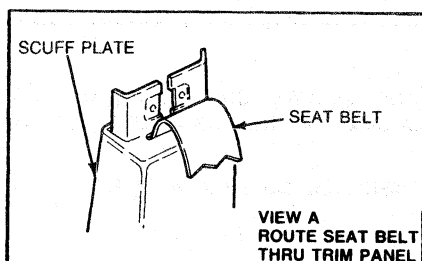
## REMOVAL AND INSTALLATION

### Moulding, Scuff Plate/Body Center Pillar

#### Removal and Installation

1. Remove three screws retaining upper center pillar moulding and remove moulding.

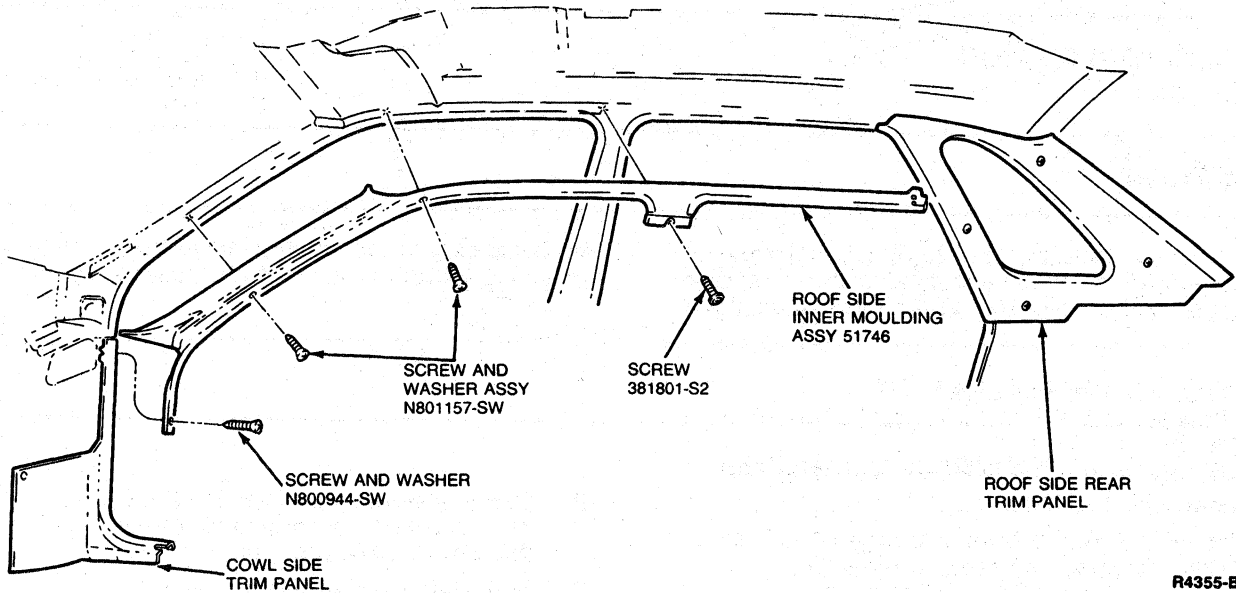
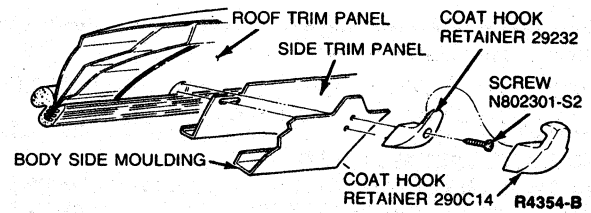
2. Remove five screws retaining scuff plate/lower center pillar moulding and thread seat belt through moulding to remove.
3. To install, reverse Steps 1 and 2.



## REMOVAL AND INSTALLATION (Continued)

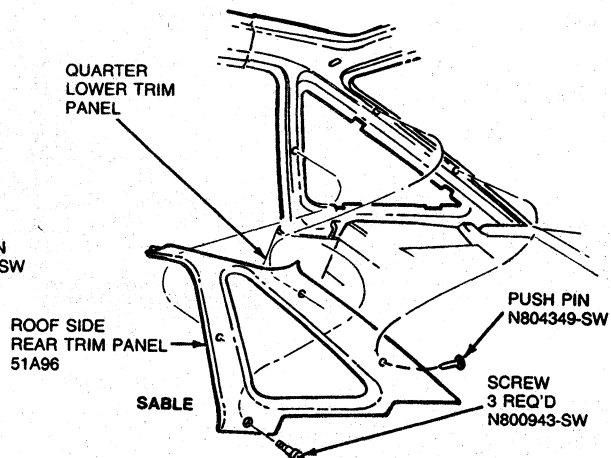
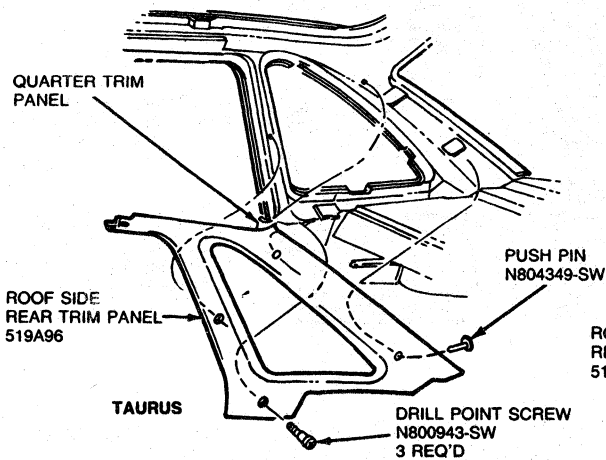
**Moulding, A-Pillar/Roof Side Rail****Removal and Installation**

1. Remove upper body center pillar moulding screws and moulding.
2. Remove coat hooks and coat hook retainer screws and retainer.
3. Remove four A-pillar/roof side rail moulding retaining screws and moulding.
4. To install, reverse Steps 1 through 3.

**Trim Panel, Roof Side Rear****Sedan****Removal and Installation**

1. Remove coat hook, coat hook retainer screw and retainer as outlined.
2. Remove rear seat back and cushion assemblies. Refer to Section 41-14.

3. Remove three screws and one push pin retaining roof side rear trim panel and remove panel.
4. To install, reverse Steps 1 through 3.



R4357-B

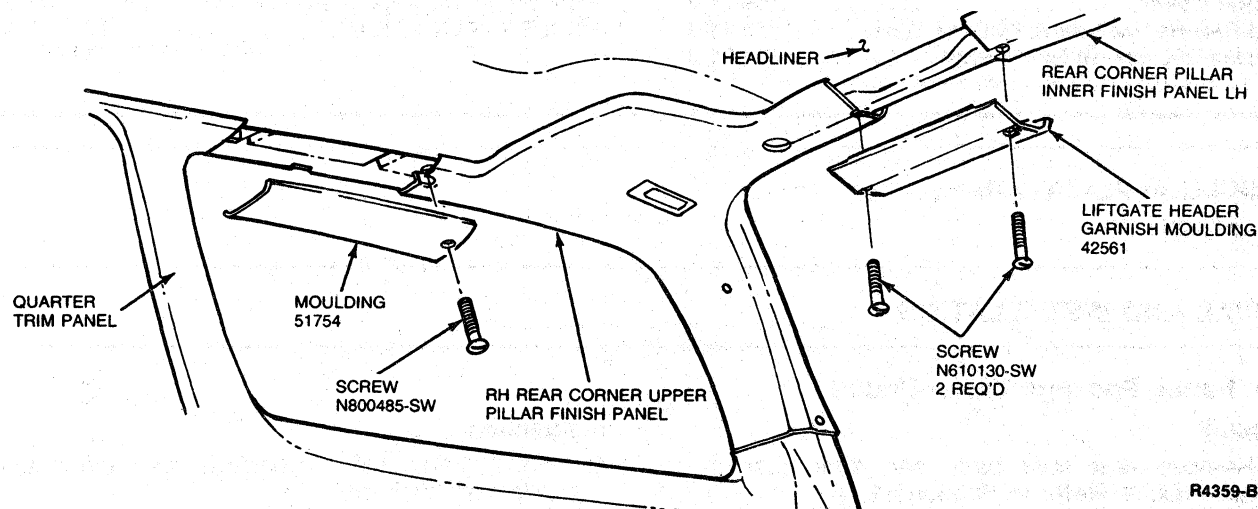
## REMOVAL AND INSTALLATION (Continued)

## Finish Panel, Upper Rear Corner

## Wagon

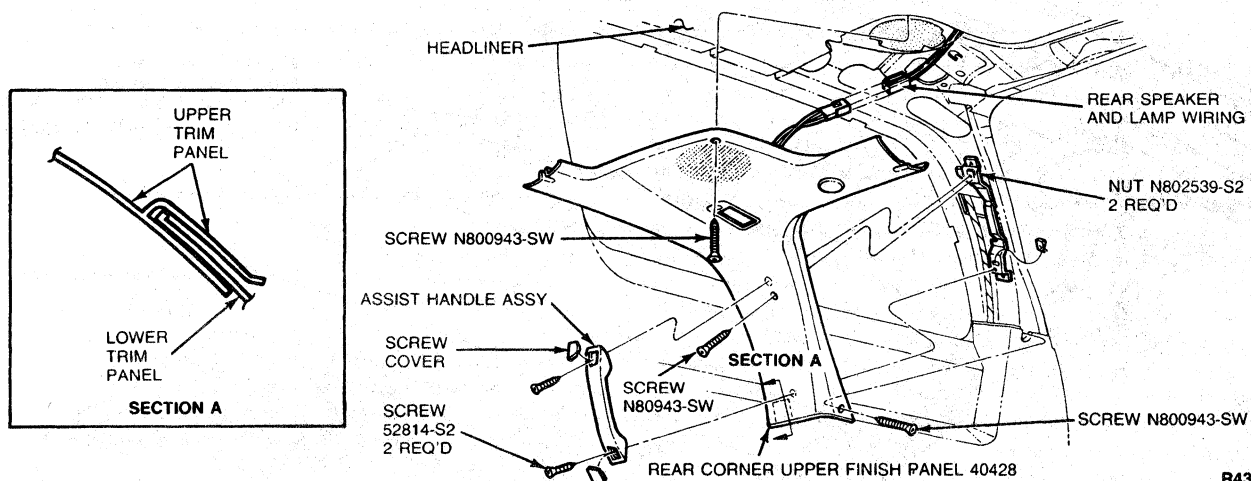
## Removal and Installation

1. Remove liftgate header rail garnish moulding retaining screws and moulding.



R4359-B

2. Remove assist handle retaining screws and handle.
3. Remove screws retaining corner finish panel and pull panel far enough away to disconnect wiring connectors. Disconnect wiring and remove panel.
4. To install, reverse Steps 1 through 3.



R4360-A

# SECTION 45-21 Package Tray

SUBJECT	PAGE	SUBJECT	PAGE
<b>REMOVAL AND INSTALLATION</b>		<b>REMOVAL AND INSTALLATION (Cont'd.)</b>	
Luggage Cover .....	45-21-2	Trim Panel, Package Tray—Sedan .....	45-21-1
End Cap Replacement, Roll-Up Type .....	45-21-3	VEHICLE APPLICATION .....	45-21-1
Retractable Spring Rewinding .....	45-21-3		

## VEHICLE APPLICATION

Taurus/Sable.

## REMOVAL AND INSTALLATION

### Trim Panel, Package Tray—Sedan

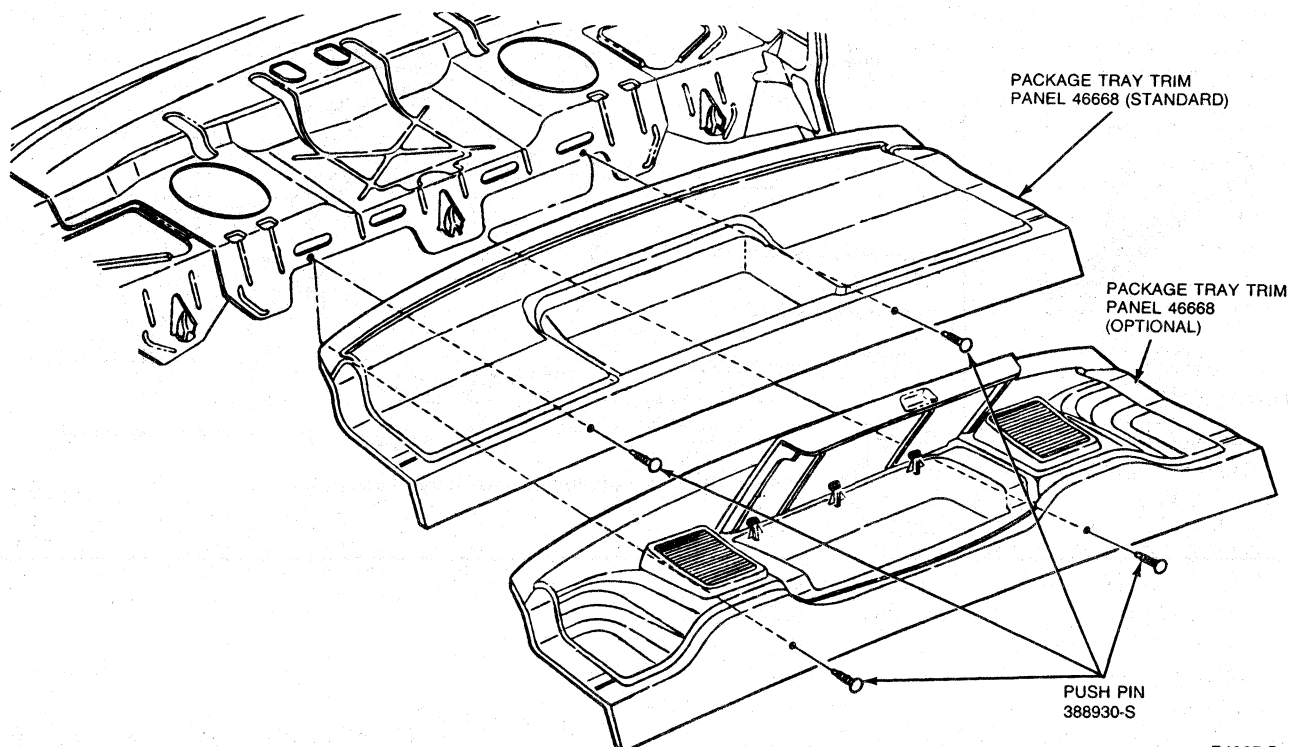
#### Removal

1. Remove rear seat back and seat cushion assemblies. Refer to Section 41-14.
2. Remove rear seat head restraints, if so equipped. Refer to Section 41-40.
3. Remove push pins retaining package tray trim panel.
4. Remove trim panel by pulling panel forward and slightly upward from package tray.

#### Taurus

#### Installation

1. Position trim panel to package tray and install retaining push pins.
2. Install head restraints, if so equipped. Refer to Section 41-40.
3. Install rear seat back and cushion assemblies. Refer to Section 41-14.

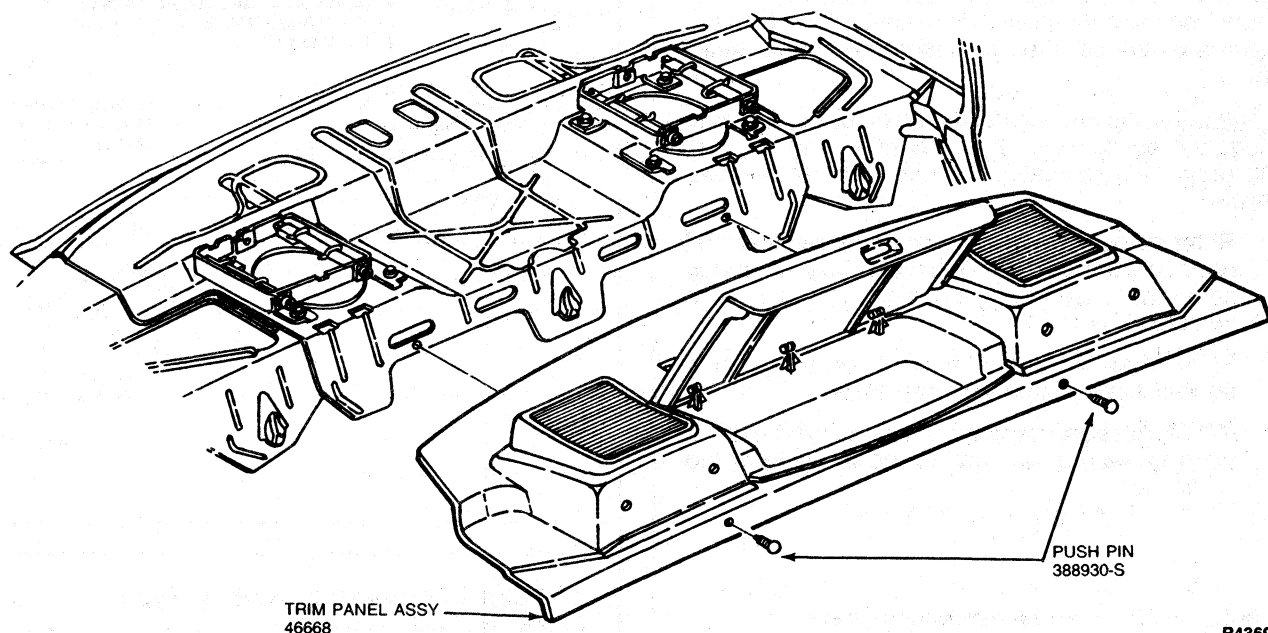


R4367-B



## REMOVAL AND INSTALLATION (Continued)

## Sable



R4369-B

## Luggage Cover

## Wagon

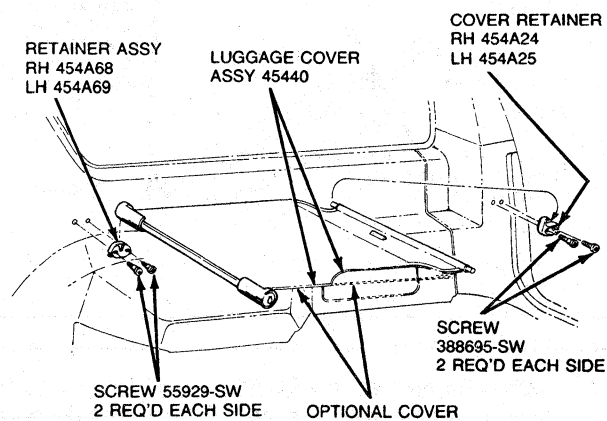
## Removal

1. Raise liftgate to full open position.
2. Grasp shade handle and pull it slightly forward to disengage hooked sides of outstretched cover from its retainers on quarter trim panels. Allow shade to retract on its roller.
3. Disengage cover roller from its side mounting brackets. Remove luggage cover assembly from vehicle.

NOTE: The luggage cover on 4-door wagon models should be removed from the vehicle when not in use. That is, when the luggage cover is not attached to its side mounting brackets.

## Installation

1. Raise liftgate to full open position.
2. Position luggage cover into its side mounting brackets, located behind rear seat back (when seat back is in UP position). When installed, shade roller should face upward.
3. Grasp shade handle and pull luggage cover. Hook sides of outstretched cover to retainers on quarter trim panels.
4. Close liftgate.



R4368-B

## REMOVAL AND INSTALLATION (Continued)

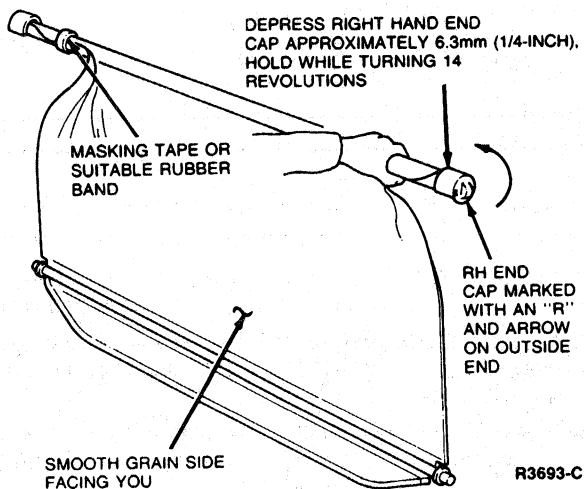
### Retractable Spring Rewinding

The retractable luggage cover contains a pre-wound torsion spring which is wound up more as the cover is extended, thus providing the spring return action.

The following procedure should be used to rewind a luggage cover which has lost all spring tension. This procedure can easily be accomplished with two people.

1. Remove cover from luggage cover retainer and remove from vehicle. Start with fully extended cover with smooth grain side up, as it is in vehicle.
2. Fold edges of the vinyl toward center and hold so that edges clear end cap slots.

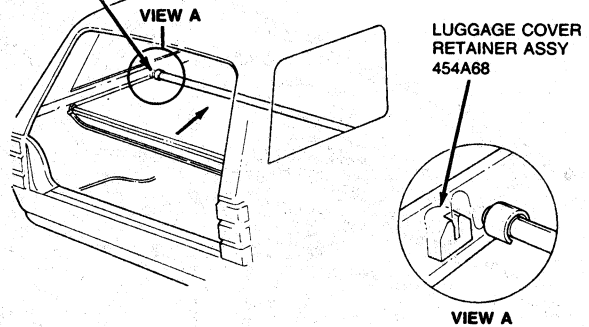
NOTE: Masking tape or a rubber band can be used to secure the vinyl to the left side of the roller tube.



3. While holding vinyl and roller tube, depress right end cap (marked with an "R" on outside end) approximately 6.53mm (1/4-inch) to disengage clutch. Then, turn 14 revolutions in direction shown. For reference, wind direction is also marked on the outside end of end cap.
4. Release right end cap. This should engage clutch and prevent loss of spring tension. Unfold vinyl and replace it in end cap slots.
5. With vinyl fully retracted, insert luggage cover retainer. Note that right retainer bracket opening is narrower than left.
6. Check for proper operation of luggage cover.

LUGGAGE COVER RETAINER ASSY 454A68

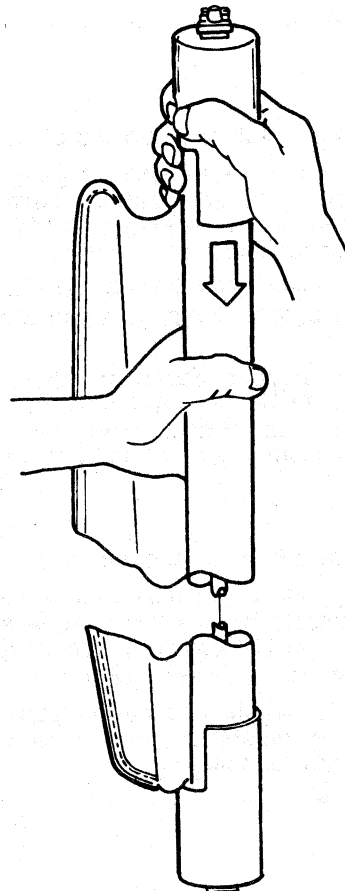
POSITION ROLL-UP LUGGAGE COVER IN MOUNTING BRACKETS AND ALLOW IT TO RETRACT



### End Cap Replacement, Roll-Up Type

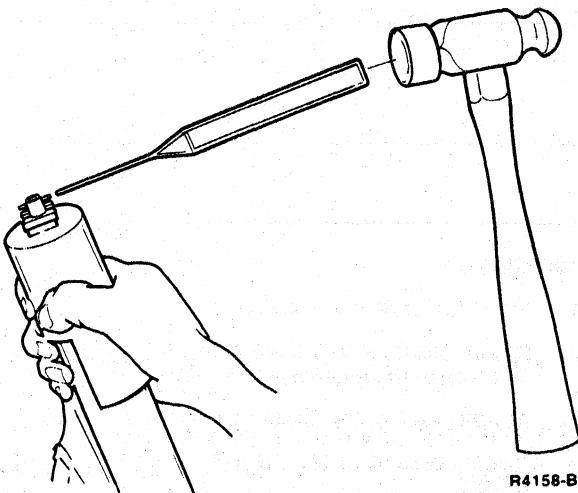
NOTE: Prior to replacing the end cap on a roll-up type luggage cover assembly, the cover fabric must be fully retracted. This may require an assistant.

1. Position cover assembly on end.



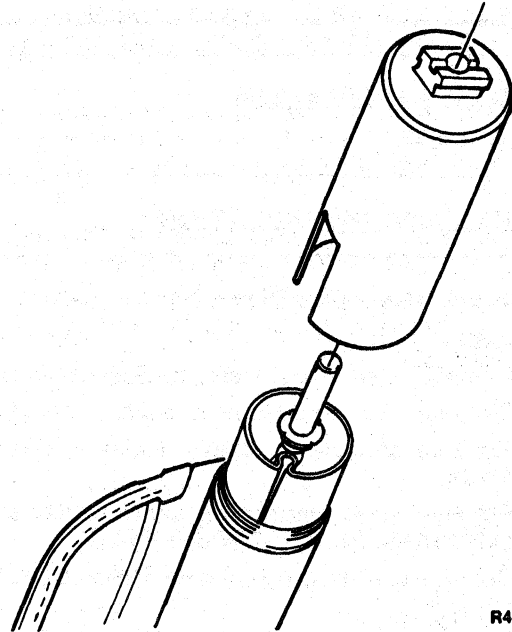
**REMOVAL AND INSTALLATION (Continued)**

2. Depress end cap until roll pin, used to retain end cap to center (metal tube), is exposed. (Maintain pressure through Step 3.)
3. Using a 3/32-inch punch, drive out roll pin and remove end cap.



NOTE: Prior to installing replacement cap, make sure no burr exists on center (metal) tube.

4. Position replacement end cap to center (metal) tube. Then, while depressing opposite end of center tube, drive roll pin until it is centered in tube.



NOTE: Make sure end cap can be compressed and returns without dragging on roll pin.

5. In the event cover assembly should lose torsion spring pre-wind, follow spring rewind instructions as outlined.
6. If both end caps are to be replaced, complete Steps for one cap, then repeat for other cap.

## SECTION 45-26 Carpets and Floor Mats

SUBJECT	PAGE	SUBJECT	PAGE
REMOVAL AND INSTALLATION .....	45-26-1	VEHICLE APPLICATION .....	45-26-1

### VEHICLE APPLICATION

Taurus/Sable.

### REMOVAL AND INSTALLATION

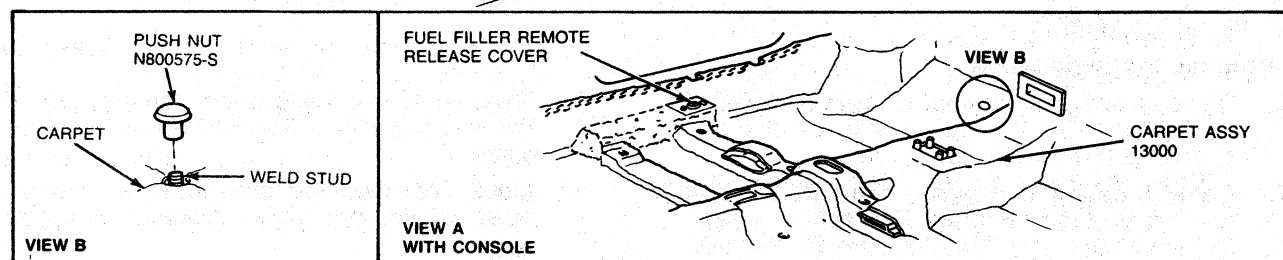
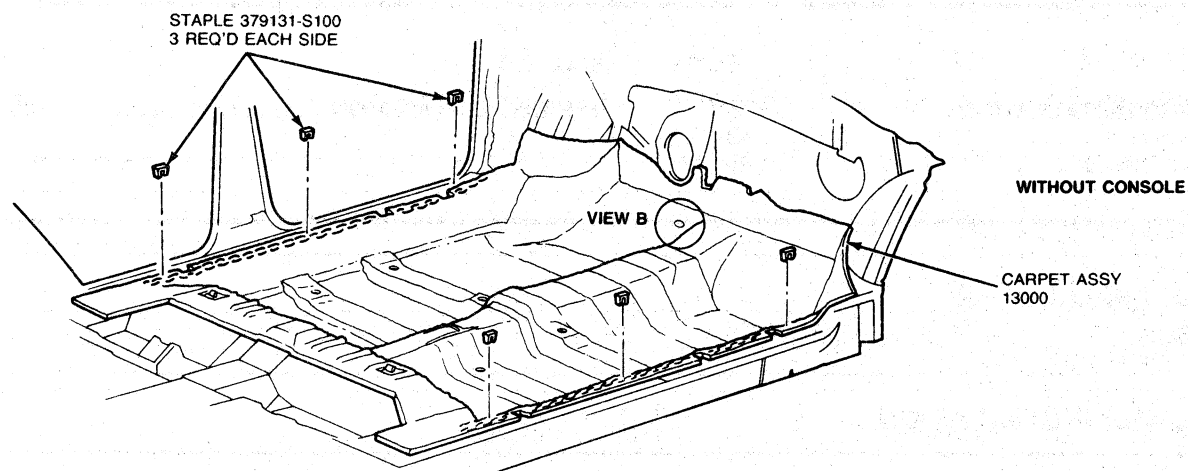
#### Front and Rear—One Piece

##### Removal

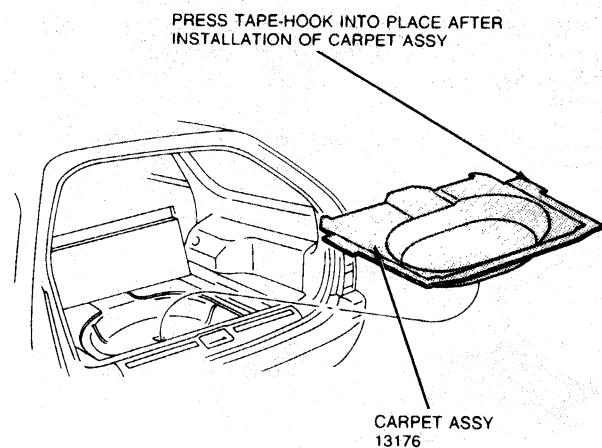
1. Remove front seats. Refer to Section 41-01.
2. Remove rear seat. Refer to Section 41-14.
3. Remove console assembly. Refer to Section 45-31.
4. Remove scuff plate/lower body center pillar trim panels. Refer to Section 45-03.
5. Remove cowl side trim panels. Refer to Section 45-03.
6. Remove quarter trim panels. Refer to Section 45-03.
7. Remove seat belts, as required. Refer to Section 41-50.
8. Remove pushnut from weld stud on dash panel (underneath accelerator pedal).
9. Remove fuel filler remote release cover.
10. Remove carpets and floor mats.

##### Installation

1. Position carpet in vehicle.
2. Install push nut on weld stud on dash panel (underneath accelerator pedal).
3. Install seat belts. Refer to Section 41-50.
4. Install quarter trim panels. Refer to Section 45-03.
5. Install cowl side trim panels. Refer to Section 45-03.
6. Install scuff plate/lower body center pillar trim panels. Refer to Section 45-03.
7. Install fuel filler remote release cover.
8. Install console assembly. Refer to Section 45-31.
9. Install rear seat. Refer to Section 41-14.
10. Install front seats. Refer to Section 41-01.

**REMOVAL AND INSTALLATION (Continued)****Carpet, Floor—Front**

R4338-B

**Carpet, Luggage Compartment  
Station Wagon**

R4339-A

# SECTION 45-31 Console—Floor

SUBJECT	PAGE	SUBJECT	PAGE
REMOVAL AND INSTALLATION		VEHICLE APPLICATION .....	45-31-1
Console Armrest .....	45-31-2		
Console Assembly .....	45-31-1		

## VEHICLE APPLICATION

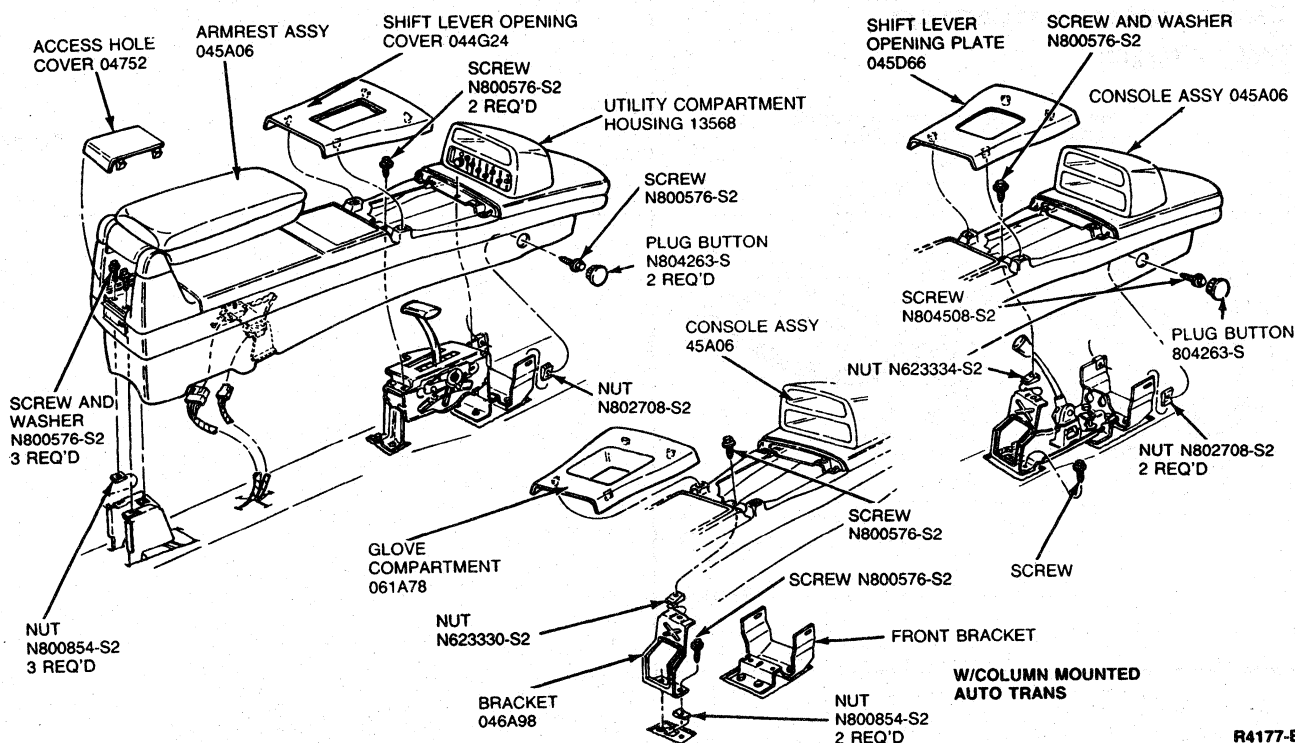
Taurus/Sable.

## REMOVAL AND INSTALLATION

### Console Assembly

#### Removal and Installation

1. Remove two plug buttons located on base of console near front of console to expose two attaching screws. Remove screws.
2. Remove gear shift opening panel (snaps out) and console-to-floor bracket attaching screws (one screw with floor-mounted manual transmission and column-mounted automatic transmission, and two screws with floor-mounted auto shifter).
3. Remove rear access panel (snaps out) and three console-to-floor bracket attaching screws.
4. Move floor-mounted shift lever to rearward-most position and slide console rearward and up.
5. Disconnect all necessary electrical connectors and remove console.
6. To install, reverse Steps 1 through 5.



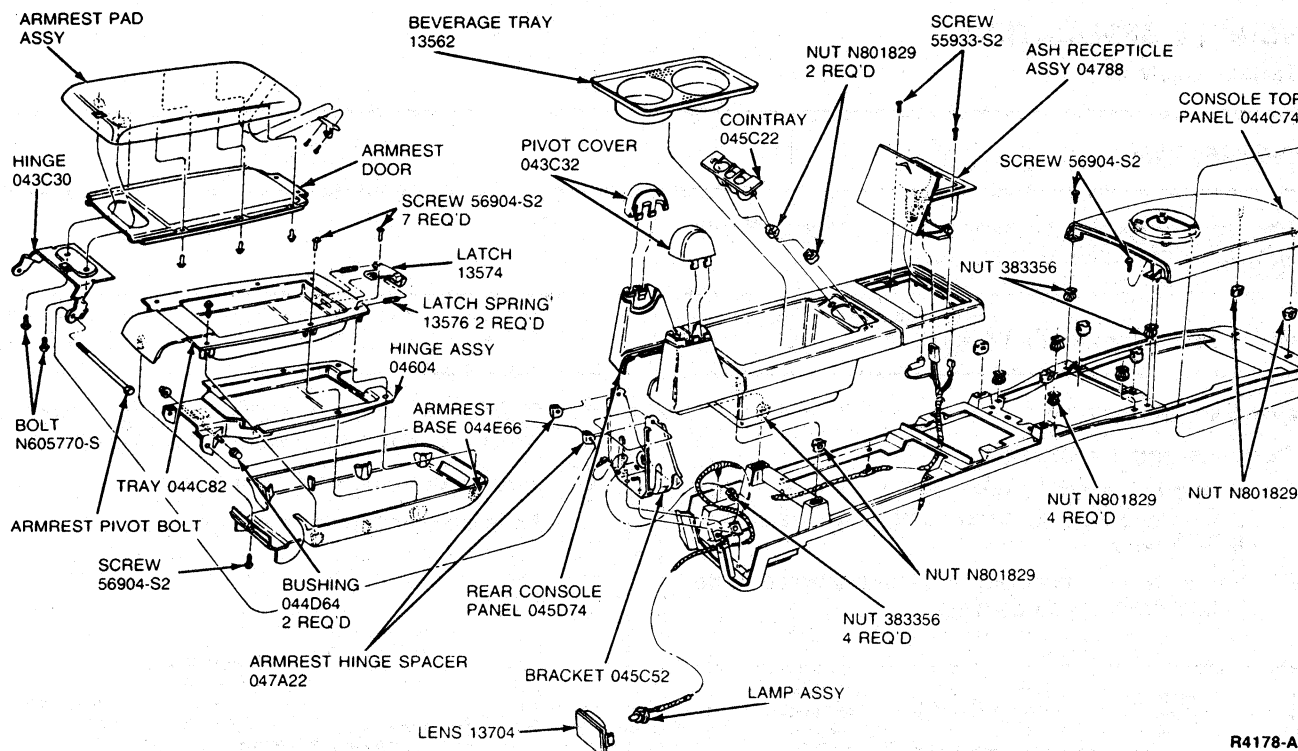
R4177-B

## REMOVAL AND INSTALLATION (Continued)

## Console Armrest

## Removal and Installation

1. Open armrest door and remove two hinge-to-door retaining screws. Remove armrest door.
2. Remove both hinge covers (snap off) to expose armrest base-to-mounting bracket attaching bolt.
3. Remove base and armrest base.
4. To install, reverse Steps 1 through 3.



R4178-A

# SECTION 45-35 Console—Roof

SUBJECT	PAGE	SUBJECT	PAGE
DESCRIPTION .....	45-35-1	VEHICLE APPLICATION .....	45-35-1
REMOVAL AND INSTALLATION			
Console Assembly .....	45-35-1		

## VEHICLE APPLICATION

Taurus/Sable.

## DESCRIPTION

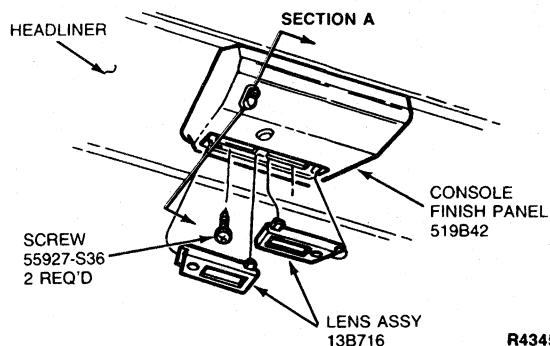
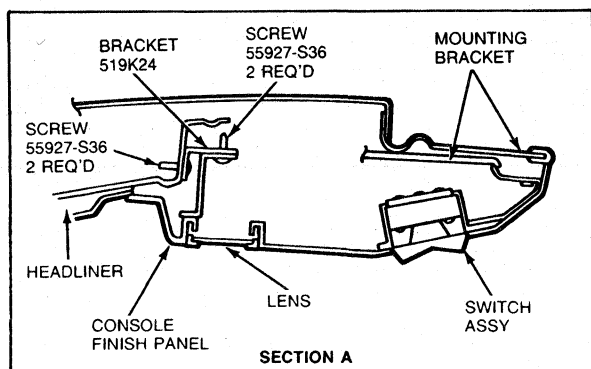
The roof console is standard on Taurus/Sable vehicles with optional moon roof.

## REMOVAL AND INSTALLATION

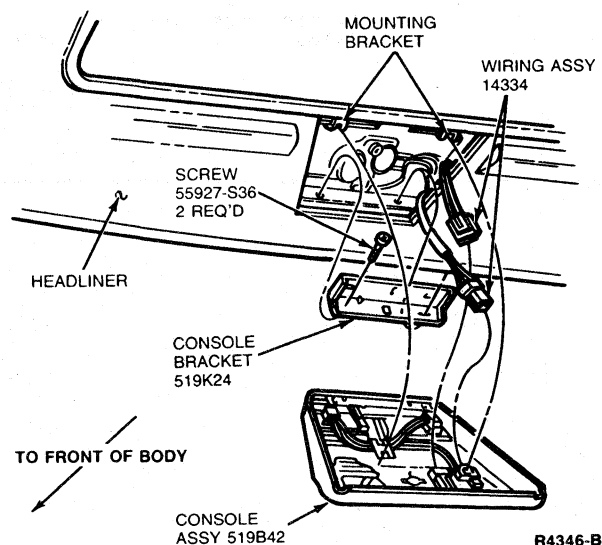
### Console Assembly

#### Removal and Installation

1. Remove lamp lenses by inserting a flat screwdriver in one of the notches on the side of the lenses.
2. Remove two console retaining screws (one inside each lens opening).



3. Remove console by sliding up and to rear of vehicle to disengage from mounting bracket.
4. Disconnect electrical connections.
5. To install, reverse Steps 1 through 4.





# SECTION 45-41 Headlining

SUBJECT	PAGE	SUBJECT	PAGE
REMOVAL AND INSTALLATION		REMOVAL AND INSTALLATION (Cont'd.)	
Headliner .....	45-41-2	Sun Visor with Lamp .....	45-41-3
Headlining .....	45-41-1	VEHICLE APPLICATION .....	45-41-1

## VEHICLE APPLICATION

Taurus/Sable.

## REMOVAL AND INSTALLATION

The headlining removal and installation procedures generally apply to all models. If one or more of the Steps do not apply to a particular model, proceed to the next Step.

Before removing headlining on wagons, the liftgate weatherstrip, and the quarter window glass and weatherstrip assemblies must be removed. When installing the headlining, start at the liftgate and move toward front of vehicle.

NOTE: If the vehicle is equipped with assist handles, they must be removed during the replacement procedure.

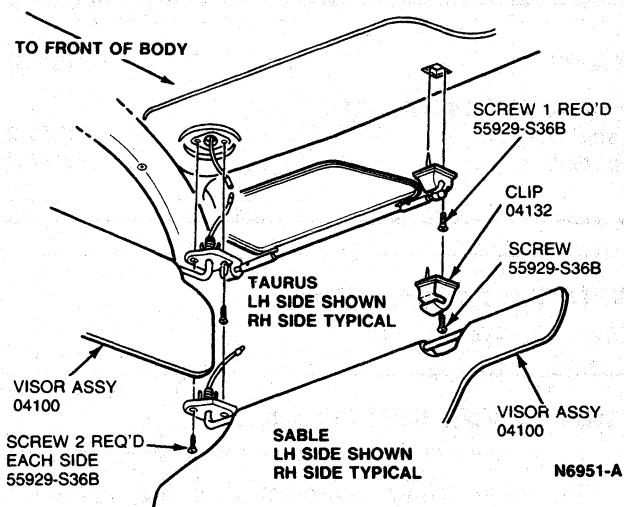
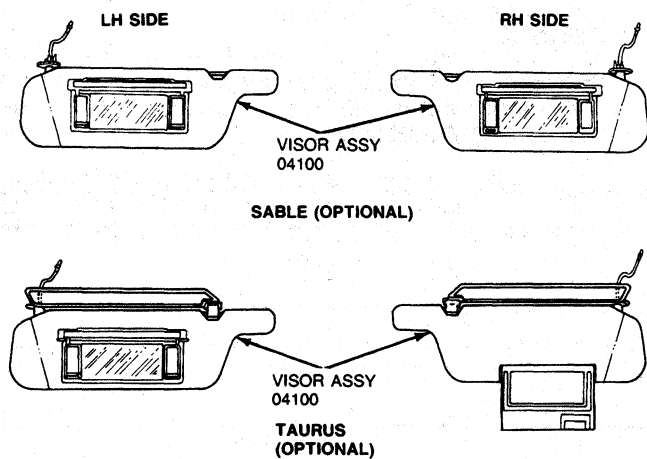
### Headlining

#### Removal and Installation

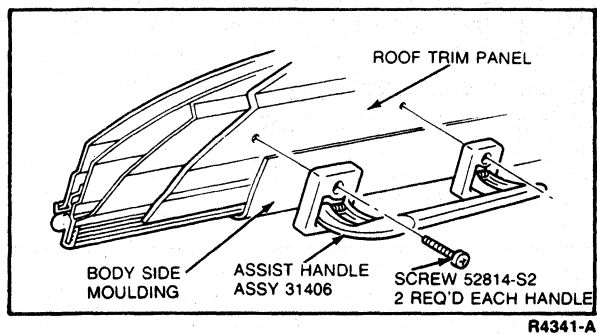
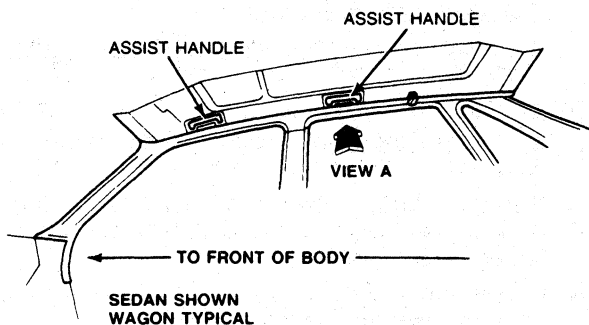
1. Remove front seats. Refer to Section 41-01.
2. Remove rear seat. Refer to Sections 41-14 and 41-20.
3. Remove RH and LH sun visor retaining screws and disconnect electrical leads (if equipped with lighted vanity) and remove visors.
4. Remove visor arm clip retaining screws and remove clips.
5. Remove roof console, if so equipped. Refer to Section 45-35.
6. Remove all dome lamps. Refer to Section 32-60.
7. Remove roof rail assist handles (two screws each).
8. Remove center body pillar inside finish panel. Refer to Section 45-03.
9. Remove coat hooks and roof side rail retaining screws and remove hooks and rails (both sides). Refer to Section 45-16.
10. Remove roof headlining retaining screws (if equipped with moon roof).
11. Remove rear roof side trim panel (sedan). Refer to Section 45-03.
12. Remove roof side inner rear moulding retaining screws and moulding (wagon). Refer to Section 45-16.
13. Remove liftgate header rail garnish moulding retaining screws and moulding (station wagon). Refer to Section 45-16.
14. Remove rear corner upper pillar finish panel (station wagon). Refer to Section 45-03.
15. Remove quarter trim panel. Refer to Section 45-03.
16. Remove headlining.
17. To install, reverse Steps 1 through 16.

## REMOVAL AND INSTALLATION (Continued)

## Sun Visor



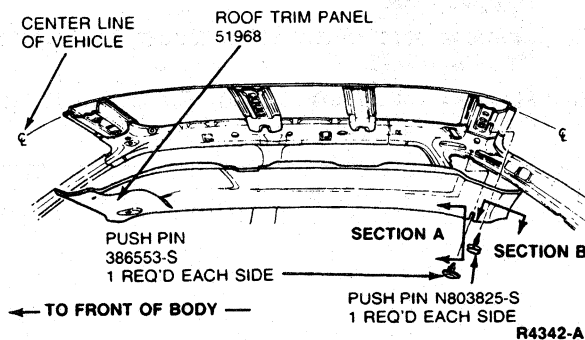
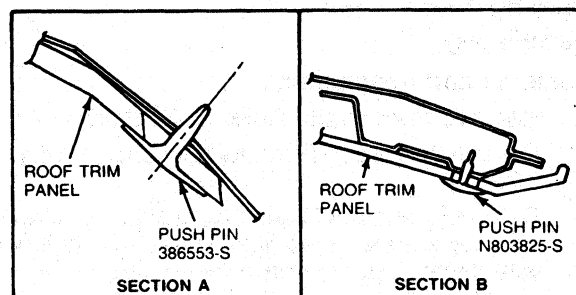
## Assist Handles



## Headliner

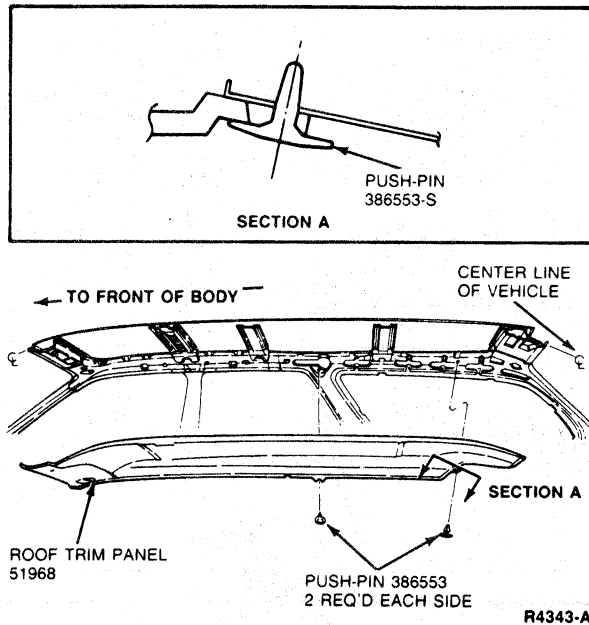
## Without Moon Roof

## Sedan

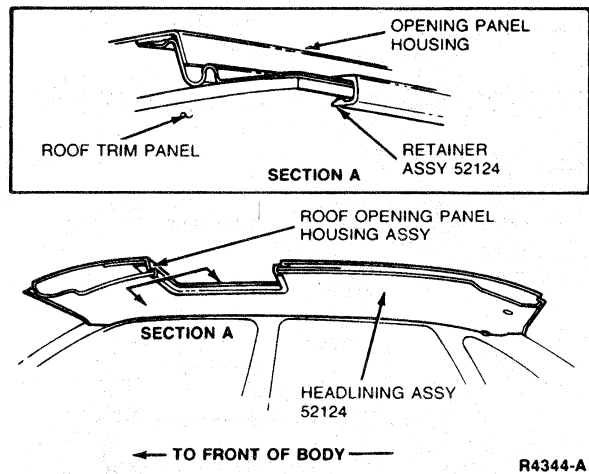


## REMOVAL AND INSTALLATION (Continued)

## Wagon



## With Moon Roof



## Sun Visor with Lamp

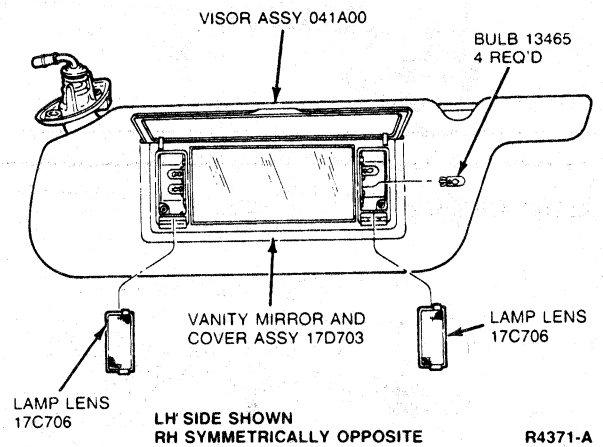
## Sable

## Removal and Installation

1. Snap out the bulb cover lenses (to expose vanity assembly retaining screws) using a small screwdriver. Remove screws and vanity assembly from visor.

NOTE: To replace one or more of the bulbs, it is only necessary to snap out the bulb cover lenses, using a small screwdriver and pull the bulb from the socket.

2. To install, reverse Step 1.



## REMOVAL AND INSTALLATION (Continued)

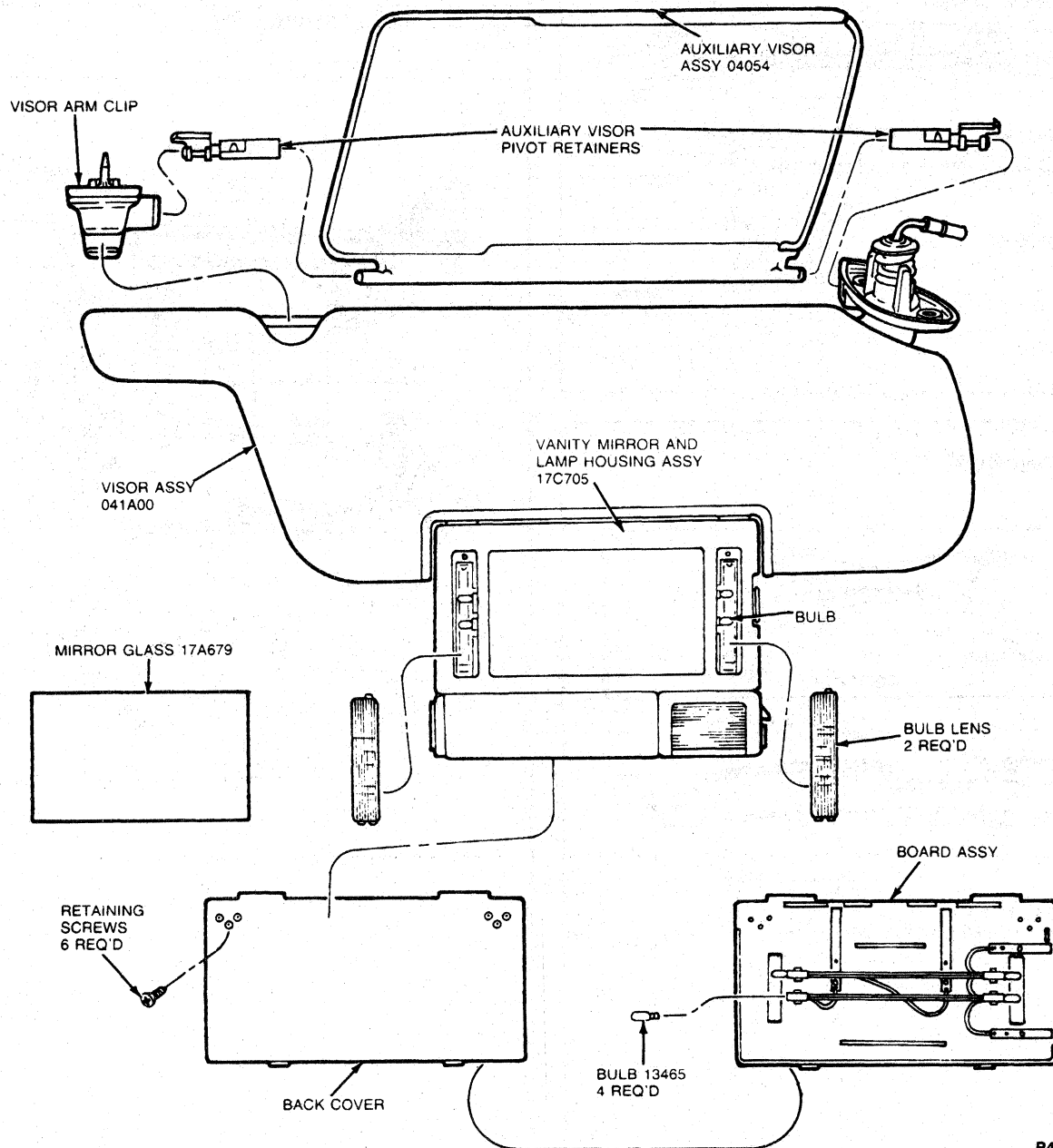
## Taurus

## Removal and Installation

1. Remove six screws retaining vanity mirror, lamp and back cover to visor and remove vanity mirror assembly.

NOTE: To replace one or more of the bulbs, it is only necessary to snap out the bulb cover lenses using a small screwdriver, and pull the bulb from the socket.

2. To install, reverse Step 1.



R4370-A

# SECTION 45-61 Instrument Panel

**SUBJECT****PAGE****SUBJECT****PAGE**

REMOVAL AND INSTALLATION ..... 45-61-1

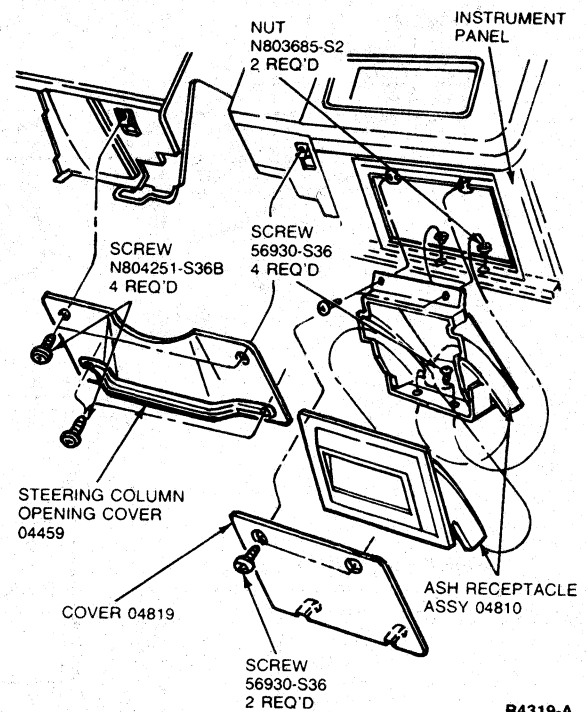
VEHICLE APPLICATION ..... 45-61-1

**VEHICLE APPLICATION**

Taurus/Sable.

**REMOVAL AND INSTALLATION****Taurus****Removal**

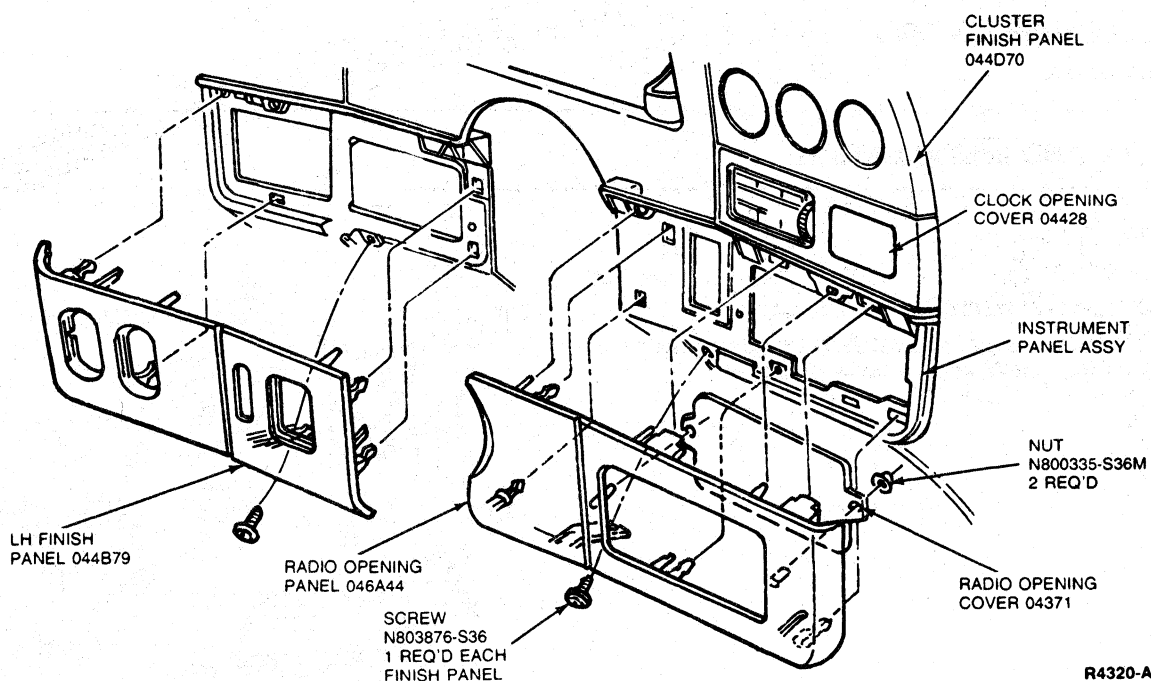
1. Disconnect battery ground cable.
2. Remove four screws retaining steering column opening cover and remove cover.



R4319-A

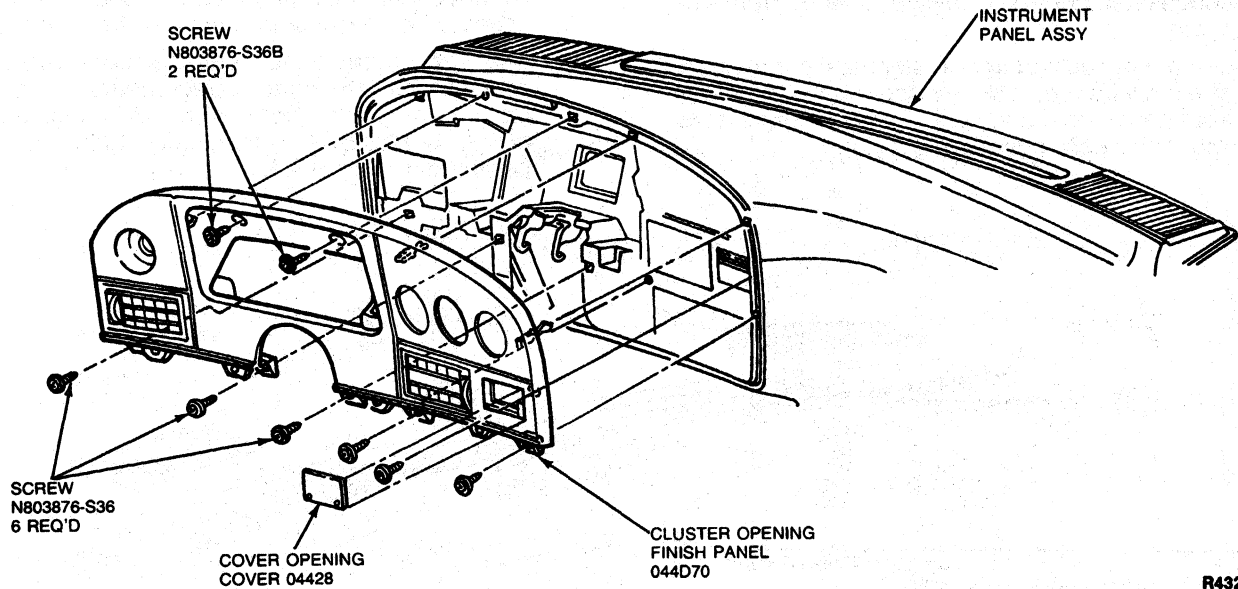
**REMOVAL AND INSTALLATION (Continued)**

3. Remove sound insulator under glove compartment by removing two pushnuts securing insulator to studs on climate control case.
4. Remove steering column trim shrouds. Disconnect all electrical connections from steering column switches.
5. Remove four screws at steering column bracket to remove steering column.
6. Remove screws retaining lower LH and radio finish panels (one screw each) and remove panels by snapping out.



## REMOVAL AND INSTALLATION (Continued)

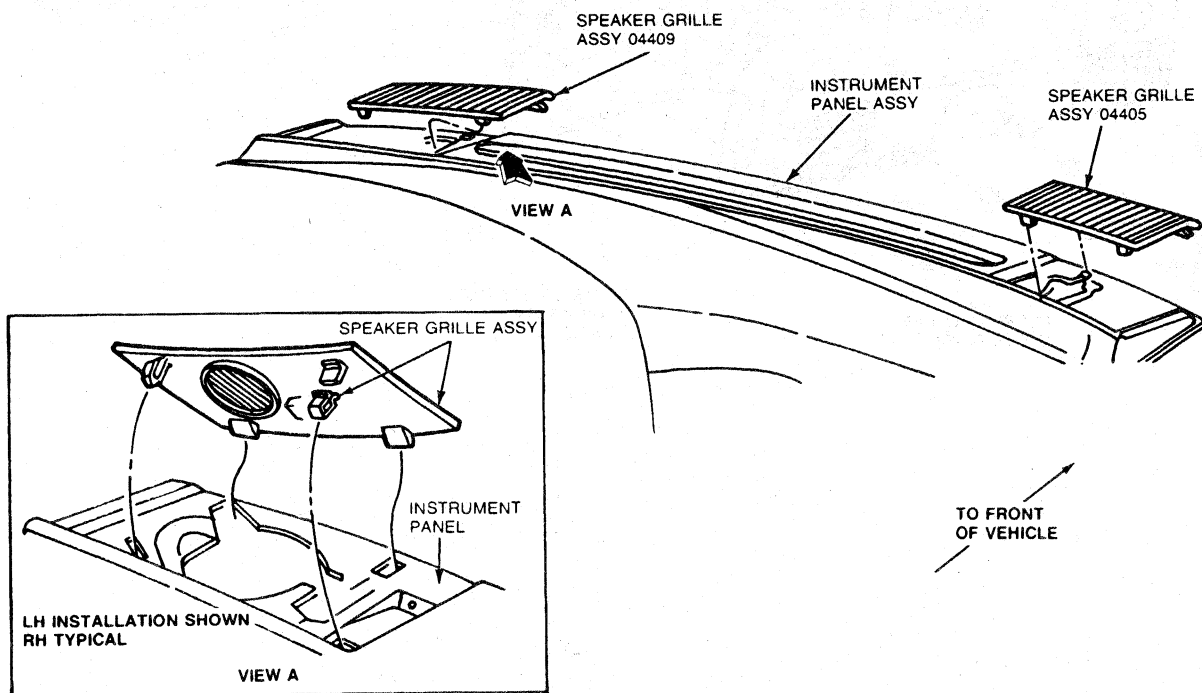
7. Remove seven cluster opening finish panel retaining screws, one jam nut behind headlamp switch, and one screw behind clock (or clock cover). Remove finish panel by rocking upper edge toward driver.
8. Disconnect speedometer cable by reaching up under instrument panel and pressing on flat surface of plastic connector.
9. Panel can be removed with cluster secured in place.



R4321-B

## REMOVAL AND INSTALLATION (Continued)

10. Release glove compartment assembly by depressing side of glove compartment bin and swinging door/bin down.
11. Using steering column, cluster and glove compartment openings, and by reaching under instrument panel, disconnect all electrical connections, vacuum hoses, heater-A/C, air conditioner control cables and radio antenna cable.
12. Disconnect all underhood electrical connectors of main wire loom. Disengage rubber grommet from dash panel and feed wire and connectors into instrument panel area.
13. Remove RH and LH speaker opening covers (snap-out).
14. Remove two lower instrument panel-to-cowl side retaining screws (RH and LH side).
15. Remove one instrument panel brace retaining screw (under the radio area).
16. Remove three instrument panel upper retaining screws. Remove instrument panel from vehicle.
17. With instrument panel removed from vehicle, transfer all attaching components to new instrument panel. (Heater or air conditioner ducts, all switches, main wire loom, glove compartment door, etc.)



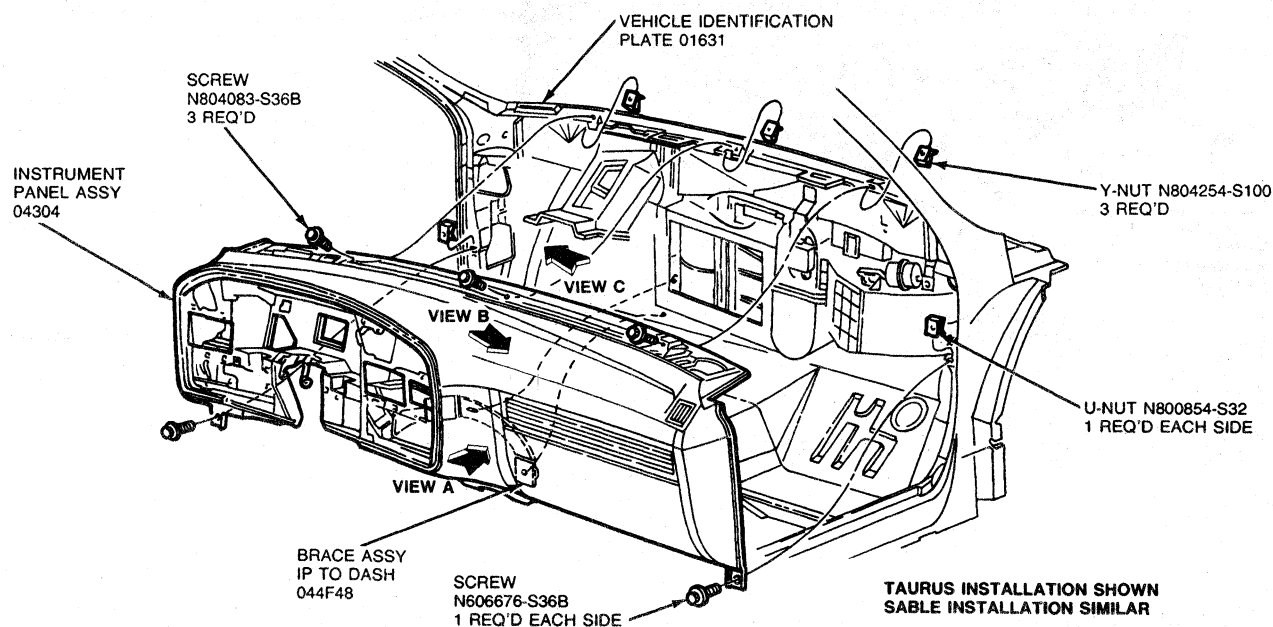
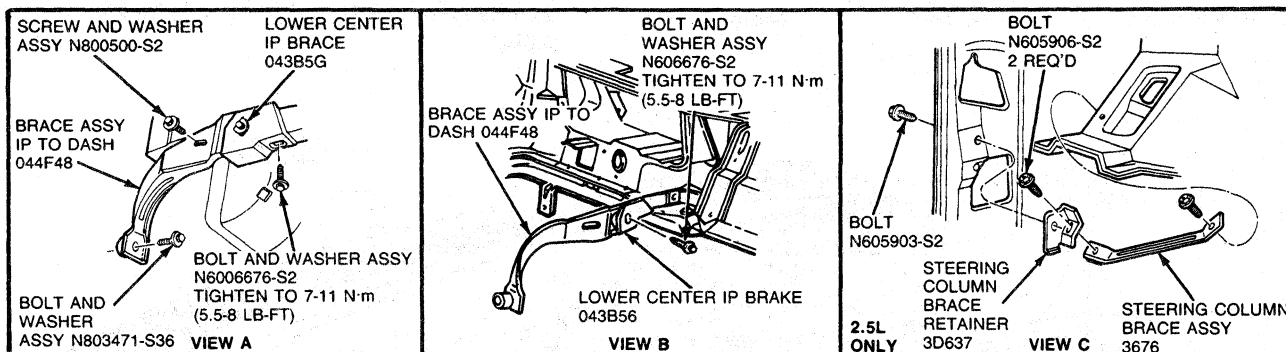
R4322-A



## REMOVAL AND INSTALLATION (Continued)

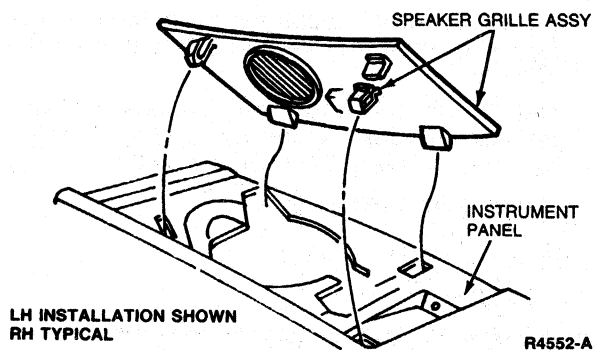
## Installation

1. Feed instrument wiring harness and connectors through dash panel into engine compartment and install grommet in dash panel.
2. Connect speedometer cable to speedometer head.
3. Position instrument panel with locating pin through hole in steering column reinforcement. Install three upper panel retaining screws. Tighten to 1.4-2.3 N·m (12-20 lb-in).
4. Install two lower instrument panel-to-side cowl retaining screws. Tighten to 6.8-10.8 N·m (5-8 lb-ft).
5. Install one brace-to-lower instrument panel retaining screw (under the radio). Tighten retaining screw to 7-11 N·m (5-8 lb-ft).
6. Install radio speaker grilles.

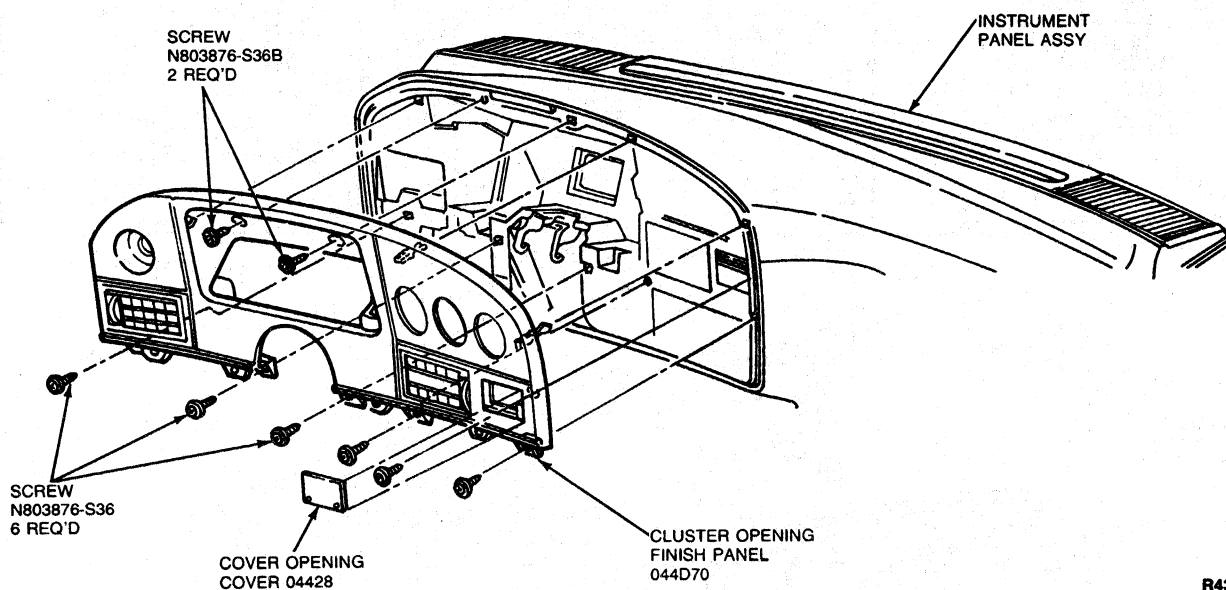


R4323-B

## REMOVAL AND INSTALLATION (Continued)

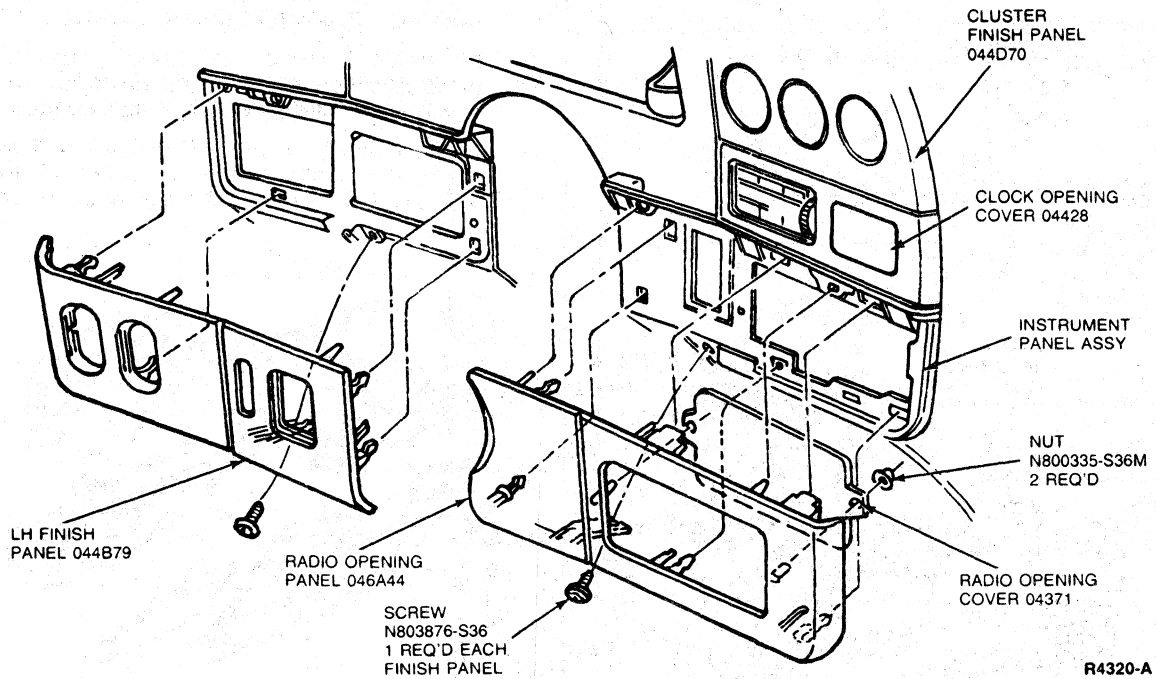


7. From inside engine compartment, connect instrument panel wiring connectors to engine compartment wiring.
8. Using instrument cluster, steering column and glove compartment openings, connect all electrical connections, vacuum hoses, heater and air conditioner control cables and radio antenna cable.
9. Swing glove compartment assembly back into place and install by depressing side tabs on bin.
10. Install instrument cluster finish panel in position and install eight retaining screws. Tighten to 2.0-2.9 N·m (18-26 lb-in). Install clock (or cover plate).



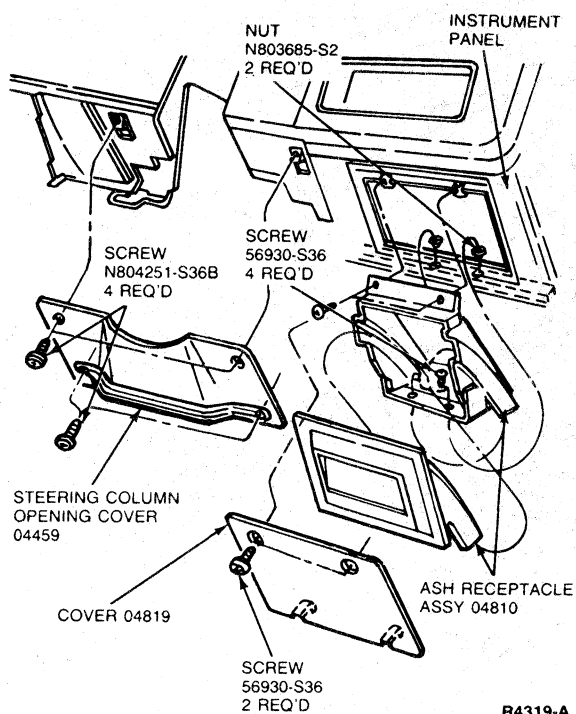
## REMOVAL AND INSTALLATION (Continued)

11. Snap lower LH and radio finish panels in position and install retaining screws (one each). Tighten to 2.0-2.9 N·m (18-26 lb-in).



**REMOVAL AND INSTALLATION (Continued)**

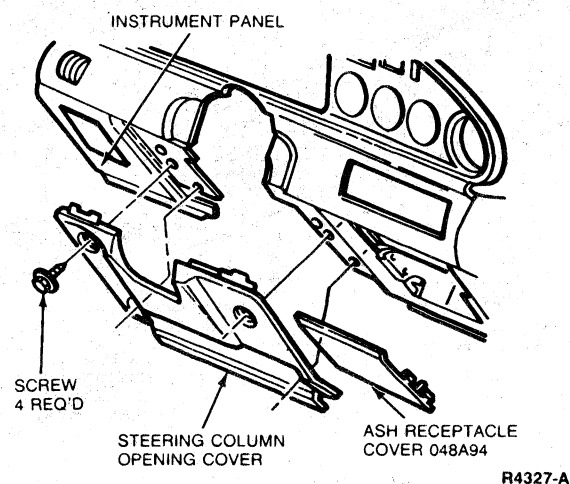
12. Raise steering column into position. Install four retaining screws at support bracket.
13. Connect all electrical connections to steering column switches. Install steering column trim shrouds.
14. Position steering column cover to instrument panel and install four retaining screws.



15. Position sound insulator under glove compartment and install pushnuts onto two studs on the climate control case.
16. Connect battery ground cable.

**Sable****Removal**

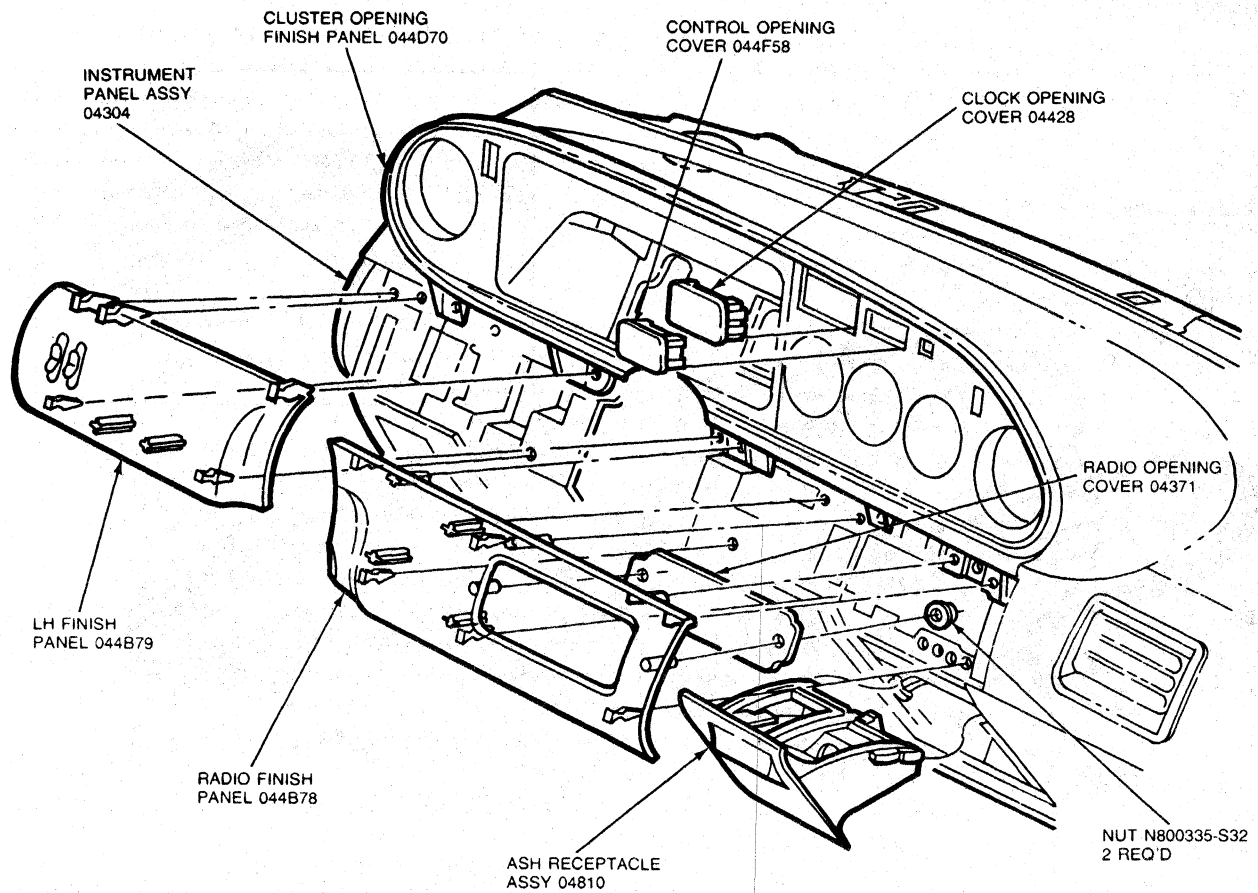
1. Disconnect battery ground cable.
2. Remove four screws retaining steering column opening cover and remove cover.
3. Remove sound insulator under glove compartment by removing two pushnuts securing insulator to studs on climate control case.



4. Remove steering column trim shrouds. Disconnect all electrical connections from steering column switches.
5. Remove one bolt and nut at lock collar U-joint and four screws at steering column bracket to remove steering column.

## REMOVAL AND INSTALLATION (Continued)

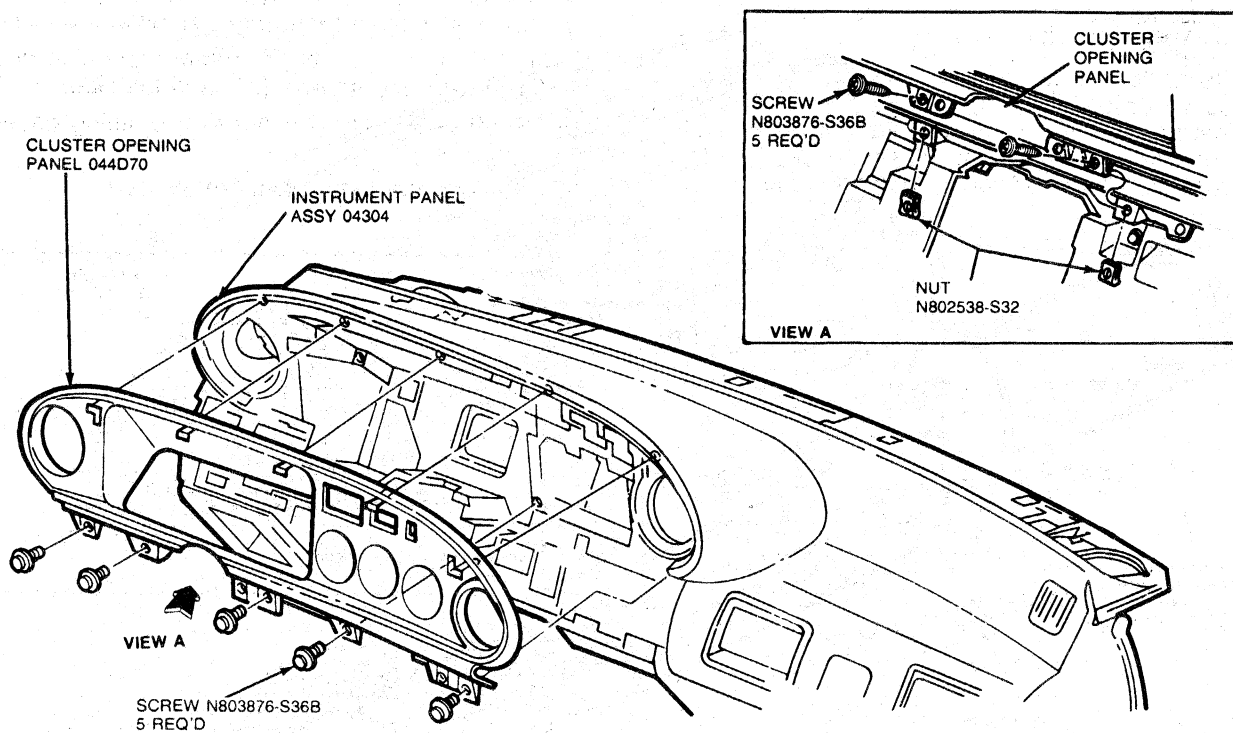
6. Remove lower LH and radio finish panels by snapping out.



R4326-A

## REMOVAL AND INSTALLATION (Continued)

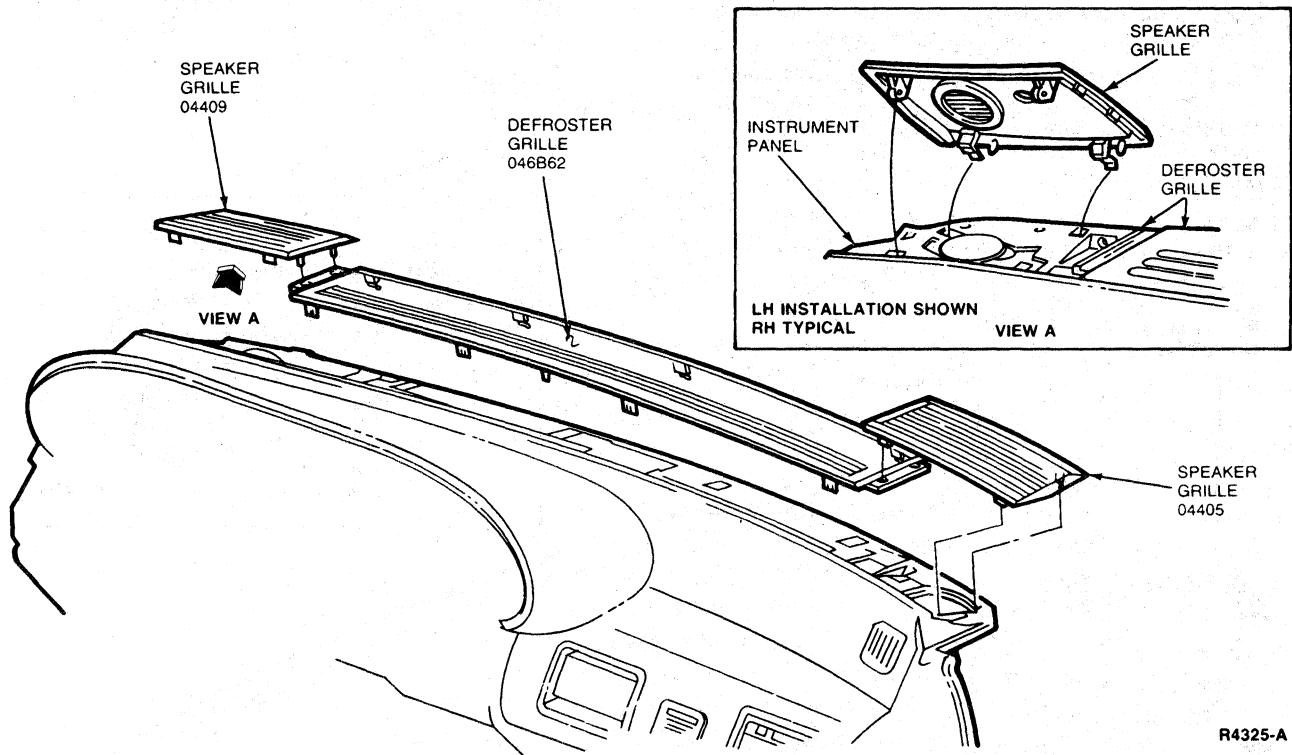
7. Remove five cluster opening finish panel retaining screws. Remove finish panel by disengaging five snap fasteners located along upper edge, and rocking upper edge toward driver.



R4324-A

## REMOVAL AND INSTALLATION (Continued)

- 8.\* Disconnect speedometer cable by reaching up under instrument panel and pressing on flat surface of plastic connector.
9. Panel can be removed with cluster secured in place.
10. Release glove compartment assembly by depressing side of glove compartment bin and swinging door/bin down.
11. Using steering column, cluster and glove compartment openings, and by reaching under instrument panel, disconnect all electrical connections, vacuum hoses, heater-A/C, control cables and radio antenna cable.
12. Disconnect all underhood electrical connectors of main wire loom. Disengage rubber grommet from dash panel, and feed wire and connectors into instrument panel area.
13. Remove one bolt attaching instrument panel to floor brace (above left side of tunnel). Refer to the illustration under Taurus Removal, Step 17 for typical instrument panel retainer locations.
14. Remove two lower instrument panel-to-cowl side retaining screws (RH and LH side).
15. Remove RH and LH speaker opening covers (snap-out).
16. Remove defroster grille (snaps out).



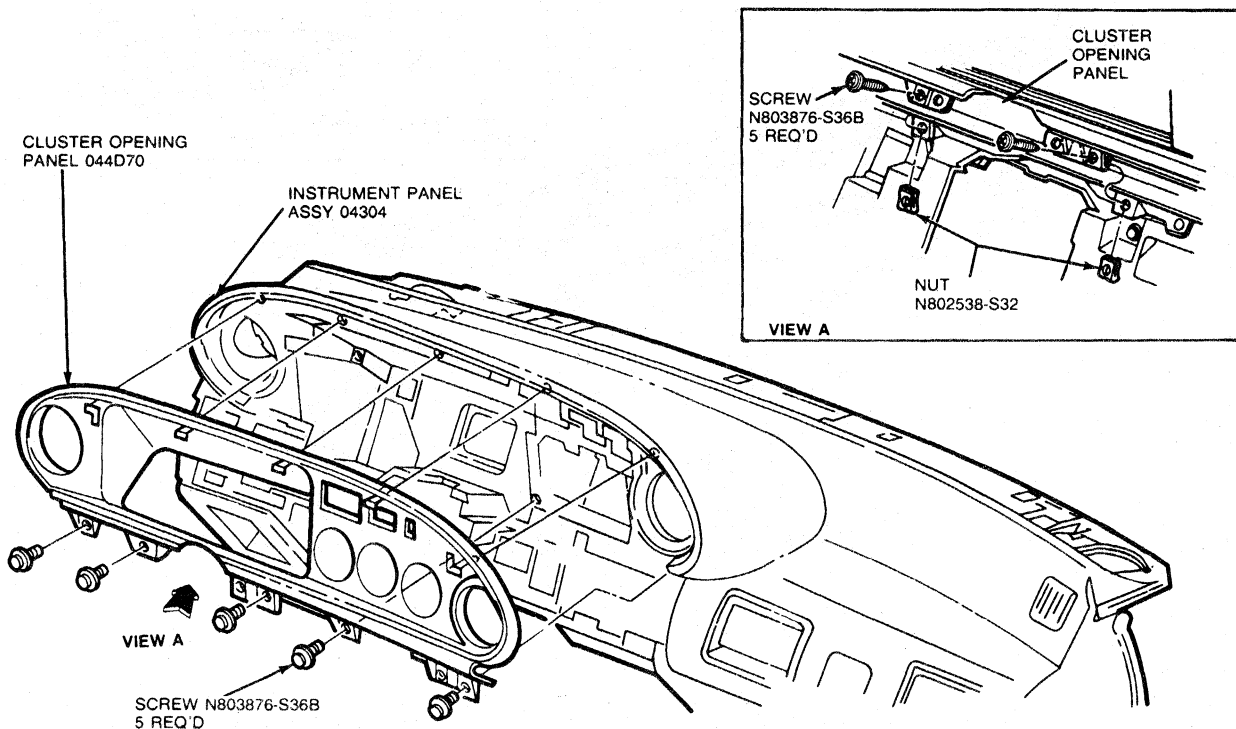
R4325-A

## REMOVAL AND INSTALLATION (Continued)

17. Remove three instrument panel upper retaining screws. Remove instrument panel from vehicle.
18. With instrument panel removed from vehicle, transfer all attaching components to new instrument panel (heater or air conditioner ducts, all switches, main wire loom, glove compartment door, etc.).

**Installation**

1. Position instrument panel to dash panel, and install three upper panel retaining screws. Tighten to 1.4-2.3 N·m (12-20 lb-in).
2. Install two lower instrument panel-to-side cowl retaining screws. Tighten to 6.8-10.8 N·m (5-8 lb-ft).
3. Install one bolt attaching instrument panel to floor brace (above left side of tunnel).
4. Feed instrument wiring harness and connectors through dash panel into engine compartment and install grommet in dash panel.
5. From inside engine compartment, connect instrument panel wiring connectors to engine compartment wiring.
6. Using instrument cluster, steering column and glove compartment openings, connect all electrical connections, vacuum hoses, heater and air conditioner control cables and radio antenna cable.
7. Swing glove compartment assembly up into place and install by depressing side tabs on bin.
8. Connect speedometer cable to speedometer head.
9. Install instrument cluster finish panel in position and engage five upper snap retainers. Install five retaining screws and tighten to 6.8-10.8 N·m (5-8 lb-ft).

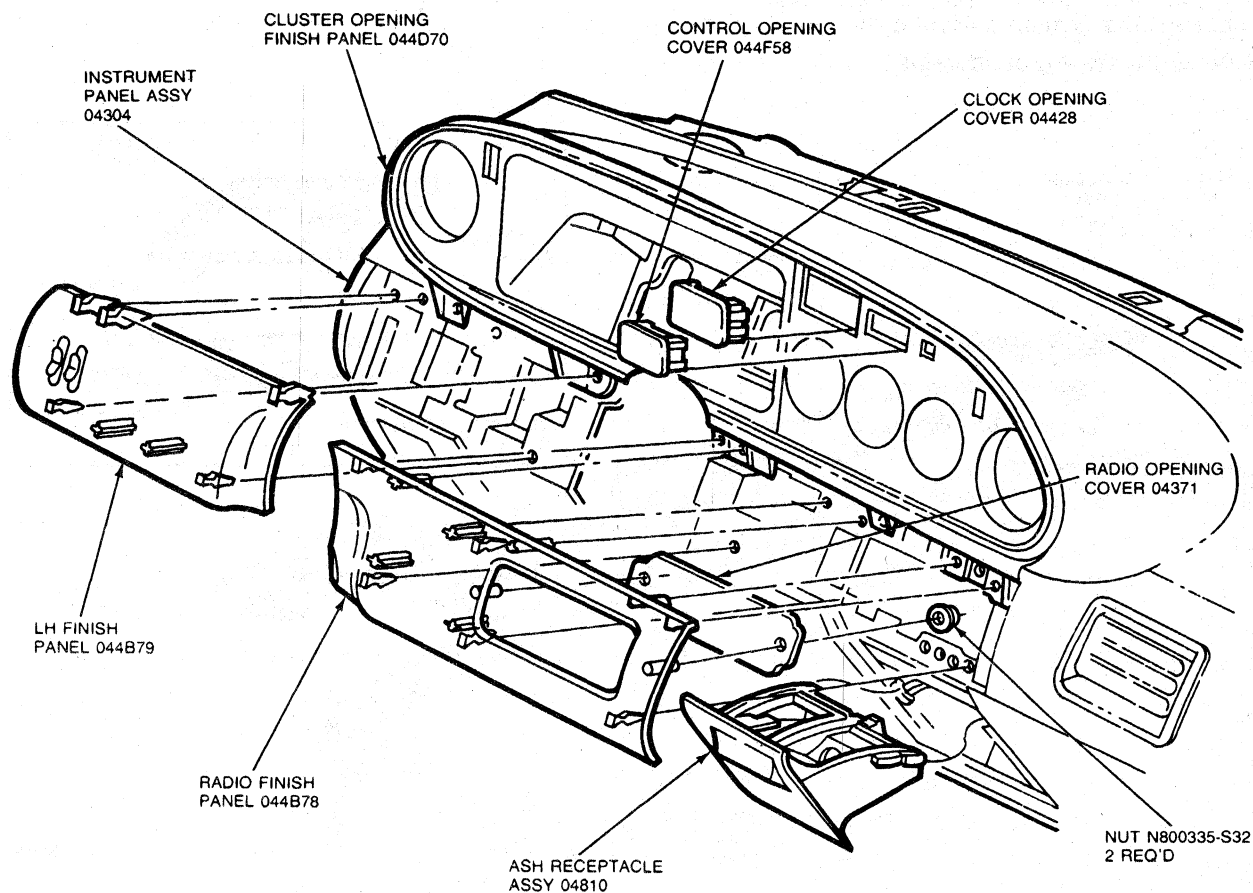


R4324-A



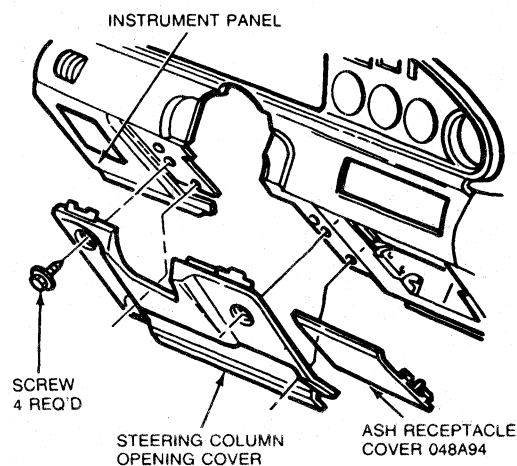
## REMOVAL AND INSTALLATION (Continued)

10. Install lower LH and radio finish panels (snap in).



R4326-A

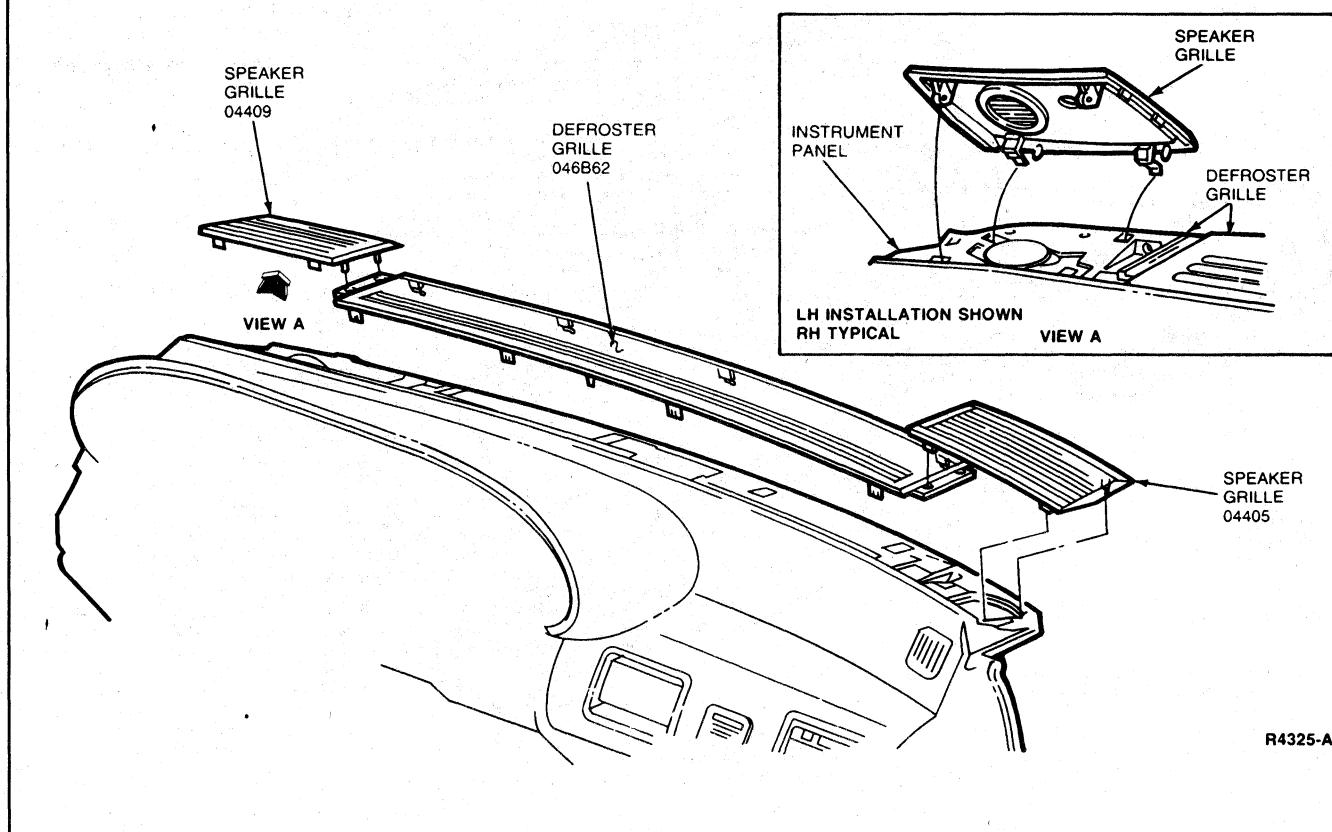
11. Raise steering column into position. Install four retaining screws at support bracket and one nut and bolt at locking collar U-joint.
12. Connect all electrical connections to steering column switches. Install steering column trim shrouds.
13. Position steering column cover to instrument panel and install four retaining screws.



R4327-A

**REMOVAL AND INSTALLATION (Continued)**

14. Install defroster and radio speaker grilles (snap in).
15. Position sound insulator under glove compartment and install pushnuts onto two studs on the climate control case.
16. Connect battery ground cable.



# TOPS AND EXTERIOR FINISHES

# GROUP 46 (70000)

SECTION TITLE	PAGE	SECTION TITLE	PAGE
MOON ROOF, ELECTRIC .....	46-07-1	TOP AND EXTERIOR FINISH—SERVICE .....	46-01-1

## SECTION 46-01 Top and Exterior Finish—Service

SUBJECT	PAGE	SUBJECT	PAGE
LOWER BODY SIDE STONE PROTECTION		PAINT AND GLASS CARE (Cont'd.)	
VINYL SERVICE		Paint .....	46-01-1
Application .....	46-01-3	PAINT REPAIR	
Coating Preparation .....	46-01-2	Complete Panel Service .....	46-01-2
Masking Vehicle .....	46-01-2	Soft Fascia Service—Front and Rear .....	46-01-2
Sheet Metal .....	46-01-2	Spot Service .....	46-01-2
PAINT AND GLASS CARE		VEHICLE APPLICATION .....	46-01-1
Glass .....	46-01-2		

### VEHICLE APPLICATION

Taurus/Sable.

### PAINT AND GLASS CARE

#### Paint

The outside finish should be washed frequently. Never wipe the painted surface with a dry cloth. Dusting the finish when it is dry tends to rub dust and dirt into the paint, causing scratches on the surface. To keep the finish bright and attractive, wash the vehicle whenever it is dirty.

Protect the exterior with frequent washing, including underside areas. Use Ford Wash and Wax Concentrate D6AZ-19523-A or equivalent, diluted to proper concentration, followed by a rinse with clear cold water. Do not wash vehicle with hot water, in direct sunlight, or while sheet metal is hot.

Polish paint and bright metal with Ford Custom Silicone Gloss B7A-19530-A, Ford Custom Auto Wax B4A-19534-A, Ford Custom Cream Auto Wax E4AZ-19534-A or equivalents, to remove harmful deposits and provide added protection to body

surfaces, body hardware, and chrome and aluminum parts. Touch up nicks and scratches with proper paint. Do not use steel wool, abrasive type cleaner, gasoline or strong detergents containing highly alkaline or caustic agents on chrome plated materials, aluminum wheels, headlamps, bumpers or anodized aluminum parts, as damage to the protective coating and discoloration or paint deterioration may occur.

Vehicles subjected to airborne pollen, insect droppings, bird droppings and other organic matter, especially vehicles subjected to this matter that are exposed to high temperatures and sunshine, should be washed as often as necessary to keep them free of this organic matter. Similar precautions should be taken where a vehicle may be exposed to chemical industrial fallout. Failure to do so may result in damage to the exterior surfaces.

**PAINT AND GLASS CARE (Continued)****Glass**

Glass should be cleaned with Ford Glass Cleaner E4AZ-19C507-A or equivalent, using a clean, soft, lint-free cloth. Follow directions on the container.

**PAINT REPAIR****Complete Panel Service**

1. Prepare surface as normal, with particular care that sand scratches have been removed.
2. **Base coat color:** Acrylic lacquer reduced 125 percent with high gloss clear acrylic lacquer thinner.
3. With 241 kPa (35 psi) **at the gun**, spray a minimum of four medium wet coats, allowing 1 to 2 minutes flash-off time between these coats. After final coat, allow 15 minutes flash-off time.
4. Allow four hours air dry or 30 minutes at 77°C (170°F). Compound by machine with an acrylic rubbing compound.

**Spot Service**

1. Perform Complete Panel Repair procedure and finish behind area with a final blend coat.
2. Apply one mist coat and allow to flash-off. Follow with medium wet coats overlapping each coat. Air pressure at gun should be 138 kPa (20 psi). Allow four hours air dry time or 30 minutes at 77°C (170°F).

**Soft Fascia Service—Front and Rear**

Use Ford Elastomeric Additive EBP-652-A or equivalent, with Acrylic Repair Lacquer according to repair procedures in Section 47-08.

**LOWER BODY SIDE STONE PROTECTION VINYL SERVICE**

A large area resulting from peeling or damage will necessitate removal of the factory sprayed-on vinyl coating. The following procedure is suggested:

**NOTE:** Where sheet metal is damaged to the extent that fender, door or quarter panel replacement is required (or in an initial installation), disregard Steps 1 and 2.

1. Using a heat gun or lamp, soften vinyl coating until it is pliable. Scrape off softened vinyl with putty knife or similar tool. If necessary, sand off any hard to remove vinyl coating, using an orbital disc sander (No. 80 disc). (The Vinyl Abrasion Resistant Coating is not suitable for spot repair.)
2. Perform necessary repairs to correct sheet metal damage.

Ford Abrasion Resistant Coating D9AZ-19515-A or equivalent is available in 0.947L (1 quart) cans. Approximately 1.89L (2 quarts) is required for an initial installation on a vehicle similar to a factory-applied system. The specified dry film thickness of 15 to 20 mils (.015 to .020 inches) requires at least three, or possibly four, applications of coating material, with flash-off time allowed between coats. As with painting, spray coat the complete panel only.

As the adherence of this coating to properly prepared sheet metal is excellent, the necessity of prime painting the sheet metal prior to protective coating is eliminated, saving both time and money. However, adhesion will be adversely affected unless the sheet metal area to be covered (either repaired or new) is prepared in accordance with the following procedure.

**Coating Preparation****Masking Vehicle**

Suitable covers should be installed over the wheels. Mask off all upper exterior body sheet metal. Remove wheel opening stone shields and mask mouldings.

**NOTE:** If the vehicle has lower body side mouldings 305-355mm (12-14 inches) above the "turn under" of the rocker panel, the moulding can serve as the upper margin of the area to be coated. If the vehicle does not have suitable mouldings, a sculpture or break line in the sheet metal can be used. However, the method used in masking off the upper coating margin line will depend on the presence or absence of mouldings in this area.

Masking tape should be positioned so that the moulding lower side is also covered down to, but not on, the sheet metal.

It is not necessary to mask off body door openings in the coating area as they will be uniformly coated where the door margins allow the coating to enter. However, these door opening areas should be cleaned to ensure coating adherence.

**Sheet Metal****Serviced Sheet Metal**

1. Scuff sand (No. 180-grit paper) to remove all of the glossy surface appearance of dry painted areas to be coated.
2. Sand off any surface rust from bare metal. Remove sanding dust using a lint-free tack cloth and compressed air.
3. Using a clean, lint-free cloth, solvent wipe area to be coated with Multi-Purpose Paint Precleaner VC-542-A or equivalent, and allow to flash-off.

**LOWER BODY SIDE STONE PROTECTION VINYL SERVICE (Continued)****New Sheet Metal**

1. Scuff sand (No. 180-grit paper) any prime paint in area to be coated. Sand off any surface rust from bare metal.
2. Remove sanding dust using a lint-free tack cloth and compressed air.
3. Using a clean, lint-free cloth, solvent wipe area to be coated with Multi-Purpose Paint Precleaner VC-542-A or equivalent, and allow to flash-off.

- c. Apply third wet, sag-free coat. Allow 3-5 minutes flash-off time.
- d. Apply final wet, sag-free coat. Allow 3-5 minutes flash-off time and pull off Fine Line tape, exposing raw upper edge of the coating.
- e. Immediately clean spray equipment using Ford Multi-Purpose Paint Precleaner VC-542-A or equivalent.
- f. Allow at least two hours drying time at approximately 21°C (70°F).

**Initial Installation**

1. The glossy surface of paint in coating area may be scuff sanded with a D/A sander. A 220/240-Grit Disc does a good, fast job. **Do not** sand through primer.
2. Remove sanding dust using a lint-free tack cloth and compressed air.
3. Using a clean, lint-free cloth, solvent wipe area to be coated with Multi-Purpose Paint Precleaner VC-542-A or equivalent.

**Color Coat**

As the complete coated area, as well as the upper raw edge, must be covered with color coat, mask off upper margin line with Fine Line tape positioned 1.59mm (1/16-inch) above coating edge. Using appropriate repair paint and application procedures, including both prime and color coat, finish paint the protective coating.

NOTE: If damaged sheet metal extends above the protective coating area, normal prime/color paint procedures should be followed.

**Application**

Coating must be applied with commercial equipment (appropriate equipment listed at end of this Section) by an experienced automotive painter. Coating must be thoroughly agitated and used without thinning. Since the material is reasonably heavy bodied, a pressure cup equipped spray gun is recommended. Satisfactory coating appearance (minimal orange peel and sagging) will result with gun air pressures of approximately 207 kPa (30 psi) and cup pressures of approximately 103 kPa (15 psi).

**Coating Spray Procedure**

To protect the lower exposed painted fender, rocker, and quarter panel down flanges, the vehicle must be elevated high enough so that the painter can spray areas effectively. When an initial installation is made, a remote 1.89L (2 quart) capacity pressure cup makes a much more efficient tool, as the spray gun can be used closer to the floor. The spray gun, fluid hose and/or cup must be cleaned immediately after use. While lacquer thinner can be used when the suggested clean-up material is unavailable, Ford Multi-Purpose Paint Precleaner, VC-542-A or equivalent, is quicker and much more efficient. With the spray gun at 207 kPa (30 psi) and pressure feed cup at 103 kPa (15 psi), follow this procedure:

- a. Apply a wet, sag-free coat. Allow 3-5 minutes flash-off time.
- b. Apply second wet, sag-free coat. Allow 3-5 minutes flash-off time.

**Materials Required**

- Abrasion Resistant Coating D9AZ-19515-A.
- Final Blend Coat.
- Acrylic Lacquer Thinner.
- Silicone and Wax Remover.
- Ford Multi-Purpose Paint Precleaner (Spray Gun Clean-Up) VC-542-A.

**Suggested Equipment**

- Rotunda Spray Gun 085-01626 (No. 63 Air Cap, No. SS Fluid Tip, No. 363 AN needle) or equivalent.
- Rotunda Attached Pressure Cup 085-01617, 0.946L (1 quart) (with Air Adjusting Gauge) or equivalent.
- Rotunda D/A Sander 009-00118 or equivalent.
- No. 180-Grit Paper
- Lint-Free Cloth.
- Tack Cloth.
- Regular Masking Tape.
- No. 80 Disc for Disc Sander.
- No. 220/240 Disc.

# SECTION 46-07 Moon Roof, Electric

SUBJECT	PAGE	SUBJECT	PAGE
<b>ADJUSTMENTS</b>		<b>REMOVAL AND INSTALLATION</b>	
Glass Fore-and-Aft .....	46-07-6	Glass and Sunshade .....	46-07-1
Glass Height .....	46-07-5	Glass Weatherstrip .....	46-07-3
Motor .....	46-07-8	Lifter Arm .....	46-07-3
Water Drainage System and Water Leak		Moon Roof Assembly .....	46-07-3
Corrections .....	46-07-6	Switch .....	46-07-5
<b>DESCRIPTION AND OPERATION</b>		<b>TESTING</b>	
Electric Operation .....	46-07-1	Switch Test .....	46-07-8
Manual Operation .....	46-07-1	<b>VEHICLE APPLICATION</b> .....	46-07-1
<b>DIAGNOSIS</b> .....	46-07-9		

## VEHICLE APPLICATION

Taurus/Sable.

## DESCRIPTION AND OPERATION

The moon roof, available as an option, is electrically operated. The moon roof can be closed manually in case of electrical power failure.

### Electric Operation

When the control switch is held in the OPEN position, the glass slides into the storage space between the roof trim panel and the roof, exposing an opening over the front seats.

When the control switch is moved to the CLOSE position, with the glass fully back in the storage space, the glass moves forward from the storage position. Near the end of the forward travel, the rear portion of the sliding panel moves upward on two lifter arms. This allows a weather-tight seal when the roof is closed.

When the control switch is moved to the CLOSE position, with the glass fully forward, the rear of the glass "pops up" to the VENT position. With the glass in the VENT position, moving the control switch to the OPEN position closes the glass.

### Manual Operation

To close the sliding panel manually, remove the motor access cover located at the front of the roof trim panel. Install the emergency crank supplied with the vehicle on the auxiliary socket drive and crank the moon roof closed.

After performing these operations, remove the crank and replace the motor access cover.

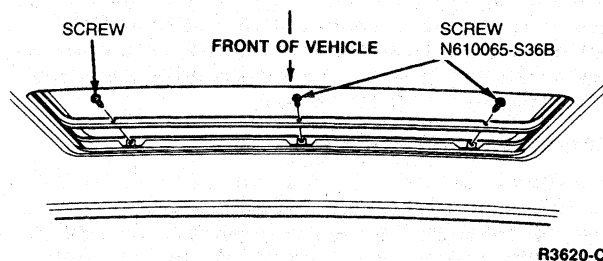
## REMOVAL AND INSTALLATION

**CAUTION:** It is recommended that the battery ground cable be disconnected.

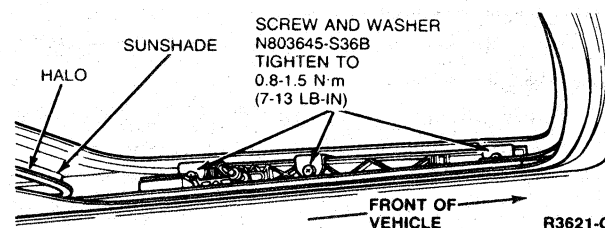
### Glass and Sunshade

#### Removal

1. To remove glass panel, remove three halo front retaining screws.

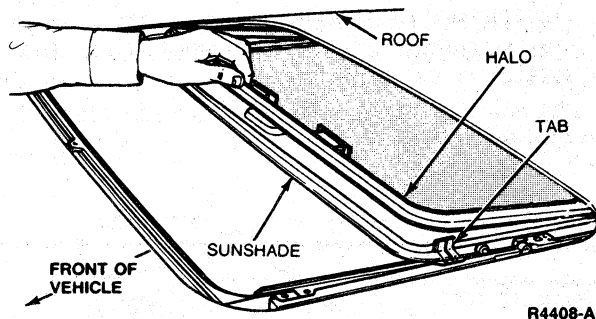


2. Slide halo and sunshade fully rearward to expose six glass retaining screws (three each side).
3. To remove sunshade, remove glass retaining screws and washers.

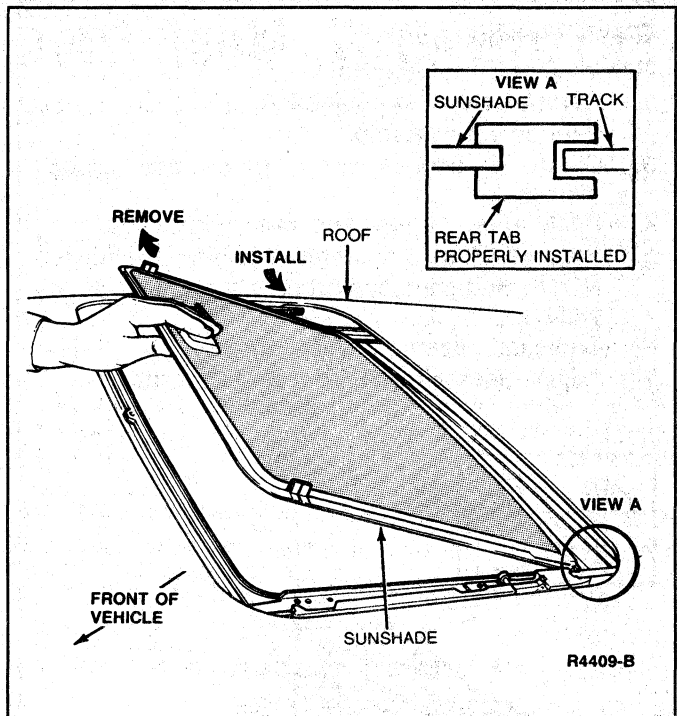


**REMOVAL AND INSTALLATION (Continued)**

4. Push glass up from below (inside vehicle) and remove. Take care not to scratch glass or roof paint.
5. Slide halo and sunshade forward halfway across moon roof opening.
6. Lift halo to clear sunshade.

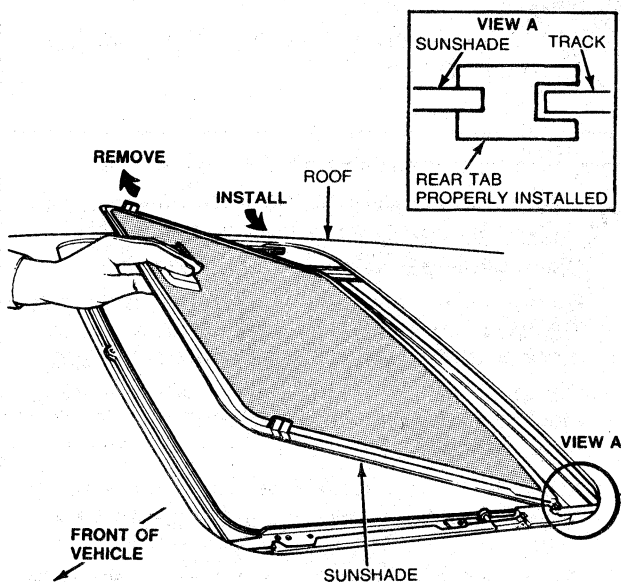


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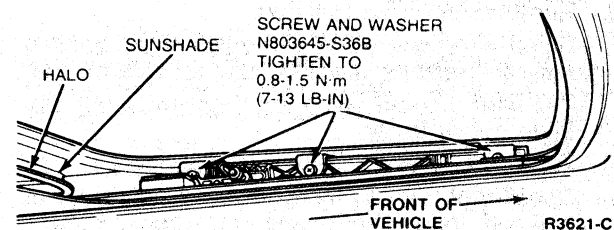
R4409-B

7. Push halo fully rearward.
8. Slide sunshade fully forward.
9. Lift front on sunshade, slide forward and rotate to remove.



R4409-B

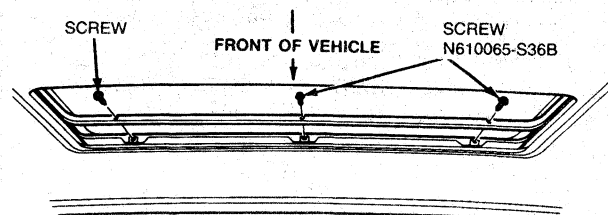
3. Slide halo forward, lifting it to clear sunshade.
4. Lower halo onto sunshade. Halo must be outside of rail or moon roof will not function properly.
5. Slide sunshade and halo fully rearward.
6. Install glass. Align with holes for screws. Take care not to push lifter arm slide out of track.



R3621-C

**Installation**

1. With sunshade at an angle, insert one sunshade rear tab into channel at rear of moon roof opening.
2. Insert other rear tab and place sunshade in position.



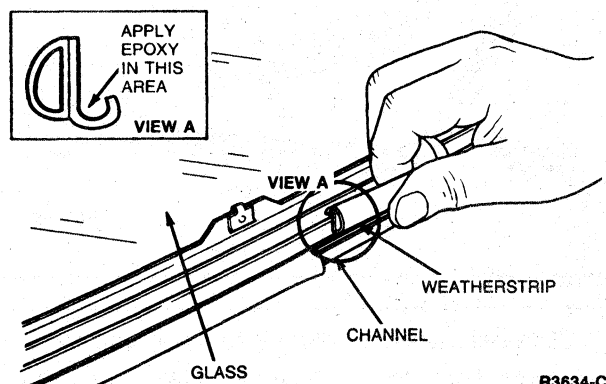
R3620-C



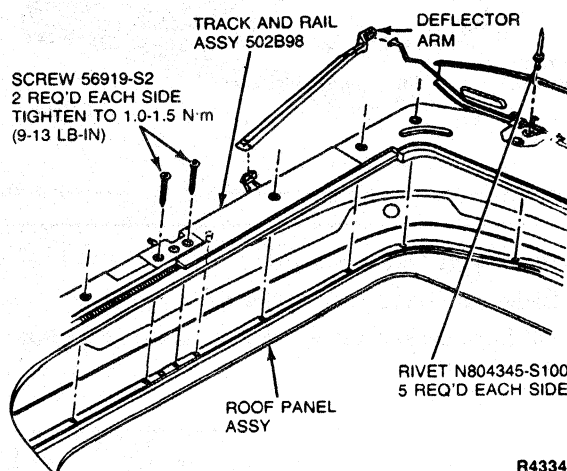
## REMOVAL AND INSTALLATION (Continued)

**Glass Weatherstrip****Removal and Installation**

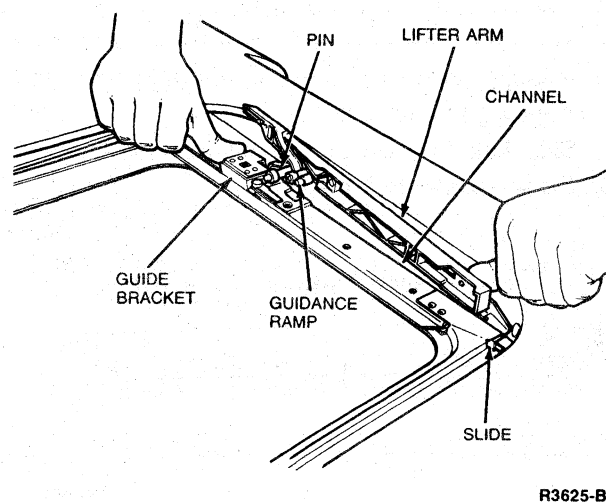
1. Remove glass as outlined.
2. Peel off weatherstrip.
3. Clean off excess epoxy from bright glass moulding.
4. Apply epoxy to new seal before installing.
5. Snap new seal onto bright moulding as shown.  
NOTE: Butt joint located on passenger side of glass.
6. To install, reverse Steps 1 through 6.
7. Adjust glass after installation as outlined.

**Moon Roof Assembly****Removal**

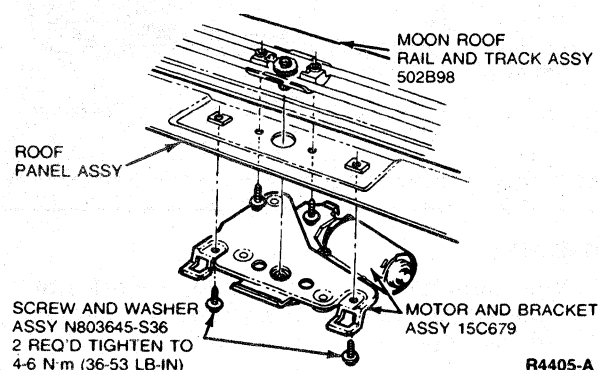
1. Open glass panel and sunshade fully.
2. Disconnect air deflector arms by pulling up on rear of arm to disengage from track retainer and rotating arm to remove from air deflector.
3. Drill out ten rivets using 3/8-inch drill stop.  
**CAUTION: Use an appropriate shield so that the headliner is not damaged while the rivets are drilled out.**
4. Connect air deflector arms by engaging rear of arm to track retainer.

**Lifter Arm****Removal and Installation**

1. Remove glass as outlined.
2. Remove motor as outlined.
3. Raise lifter arm to VENT position by holding slide and pushing guide bracket forward to stop.
4. Pull lifter arm off guidance ramp retaining pin. Slide out of track.
5. To install, reverse Steps 1 through 4.
6. Check motor for synchronization and adjust as outlined. Install motor and glass as outlined.



5. Remove four pivot bolts (two forward, two rearward). Do not remove center bolt.
6. Close glass panel.
7. Remove roof console as outlined in Switch Removal to expose motor and mounting bracket, and disconnect electrical connections.
8. Remove two attaching screws while holding motor in place. Remove motor.



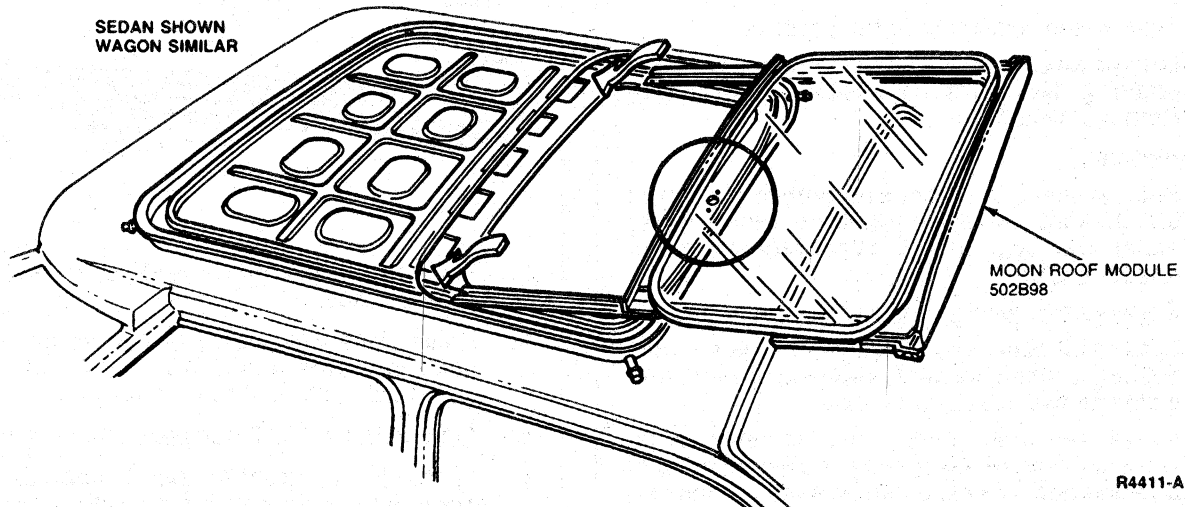


**REMOVAL AND INSTALLATION (Continued)**

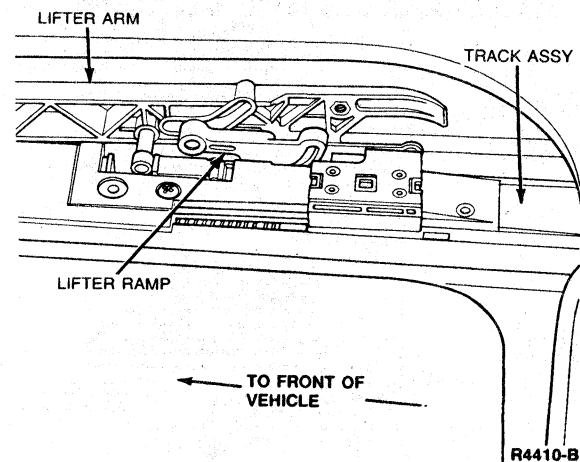
9. Remove two screws retaining moon roof front rail to roof panel.
10. Lift and slide entire moon roof module out of vehicle. Protect roof's painted surface. Make certain halo trough clears roof edge.

**Installation**

1. Slide moon roof into vehicle, taking care not to damage roof finish.



2. Install two screws retaining moon roof front rail to roof panel.
3. Check motor for synchronization. If not synchronized, adjust as outlined.
4. Install motor and attaching screws. Connect electrical connectors.
5. Ensure lifter arm and guidance ramp are aligned as shown.
6. Open glass and sunshade fully.
7. Install ten pop rivets.
8. Adjust glass as outlined.
9. Install four pivot bracket retaining screws after glass is adjusted.
10. Install roof console.



## REMOVAL AND INSTALLATION (Continued)

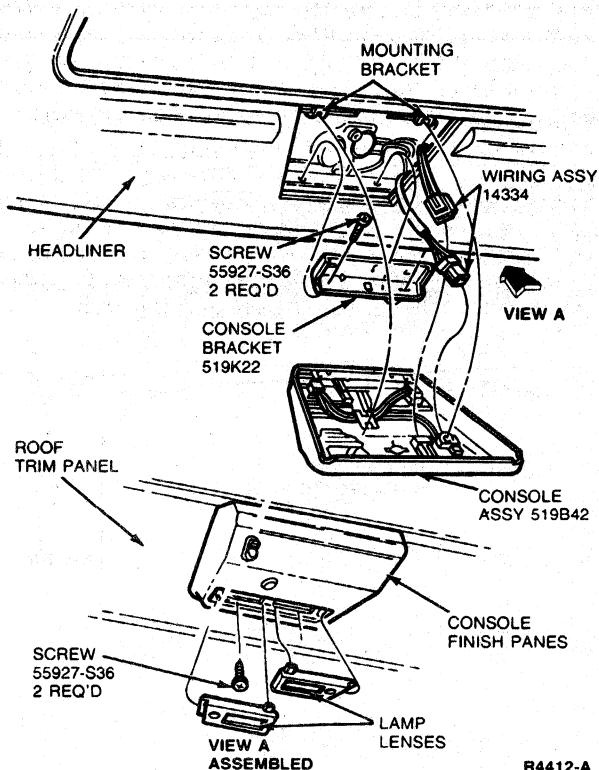
## Switch

## Removal

1. Remove two map lens assemblies by holding lens in switch depressed position, and using a flat, thin tool (such as a putty knife), pop out lens assembly at center gap between two lens assemblies.
2. Remove two roof console retaining screws and remove roof console by lowering forward edge of console and slide console rearward, disengaging console rear retaining tabs.
3. Disconnect two wiring connectors.
4. Test switch assembly (if necessary).
5. Using a small screwdriver, pry apart two switch retaining tabs and connector retaining tab. Remove switch.

## Installation

1. Snap switch into its housing (ribbed portion of switch knob is rearward), slide wiring under metal clip and attach connector to metal retaining tab.
2. Connect two wiring connectors.
3. Install roof console by engaging two latch tabs, pushing console forward, swinging upward, and installing two retaining screws.
4. Install two map lamp lens assemblies by engaging lens retaining tab at outboard edge of opening and snapping center edge of lens into console.

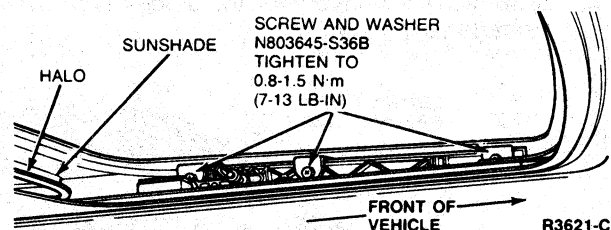


R4412-A

## ADJUSTMENTS

## Glass Height

1. Perform Steps 1 and 2 of Glass and Sunshade Removal.
2. Loosen six glass attaching screws. Then, tighten them so that they are snug, but not tightened to specification.



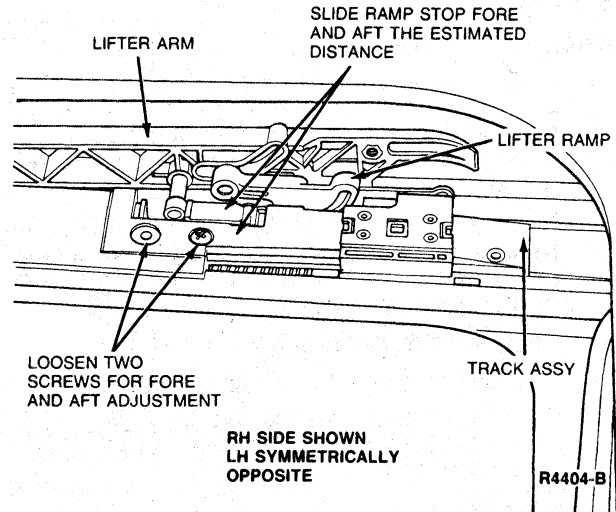
3. Back each screw off one turn, so that the glass moves freely.
4. Raise glass from inside vehicle so that rear of glass is approximately 1mm (0.04 inch) higher than flush with roof at rear corners.
5. Tighten RH and LH rear glass attaching screws.
6. Lower glass in front so that it is approximately 1mm (0.04 inch) below flush with roof at front corners.
7. Tighten RH and LH front glass attaching screws.
8. Tighten RH and LH center glass attaching screws.
9. Perform Steps 9 and 10 of Glass and Sunshade Installation.

## ADJUSTMENTS (Continued)

### Glass Fore-and-Aft

Fore-and-aft adjustment of the glass panel can be accomplished by first estimating the amount of fore or aft adjustment necessary for proper glass panel fit, then:

1. Run glass panel fully rearward. Use emergency crank if necessary.
2. Loosen five screws on pivot brackets, noting position of ramp stop.
3. Move ramp stops equally fore or aft the estimated distance necessary for proper glass panel fit.
4. Tighten six pivot bracket screws and cycle moon roof, checking for proper fit. Repeat procedure until desired fit is obtained.



### Water Drainage System and Water Leak Corrections

#### Drain Hoses

The roof panel module contains the track assemblies, cable and drive mechanisms, and a drain trough that encircles the sliding panel. Attached to the module are four drain hoses. One drain hose is attached at each corner of the module. The two front drain hoses are routed down the windshield pillars and into the cowl sides exiting at rocker panel drain holes; ends of hose are not re-usable. The two rear drain hoses are routed down the rear pillars, forward of the rear wheelbase, exiting at rocker panel drain holes on station wagons.

On sedan vehicles, the rear hoses are routed aft of wheelhouse and through the quarter panel behind the bumper fascia. A rubber valve is employed at the end of the tube to prevent noise from entering the passenger compartment.

**NOTE:** Prior to performing any services, first verify that the drainage system is not plugged or restricted.

Use a 473ml (16 oz) container and pour water into the drain trough. Look at the rear of the vehicle to

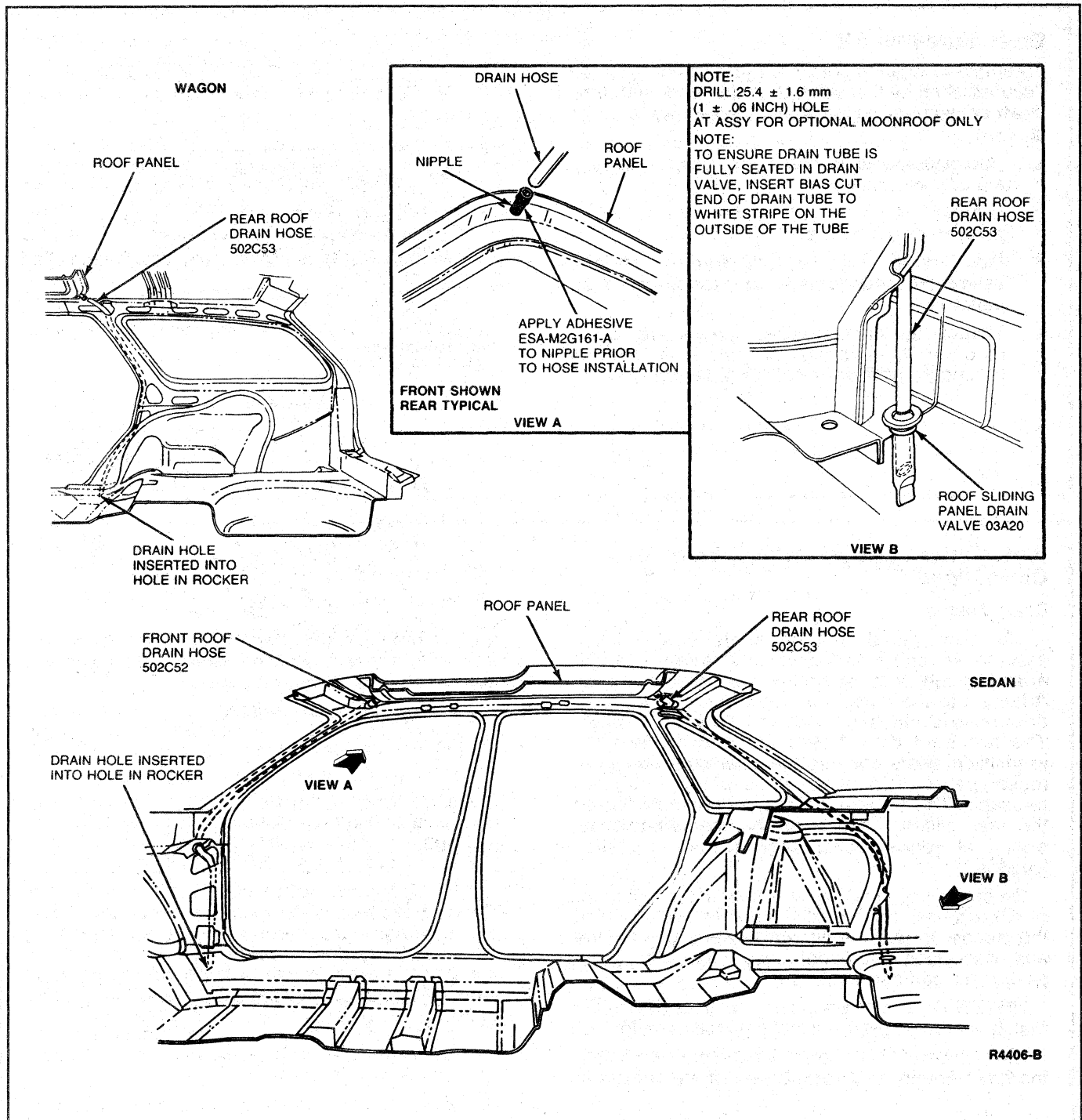
ensure that the water drains from the rocker panels forward of the rear wheelhouse for station wagons, and aft of wheelhouse on sedans.

If the water flow is restricted, use compressed air to blow out any material in the drain hose system. Test by pouring water slowly into the system again.

After ensuring that the drainage system is not restricted, verify that gaps do not exist between the glass seal and the roof panel. If a gap exists, the gap must be brought to specification before any further action is taken. Adjust sliding panel as outlined.

With clearances within specification, and panel closed, have an assistant spray water on the sliding panel while you are on the inside, visually inspecting the area to see if an excessive amount of water is entering the drain trough. A large volume of water indicates that an excessive clearance exists between the sliding panel seal and the roof.

## ADJUSTMENTS (Continued)

**Sliding Panel**

The sliding panel has controlled water leak at the seals. A properly adjusted glass panel should result in snug fit between the seal and the roof skin around the entire opening. The fit can be checked by using a feeler gauge set at 0.25mm (0.10 inch) between the seal and roof. **If these specifications are not maintained, water will overflow the drain troughs and enter the module, running down into the passenger compartment when the**

**vehicle is stopped abruptly. Also, increased wind noise could result if glass clearances are not kept to these specifications.**

**Wet Headliner—Sides**

If water drips from the headliner above the door or quarter window, check to see if the drain tube(s) are disconnected from the module. Apply Weatherstrip Adhesive C0AZ-19552-A or equivalent, on drain tube nipple and insert drain hose.

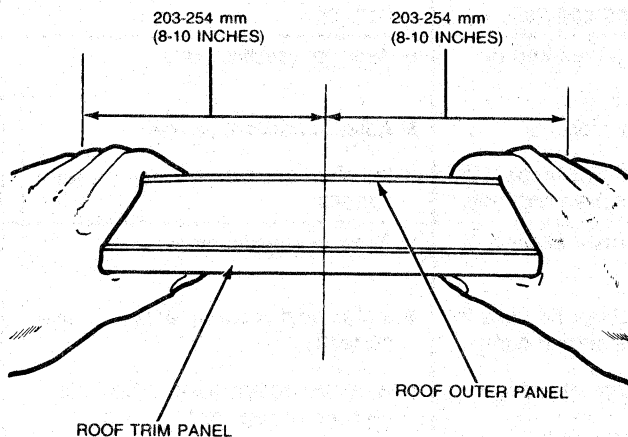
## ADJUSTMENTS (Continued)

### Overcrowned Rear Roof Panel

If the roof panel is overcrowned to the contour of the sliding panel (at rear of sliding panel), this can cause wind noise or water leak conditions.

**CAUTION: Excessive overbending could distort the roof panel, requiring costly metal finishing service. This procedure should be used only as a last resort.**

Remove sliding panel from vehicle and carefully overbend the center of the roof panel by applying downward pressure.

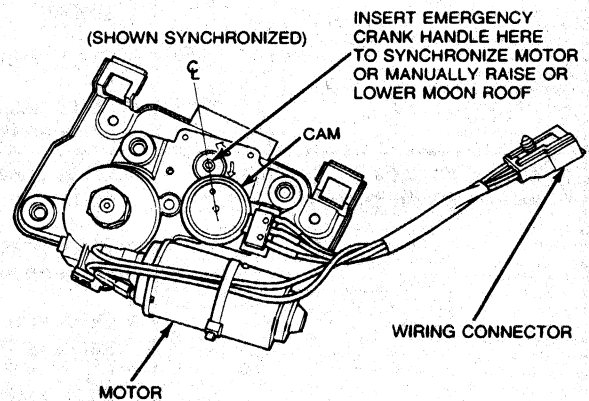


R4026-C

**NOTE:** The glass panel should be in the CLOSED position for synchronization.

1. Insert emergency crank handle in auxiliary socket drive.
2. Rotate handle either clockwise or counterclockwise until centerline of gear, centerline of cam, and hole in cam are aligned.
3. Remove emergency crank handle from motor. Make sure the lifter arm and guidance ramp are aligned as shown. Motor may now be installed in vehicle.

**NOTE:** It may be necessary to rotate motor assembly slightly to engage drive splines when installing.



R4402-A

### Undercrowned Rear Roof Panel

A glass panel scratch can be caused by the rear of the roof panel being slightly undercrowned.

**CAUTION: Excessive overbending could distort the roof panel, requiring costly metal finishing service. This procedure should be used only as a last resort.**

Open the sliding panel assembly slightly and compare the contour of roof panel and glass panel. If the roof panel appears flattened in the center, and the glass scuffs on the underside of the roof panel, remove the sliding panel from the vehicle and arch the roof panel by pushing up on underside of roof panel to increase the roof panel arch.

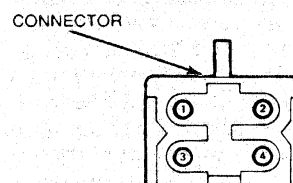
### Motor

Any time the moon roof motor is removed from the vehicle, it must be checked for synchronization before it is installed. The motor is synchronized when the centerline of the gear, the centerline of the cam, and the hole in the cam are aligned. If the motor is not synchronized, remove the motor as outlined and adjust it as follows:

## TESTING

### Switch Test

1. Use a self-powered test lamp or an ohmmeter to test moon roof switch.
2. With switch in NEUTRAL position, there should be continuity between terminals 1, 2 and 4.
3. With rocker switch pushed rearward, there should be continuity between terminals 1 and 2 and terminals 3 and 4.
4. With rocker switch pushed forward, there should be continuity between terminals 2 and 3 and terminals 1 and 4.
5. If switch does not test as stated, replace switch.



R4407-A

**DIAGNOSIS**

Refer to the following charts for diagnosis of the moon roof.

CONDITION	POSSIBLE SOURCE	ACTION
<ul style="list-style-type: none"> <li>• Water leaks</li> </ul>	<ul style="list-style-type: none"> <li>• Glass panel not properly aligned or fitted to roof.</li> <li>• Glass panel not fully closing.</li> <li>• Drain tubes not properly connected and/or blocked.</li> <li>• Cracks in housing.</li> <li>• Glass assembly seal not properly in place and/or attached securely.</li> </ul>	<ul style="list-style-type: none"> <li>• Align to specifications.</li> <li>• Adjust to specifications.</li> <li>• Connect properly and/or service or replace drain tubes as required.</li> <li>• Service as required.</li> <li>• Install seal properly and/or attach correctly.</li> </ul>
<ul style="list-style-type: none"> <li>• Windnoise</li> </ul>	<ul style="list-style-type: none"> <li>• Glass panel not properly fitted or aligned.</li> <li>• Glass panel not fully closing.</li> <li>• Glass assembly seal not properly in place and/or not attached securely.</li> </ul>	<ul style="list-style-type: none"> <li>• Align to specifications.</li> <li>• Adjust to specifications.</li> <li>• Install seal properly and/or attach correctly.</li> </ul>
<ul style="list-style-type: none"> <li>• Moon Roof does not function and/or perform properly</li> </ul>	<ul style="list-style-type: none"> <li>• Glass panel not properly aligned or fitted to roof.</li> <li>• Glass assembly seal not properly in place and/or not attached securely.</li> <li>• Obstructions or foreign objects in tracks or troughs.</li> <li>• Rear guide pin not properly engaged in cam slot of lifter assembly.</li> <li>• Rear lifter assemblies not properly connected to glass module.</li> <li>• Front guides not properly installed and/or secured.</li> <li>• Adequate voltage not being supplied to the motor (12.6 V).</li> <li>• Tracks not securely attached to housing.</li> <li>• Rear guide cables not properly synchronized.</li> <li>• Rear drive cable or guide broken.</li> <li>• Sunshade not properly installed.</li> <li>• Amperage range for glass running not adequate (3-5 A).</li> </ul>	<ul style="list-style-type: none"> <li>• Align to specifications.</li> <li>• Install seal properly and/or attach correctly.</li> <li>• Remove obstructions or foreign objects as required.</li> <li>• Engage rear guide pin properly.</li> <li>• Properly connect lifter assemblies to glass module.</li> <li>• Install and/or secure front guides as required.</li> <li>• Check voltage and correct if voltage not adequate.</li> <li>• Attach track securely to housing.</li> <li>• Synchronize cables and motor.</li> <li>• Replace or service as required.</li> <li>• Check and install sunshade properly as required.</li> <li>• Check for proper amperage and correct if required.</li> </ul>

CR4027-C

## DIAGNOSIS (Continued)

CONDITION	POSSIBLE SOURCE	ACTION
<ul style="list-style-type: none"> <li>Noisy Operation</li> </ul>	<ul style="list-style-type: none"> <li>Glass panel not fitted properly to housing.</li> <li>Glass assembly seal not properly in place and/or secured.</li> <li>Rear guide pins not properly engaged in cam slot of lifter assembly.</li> <li>Rear lifter assemblies not properly attached to glass module.</li> <li>Front guides not properly installed and/or secured.</li> <li>Track assembly not properly secured to housing.</li> <li>Rear drive cables not properly synchronized.</li> <li>Sunshade not installed properly.</li> <li>Amperage range for glass running not adequate (3.5 A).</li> </ul>	<ul style="list-style-type: none"> <li>Align to specification.</li> <li>Properly fit and/or secure glass assembly seal.</li> <li>Engage rear guide pins properly.</li> <li>Properly attach lifter assembly to glass module.</li> <li>Properly install or service as required.</li> <li>Secure track assembly to housing.</li> <li>Synchronize cables and motor.</li> <li>Check and install sunshade properly as required.</li> <li>Check for proper amperage and correct if required.</li> </ul>
<ul style="list-style-type: none"> <li>Rattles</li> </ul>	<ul style="list-style-type: none"> <li>Glass panel not properly aligned or fitted to roof.</li> <li>Glass panel not fully closing.</li> <li>Drain tubes not properly connected and/or blocked.</li> <li>Glass assembly seals not properly in place and/or not attached securely.</li> <li>Obstructions or foreign objects in tracks or troughs.</li> <li>Rear guide pin not properly engaged in cam slot of lifter assembly.</li> <li>Rear lifter assemblies not properly connected to glass module.</li> <li>Front guides not properly installed and/or secured.</li> <li>Tracks not attached to housing securely.</li> <li>Sunshade not installed properly.</li> <li>Sunshade magnets rattle.</li> </ul>	<ul style="list-style-type: none"> <li>Align glass panel to specification. Band glass attaching tabs inboard 1.5 mm (0.059 inch).</li> <li>Adjust to specification.</li> <li>Connect properly and/or fix to replace drain tubes as required.</li> <li>Install seals properly and/or attach correctly.</li> <li>Remove obstructions or foreign objects as required.</li> <li>Engage rear guide pin properly. Add retaining clip as required.</li> <li>Properly connect lifter assemblies to glass module.</li> <li>Install and/or secure front guides.</li> <li>Attach tracks securely to housing.</li> <li>Check and install sunshade properly as required.</li> <li>Replace sunshade magnets as required.</li> </ul>
<ul style="list-style-type: none"> <li>Glass Broken or Scratched</li> </ul>	<ul style="list-style-type: none"> <li>Glass panel not fitted or aligned properly.</li> <li>Obstructions or foreign objects in tracks or troughs.</li> <li>Clearances to underside of roof panel and reinforcement ring not adequate.</li> </ul>	<ul style="list-style-type: none"> <li>Align to specification.</li> <li>Remove foreign objects and/or obstructions as required.</li> <li>Adjust clearance as required to obtain adequate clearance.</li> </ul>





# BODY SHELL, EXTERIOR TRIM, FRAME AND UNDERBODY

GROUP

**47**

(70000)

SECTION TITLE	PAGE	SECTION TITLE	PAGE
BODY—TAURUS/SABLE .....	47-06-1	BODY SHELL, EXTERIOR TRIM, FRAME AND UNDERBODY—SERVICE .....	47-01-1

## SECTION 47-01 Body Shell, Exterior Trim, Frame and Underbody—Service

SUBJECT	PAGE	SUBJECT	PAGE
ADJUSTMENTS		CLEANING AND INSPECTION (Cont'd.)	
Body Alignment, Unitized .....	47-01-2	Trim .....	47-01-3
Body Misalignment Check .....	47-01-3	DESCRIPTION	
Underbody Misalignment Check .....	47-01-3	Body Sealer Types .....	47-01-2
CLEANING AND INSPECTION		Body Side Protection and Bumper	
Appearance Protection .....	47-01-4	Rubstrip Mouldings .....	47-01-1
Body Maintenance .....	47-01-3	Hoisting, Jacking and Towing .....	47-01-2
Chrome and Bright Metal Care .....	47-01-4	DIAGNOSIS AND TESTING	
Floorpan Plugs and Grommets .....	47-01-3	Dust and Water Leaks .....	47-01-2
Rattle Elimination .....	47-01-3	SPECIAL SERVICE TOOLS .....	47-01-4
Rustproofing .....	47-01-4	VEHICLE APPLICATION .....	47-01-1

### VEHICLE APPLICATION

Taurus/Sable.

### DESCRIPTION

#### Body Side Protection and Bumper Rubstrip Mouldings

##### Tape, Pressure-Sensitive

To install the optional body side moulding (extruded PVC with two-way tape), wipe the body surface with alcohol or a suitable cleaning solvent to remove all foreign material. Then, at room temperature of 19°C

(65°F), remove protective carrier from pressure-sensitive tape on the mouldings. Position moulding and press firmly to ensure adhesion.

**DESCRIPTION (Continued)****Body Sealer Types****Caulking Cord D6AZ-19560-A**

This sealer or equivalent is commonly known as permagum. It is used on spot weld holes, around moulding clips or between two surfaces not properly sealed by a gasket. Apply with a putty knife.

**Rubber Cement 8A-19552-B**

This material or equivalent, is designed to hold weatherstripping on doors, bodies, deck lids, cowl ventilators and the surrounding metal. Windows and windshields which are set in rubber can be sealed effectively against leakage by flowing cement into the affected areas.

Clean all grease, dirt and old sealer from the surfaces to be cemented, and apply a medium coat of cement to both surfaces. Allow to dry until tacky, and press both surfaces firmly together.

**Silicone Lubricant C0AZ-19553-A Jelly**

This lubricant, or equivalent, is to be used on the door and window weatherstrips. It is recommended that silicone lubricant be applied to the weatherstrips at every lubrication period. Its use makes the doors easier to close, avoids weatherstrip squeaks, retards weatherstrip wear from chafing between the door glass upper frame and the weatherstrip, and helps to retain door window alignment by reducing friction between the glass frame and rubber weatherstrip.

**Hoisting, Jacking and Towing**

Refer to Section 50-04 for Hoisting and Jacking. Refer to Section 50-05 for Towing.

**DIAGNOSIS AND TESTING****Dust and Water Leaks**

Sealer locations should be considered when checking for dust or water leaks. The forward motion of the vehicle causes any unsealed, small opening in the lower section of the body to permit air and dust to be drawn into the body. Opening the ventilator air ducts will equalize these pressures. Dust accumulates in the rocker panel, and may move into the luggage compartment.

To eliminate dust leakage, determine the exact point at which the dust enters.

Under certain conditions, water can enter the body at any point where dust can enter.

To determine the exact location of a dust leak, it may be necessary to remove the following trim from the vehicle:

1. Cowl trim panel.
2. Quarter trim panel.
3. Rear seat back and seat cushion.
4. Luggage compartment floor mats, spare wheel and side trim panel.
5. Center pillar trim.
6. Scuff plates.

After removing the trim, the location of most leaks will be evident. The entrance of dust is indicated by a pointed shaft of dust or silt. Seal these leaks, and road test the vehicle on a dusty road to ensure all leaks are sealed.

After the road tests, check for indications of a dust pattern around the door openings, cowl panel, lower part of the quarter panel and in the luggage compartment.

Sometimes leaks can be located by putting bright lights under the vehicle, with the above components removed, and checking the interior of the body joints and weld lines. A light will show through where leaks exist. The Rotunda Ultra-Sonic Leak Detector 029-00001 or equivalent, can locate dust leaks, as well as wind noise and water leaks.

**ADJUSTMENTS**

**CAUTION:** Never apply heat to the bumper energy absorber. Heat could cause the material inside the absorbers to expand and flow out of the absorbers or crack the metal housing. Always remove the absorbers before making body frame service near them.

**CAUTION:** Never apply excessive heat to bumper surface. Heat could cause the bumper to distort.

**CAUTION:** When collecting exhaust fumes in service area, never attach a metal collector to the exhaust tail pipe as the heat could damage the bumper.

**Body Alignment, Unitized**

Heat and the use of heavy duty jacks must be carefully controlled because of the difference in the gauge of the metal in the side rails of a unitized body and the stress points in a unitized body. It is possible to pull damaged areas back into alignment with the use of light-weight jacks and hydraulic equipment, without heating the metal.

**ADJUSTMENTS (Continued)**

Rough-out badly damaged areas before taking measurements for squaring up a body. If necessary, remove the glass from the damaged area to prevent breakage. In severe cases, reinforcement brackets and other inner construction may have to be removed or cut to permit restoration of the outer shell and pillars, without excessive strain on the parts. Straighten, install and secure all such parts in place before attempting to align the body.

In cases of severe or sharp bends, it may be necessary to use heat. Any attempt to cold-straighten a severely bent bracket may cause ruptures of the welds and may also cause cracks in the bent part. Never heat the area to more than a dull red.

**Underbody Misalignment Check**

The dimensions of the underbody must be restored in the service of major body damage, to provide correct front and rear wheel geometry. Refer to Section 47-06 for the underbody dimensions. All the dimensions are detailed to the center line of existing holes in the underbody assembly. Once the frame and suspension members are aligned, other operations in this Section can be performed.

**Body Misalignment Check**

To align or square up a body, take two opposite diagonal measurements between the front, center or rear pillars. Take the measurements between reference points, such as crease lines or weld joints which are diagonally opposite each other on the two pillars being measured. Since all measurements should be made from the bare metal, remove all interior trim from the checking points.

Do not attempt to correct any serious misalignment with one jacking operation. Align each section proportionately, until the proper dimensions are obtained. If body alignment is questionable, refer to Section 47-06 for underbody dimensions.

**CLEANING AND INSPECTION****Floorpan Plugs and Grommets**

Many plugs and grommets are used in the floorpan and dash panel. The floorpan plugs seal the various access holes. If any plugs are missing or improperly installed, a dust or water leak may result. This also applies to the grommets used on the dash panel. When dust or water leaks are evident, these plugs and grommets should be checked for proper installation.

**Rattle Elimination**

Foreign objects such as nuts, bolts or small pieces of body deadener in the door wells, pillars and quarter panels are often the source of rattles. Door wells can be checked by carefully striking the underside of the door with a rubber mallet.

All bolts and screws should be tightened periodically. In the event that tightening the bolts and screws located on such assemblies as the doors, hood, and deck lid does not eliminate the rattles, the trouble is probably caused by misalignment. If this is the case, follow the adjustment and alignment procedures for these assemblies.

Rattles and squeaks are sometimes caused by weatherstripping and anti-squeak material that has slipped out of position. Apply additional cement or other adhesive.

**Trim**

Bright metals should be periodically cleaned with a soft, clean cloth or sponge and clear water. For excessively dirty parts, use Ford Multi-Purpose Cleaner B8A-19523-A or equivalent diluted to proper concentration. Wash, rinse and wipe the parts dry. To remove rust or salt corrosion from chrome plated parts, sparingly use Ford Bright Metal Cleaner 8A-19522 or equivalent. On aluminum or chrome finished parts, avoid scouring with steel wool and polishing with products containing abrasives. Use Ford Custom Silicone Gloss Polish B7AZ-19530-A or equivalent for excellent protection of all bright metal parts.

**Body Maintenance**

Regular body maintenance preserves the vehicle's appearance during the life of the vehicle. The following steps are suggested as a guide for regular body maintenance.

1. Vacuum the interior thoroughly and wash the vehicle.
2. Check all openings for water leaks and seal where necessary.
3. Cement all loose weatherstrips which are still usable using Ford Weatherstrip Adhesive COAZ-19552-A or equivalent.
4. Replace all door and deck lid weatherstrips that are unfit for service.
5. Apply Ford Silicone Lubricant COAZ-19553-A or equivalent, to the weatherstripping.

**CLEANING AND INSPECTION (Continued)**

6. Replace all cracked, fogged or chipped glass.
7. Align the hood, doors and deck lid if necessary.
8. Inspect the windshield wiper blades and replace them if necessary.
9. Tighten the sill plate and garnish moulding screws.
10. Clean the seats, door trim panels and headlining.
11. Apply touch-up paint to chipped or scratched areas.
12. Drain holes (located on the underside of each rocker panel, quarter panel and door) should be cleared periodically.

**Appearance Protection**

Proper maintenance will help keep the vehicle looking factory new for years to come. The following cleaning and care recommendations will provide the vehicle with necessary appearance protection.

Proper exterior appearance protection includes proper and frequent washing (including underside areas), polishing to shield paint and bright metal surfaces, touching up nicks and scratches with proper paint, and keeping body drain holes unplugged.

**NOTE:** It is very important to remember when using any chemical cleaner or polish to always follow label directions. Read all warning and cautionary statements which appear on label.

**Washing**

Use Ford Wash and Wax Concentrate D6AZ-19523-A or equivalent diluted to the proper concentration, followed by a rinse with clear cold water. Do not wash vehicle with hot water in the direct rays of the sun or while sheet metal is hot.

**Polishing**

Use Ford Custom Silicone Gloss Polish B7AZ-19530-A Ford Custom Auto Wax B4A-19534-A, Ford Custom Cream Auto Wax E4AZ-19534-A or equivalent to remove harmful deposits and provide added protection on body surfaces.

**Underbody**

In geographic areas using a heavy concentration of road salt or other corrosive materials for snow removal or road dust control, flush and inspect the complete underside of the vehicle at least twice each year.

Particular attention should be given to cleaning out underbody members and drain holes where dirt and other foreign materials may have collected.

**Rustproofing**

The elastomeric (flexible) plastic claddings and fairings, front and rear polycarbonate bumpers and urethane rear sight shields on the vehicle may be damaged by any of the presently available aftermarket body rustproofing compounds. Damage results when the rustproofing compounds are absorbed by the plastic, causing it to swell.

**CAUTION:** The flexible plastic and/or rubberlike parts such as front and rear polycarbonate bumpers, plastic claddings and fairings, and urethane rear sight shields, if so equipped, may be damaged by aftermarket rustproofing compounds. If rustproofing overspray, drips or runs are allowed to remain on the front or back side of the noted plastic parts, they may swell or distort. To prevent this, if the vehicle has been aftermarket rustproofed, inspect and clean with Ford Tar and Road Oil Remover B7A-19520-A or equivalent or a naphtha-wetted cloth. Wipe completely dry. Inspect frequently, as rustproofing may run or drip for some time after installation, especially in hot weather.

**Chrome and Bright Metal Care**

Frequent washing and the use of Ford Bright Metal Cleaner 8A-19522 or equivalent, are recommended for body hardware, chrome-plated materials and aluminum components.

**CAUTION:** Plastic wheelcovers should always be washed with mild detergent and water immediately after using any commercial-type cleaner to prevent any possible damage to wheelcover.

**CAUTION:** Do not use steel wool, abrasive type cleaner or strong detergents containing highly alkaline or caustic agents on chrome-plated materials, aluminum wheels or anodized aluminum parts as damage to the protective coating, and discoloration may result. Clean with Ford Wash and Wax Concentrate D6AZ-19523-A or equivalent, diluted per label directions.

**Bright Metal Cleaner 8A-19522**

**WARNING: READ THE WARNING INFORMATION ON THE PRODUCT LABEL.**

**Multi-Purpose Cleaner Concentrate B8A-19523-A**

**WARNING: READ THE WARNING INFORMATION ON THE PRODUCT LABEL.**

**SPECIAL SERVICE TOOLS****ROTUNDA EQUIPMENT**

Model	Description
029-00001	Ultrasonic Leak Detector

CN6588-B

# SECTION 47-06 Body—Taurus/Sable

SUBJECT	PAGE	SUBJECT	PAGE
<b>REMOVAL AND INSTALLATION</b>		<b>REMOVAL AND INSTALLATION (Cont'd.)</b>	
Bumper, Front and Rear .....	47-06-3	Mouldings, Exterior .....	47-06-7
Bumper Isolator and Bracket .....	47-06-6	Radiator Grille .....	47-06-1
Bumper Stone Deflector, Rear .....	47-06-6	<b>VEHICLE APPLICATION</b> .....	47-06-1
Fender .....	47-06-7		

## VEHICLE APPLICATION

Taurus/Sable.

## REMOVAL AND INSTALLATION

### Radiator Grille

#### Taurus

The grille snaps onto the headlamp housing at two places on each end.

#### Removal

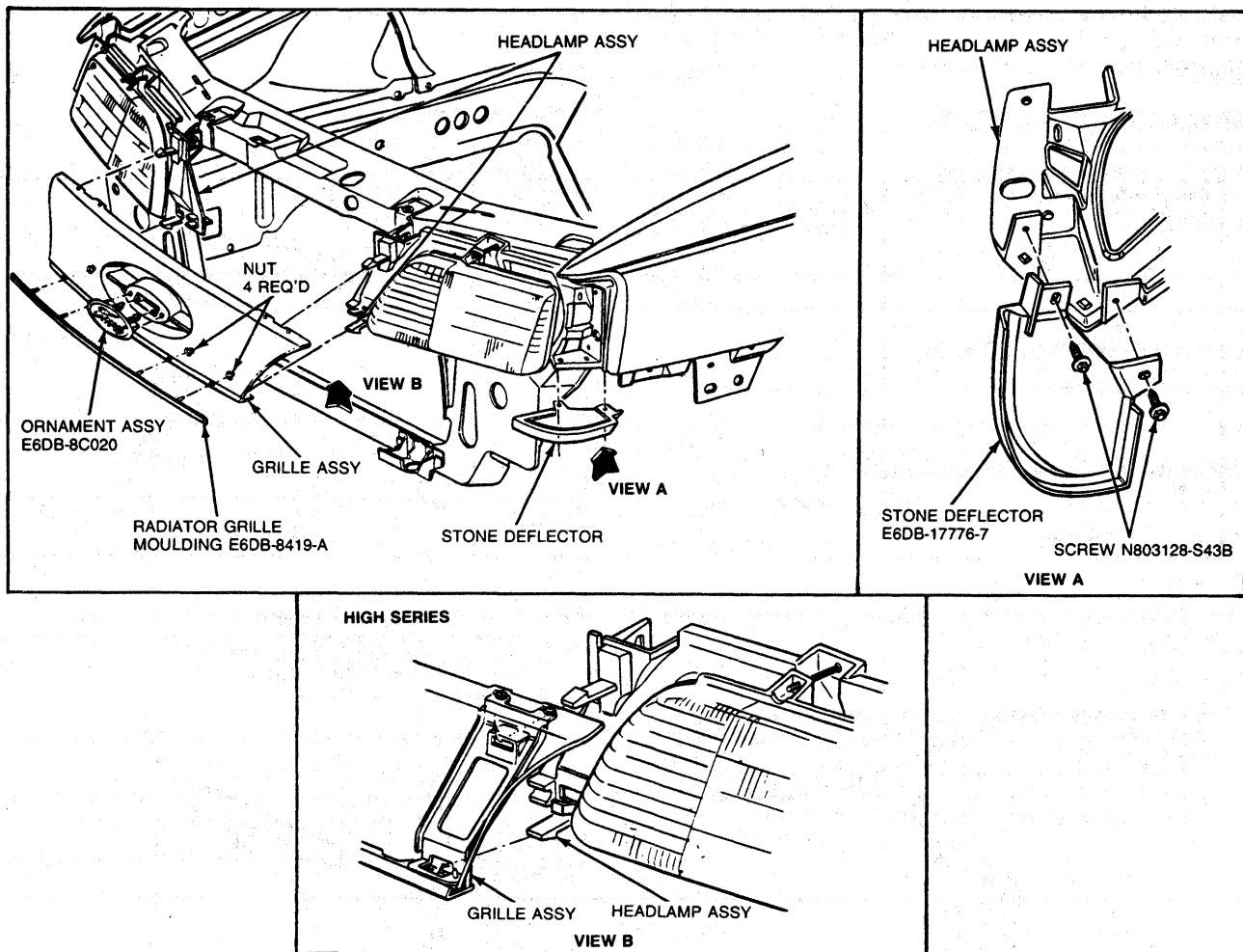
1. With hood propped open, remove blind rivet from strap at LH end of grille assembly, reach behind grille and apply downward pressure on upper attaching tab portion of headlamp housing to disengage tabs.

2. Pull top of grille forward until clear of upper tabs and apply downward pressure to disengage grille from lower tabs.

#### Installation

1. Position bottom slots on grille over lower snap retainers on headlamp housing.
2. Rotate top of grille toward rear of vehicle until upper tab slots snap onto upper retainers.
3. Replace rivet through strap and hole in grille.

## REMOVAL AND INSTALLATION (Continued)



N6572-B

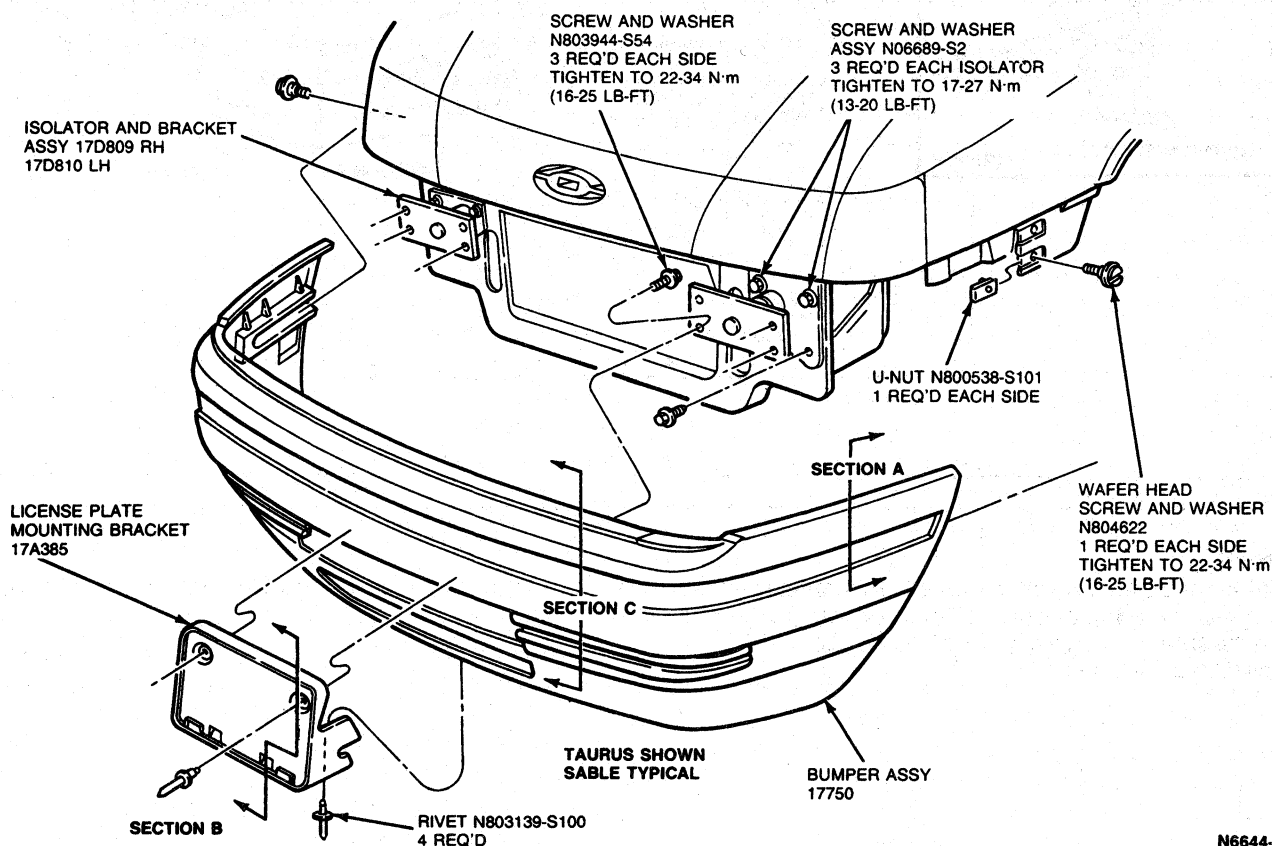
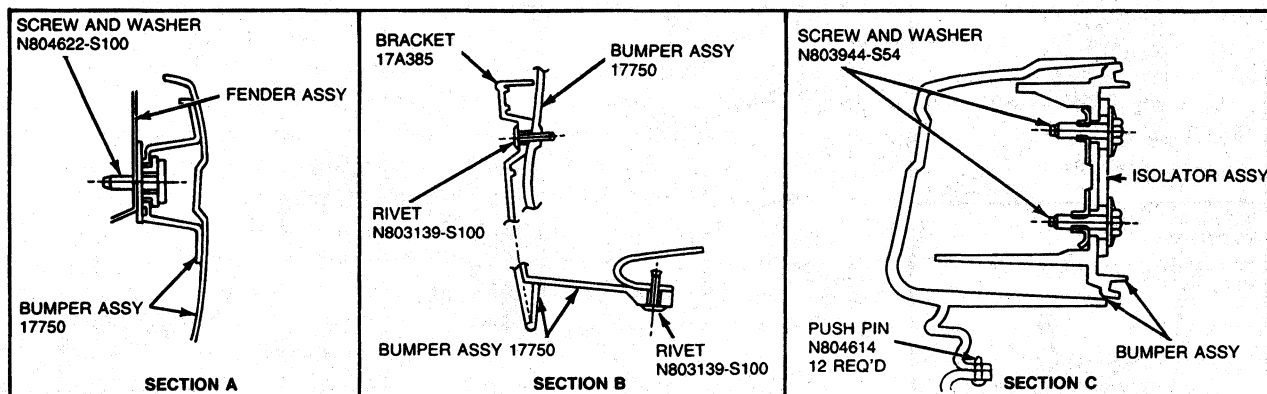
**Sable**

Sable vehicles do not have a conventional grille, they have a reflective panel that is an integral part of the headlamp assembly. Refer to Section 32-02 for headlamp information.

## REMOVAL AND INSTALLATION (Continued)

**Bumper, Front and Rear**

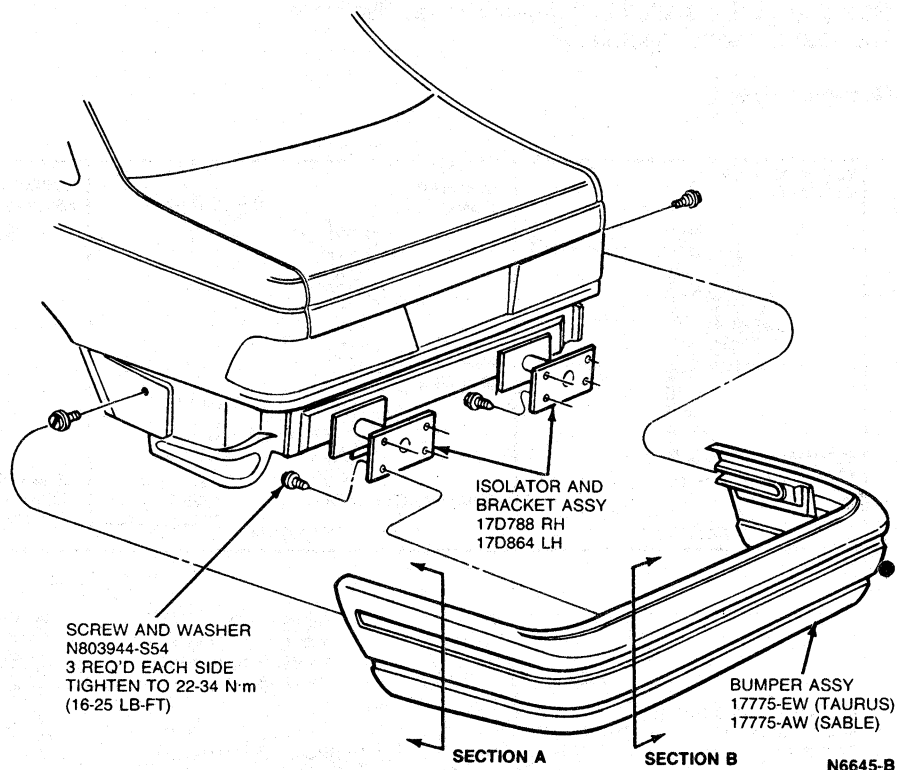
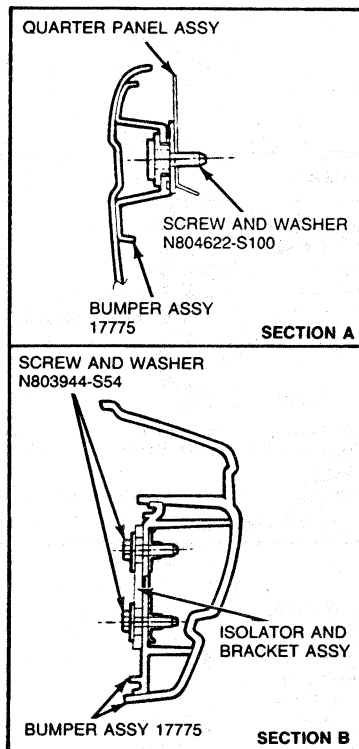
Refer to the following illustrations when performing Removal and Installation procedures on the front and rear bumper assemblies.

**Bumper, Front**

N6644-B

## REMOVAL AND INSTALLATION (Continued)

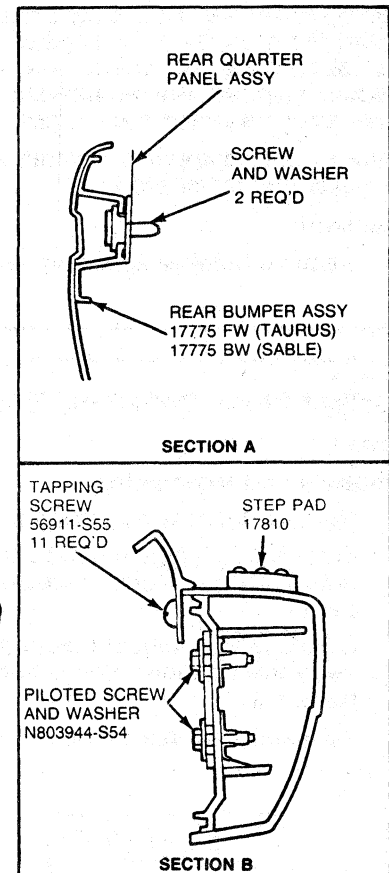
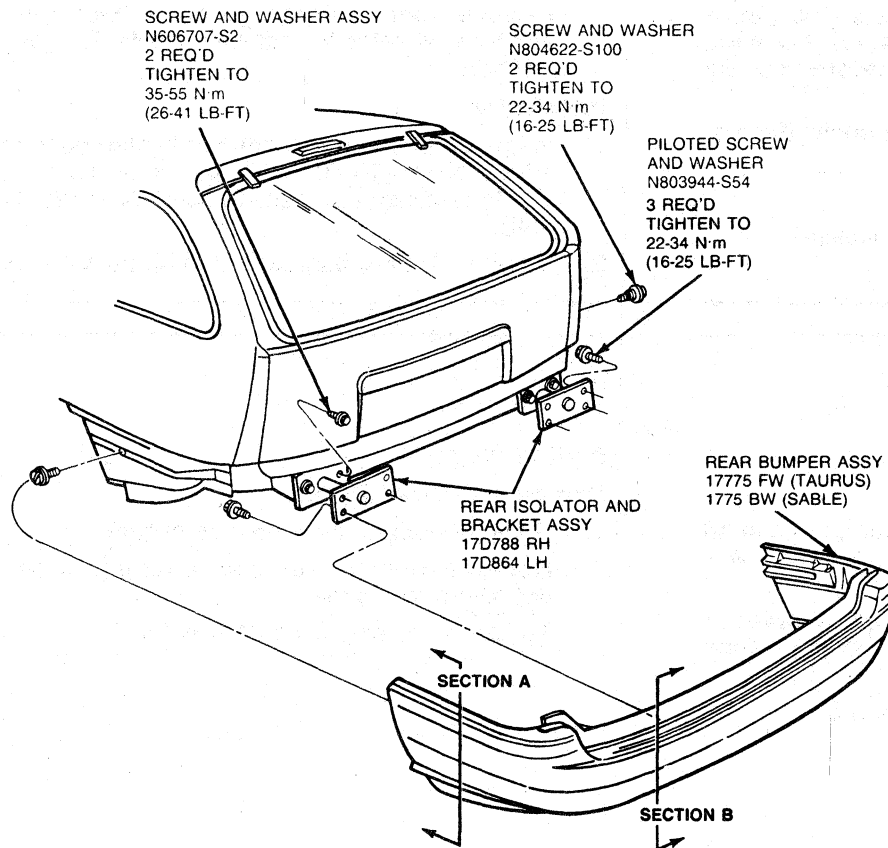
## Bumper, Rear—Sedan





## REMOVAL AND INSTALLATION (Continued)

## Bumper, Rear—Wagon



N6646-B

## Removal

1. Remove bolts attaching bumper to isolator and bracket assemblies. Disconnect front cornering lamps, if so equipped.
2. Slide bumper off screw and washer assemblies mounted on front fender (or quarter panel for rear bumper removal).

## Installation

NOTE: Only the attaching hardware shown may be used. Do not substitute any other parts or finishes for those specified.

1. If the bumper is to be replaced, assemble valance panel for front bumpers and paint new bumper. Assemble step pad and stone deflector for Station Wagon rear bumper. Assemble rubstrip to bumper for Taurus. Assemble front cornering lamps, if so equipped.
2. To install Taurus rubstrip mouldings, wipe bumper surface with alcohol or suitable solvent to remove all foreign material. For Station Wagon rear bumpers, install two pushnuts (one each side) in bumper. At room temperature of 19°C (65°F), remove protective carrier from pressure sensitive tape on mouldings. Position moulding and press firmly to ensure adhesion.
3. To install Station Wagon rear bumper step pad, starting at center of pad, carefully align attaching tabs to bumper and impact pad surface with rubber mallet.
4. Slide bumper onto screw and washer assemblies mounted on front fender (or quarter panel). Install front cornering lamp sockets, if so equipped.
5. Position bumper to isolators and install attaching bolts.
6. Tighten isolator-to-bumper bolts to 22-34 N·m (16-25 lb-ft).

**REMOVAL AND INSTALLATION (Continued)****Bumper Isolator and Bracket**

**CAUTION:** Never apply heat to the bumper energy absorber. Heat could cause the material inside the absorbers to expand and flow out of the absorbers or crack the metal housing. Always remove the absorbers before making body frame service near them.

Refer to the appropriate illustration under Bumper Removal and Installation.

**Removal**

1. Remove bumper assembly as outlined.

2. To remove front isolator, remove three bolts attaching isolator to body. Remove isolator. To remove rear isolator, remove two bolts attaching isolator to rear frame rails. Remove isolator.

**Installation**

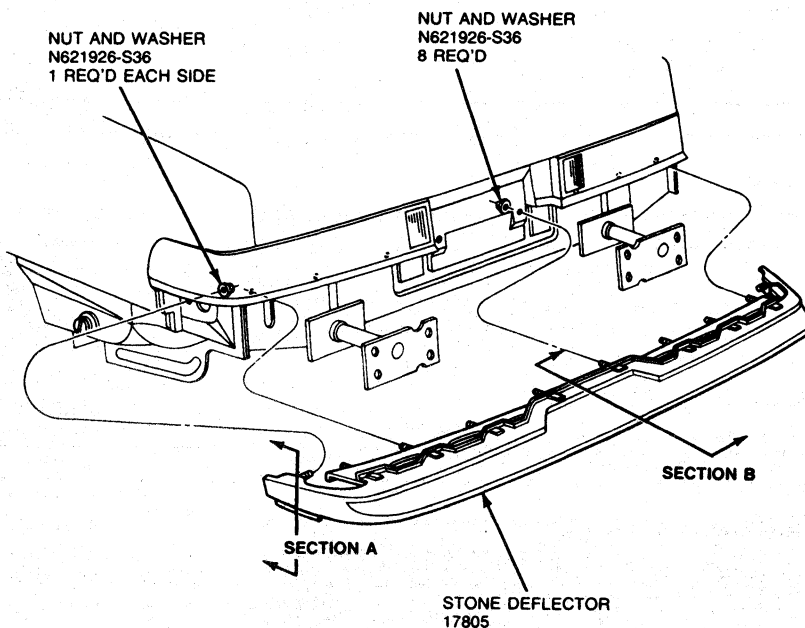
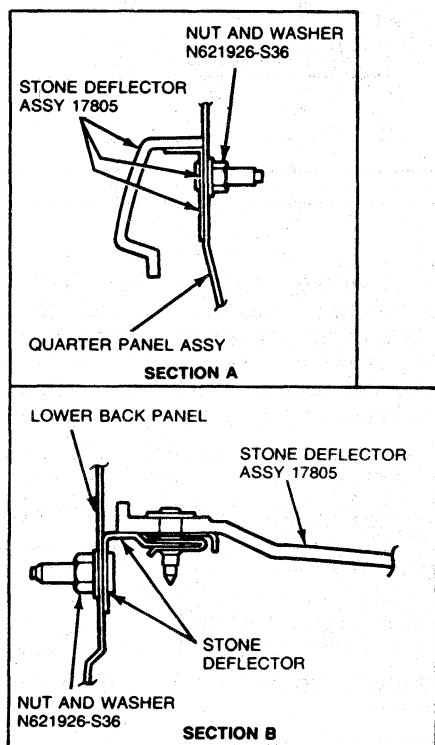
1. Install isolator and bracket and tighten bolts to 17-27 N·m (13-20 lb-ft) for front isolator. Tighten rear isolator bolts to 35-55 N·m (26-41 lb-ft).
2. Install and adjust bumper assembly as outlined.

**Bumper Stone Deflector, Rear****Sedan****Removal and Installation**

1. Remove bumper as outlined.
2. From inside luggage compartment, remove 10 nuts retaining stone deflector to lower back panel.
3. Carefully pull outboard ends of stone deflector away from quarter panels and move deflector rearward.
4. To install, reverse Steps 1, 2 and 3.

**Station Wagon****Removal and Installation**

1. Remove bumper assembly as outlined.
2. Remove eleven screws retaining stone deflectors to bumper.
3. To install, reverse Steps 1 and 2.



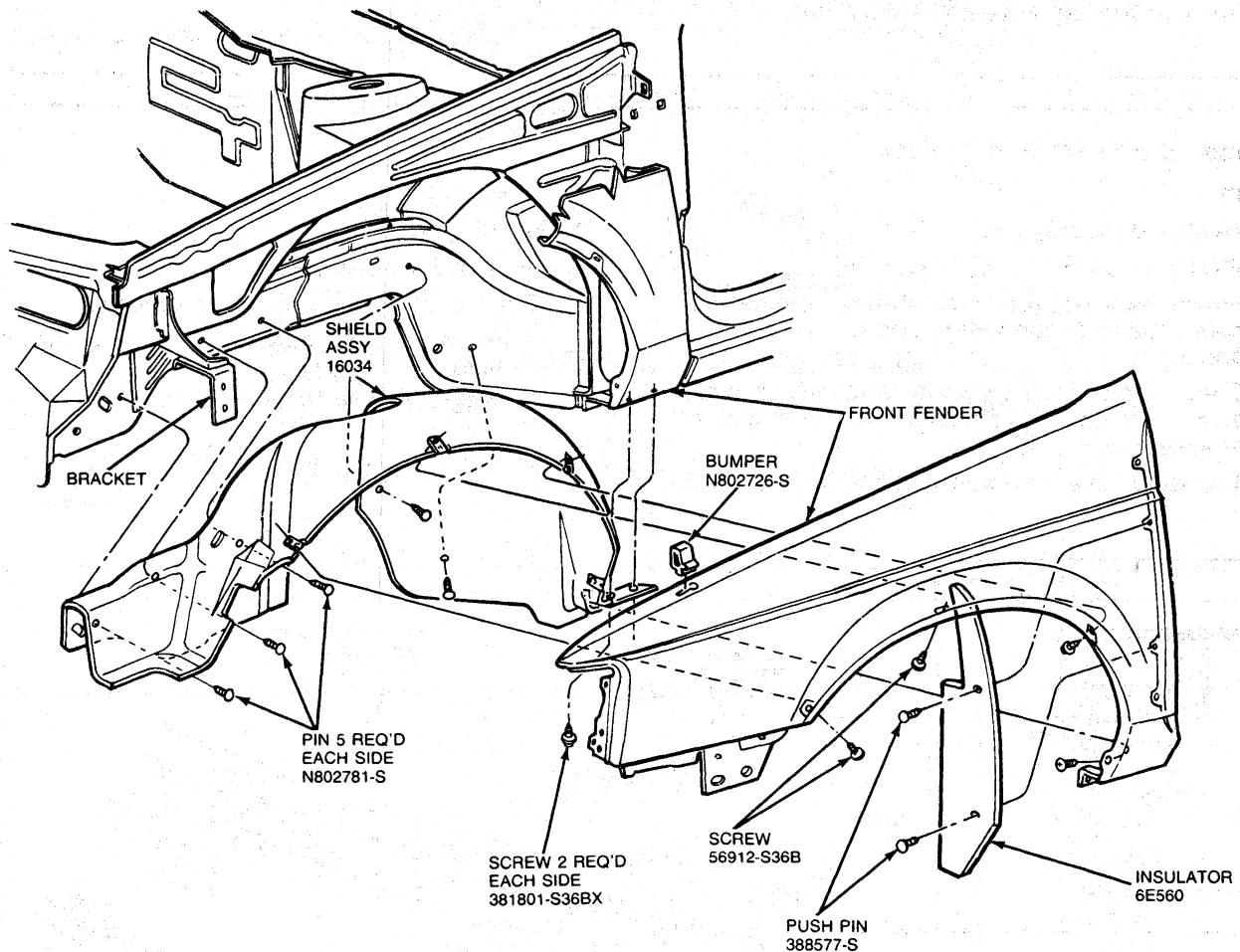
N6649-A

**REMOVAL AND INSTALLATION (Continued)****Fender****Removal**

1. Remove pins securing splash shield to body.
2. Remove screws securing fender and splash shield to body.
3. Remove insulator assembly from fender.
4. Remove fender and splash shield from vehicle.

**Installation**

1. Position splash shield to fender. Secure with screws.
2. Position splash shield and fender to body. Secure with screws and pushpins.



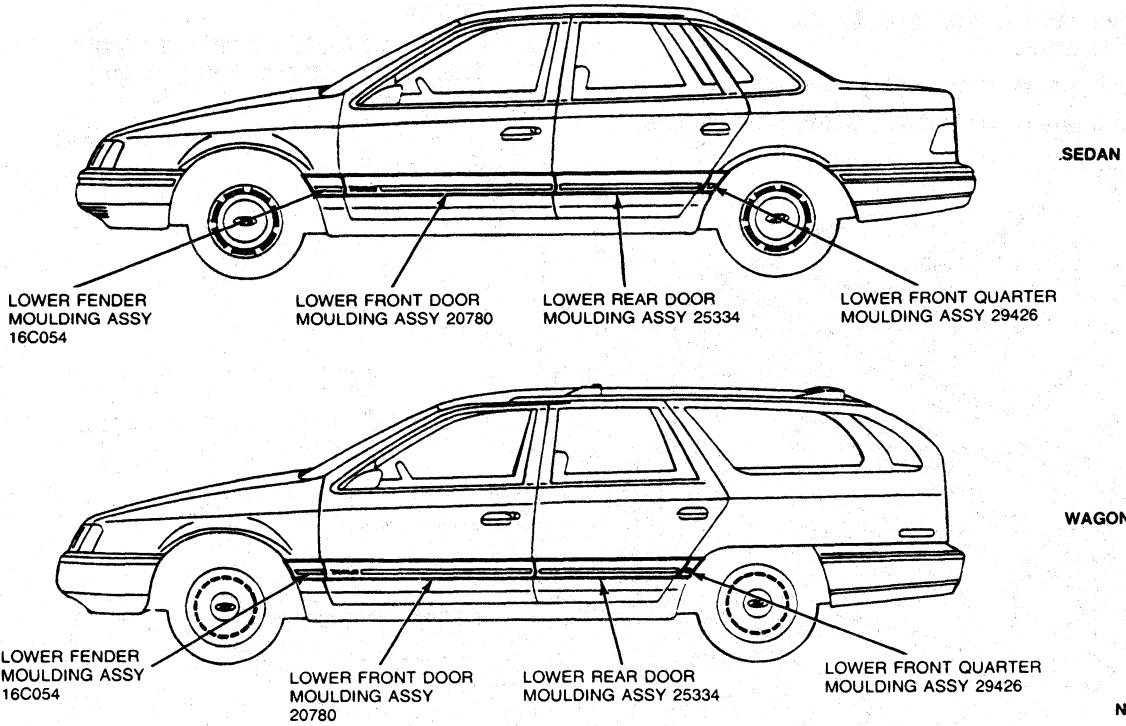
N5509-A

**Mouldings, Exterior**

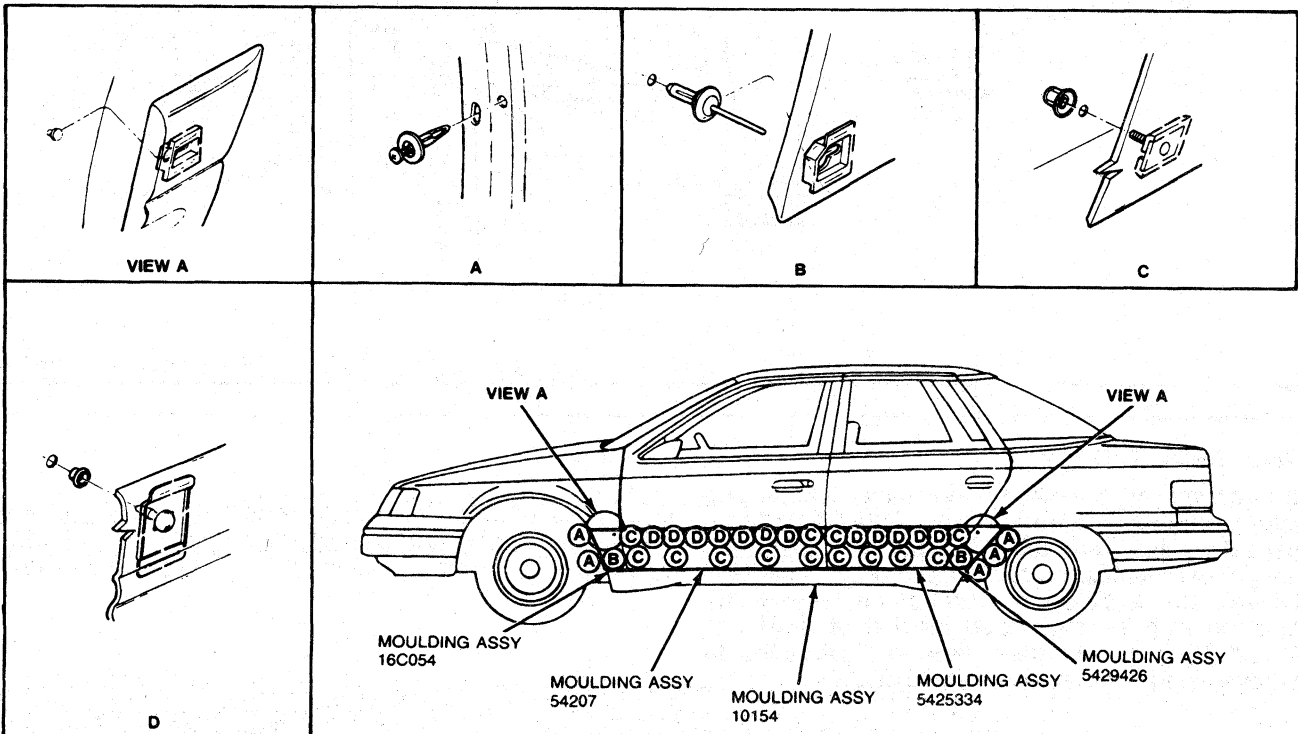
Before removing the exterior mouldings, it should be determined by the type of retainer used, whether a respective door, quarter or luggage compartment trim panel must first be removed to provide access. If a weld stud is distorted or broken off, it should be replaced with an oval head blind rivet (Part No. 383229-S). Refer to the following illustrations to remove and install exterior mouldings.

REMOVAL AND INSTALLATION (Continued)

Body, Side—Upper  
Taurus

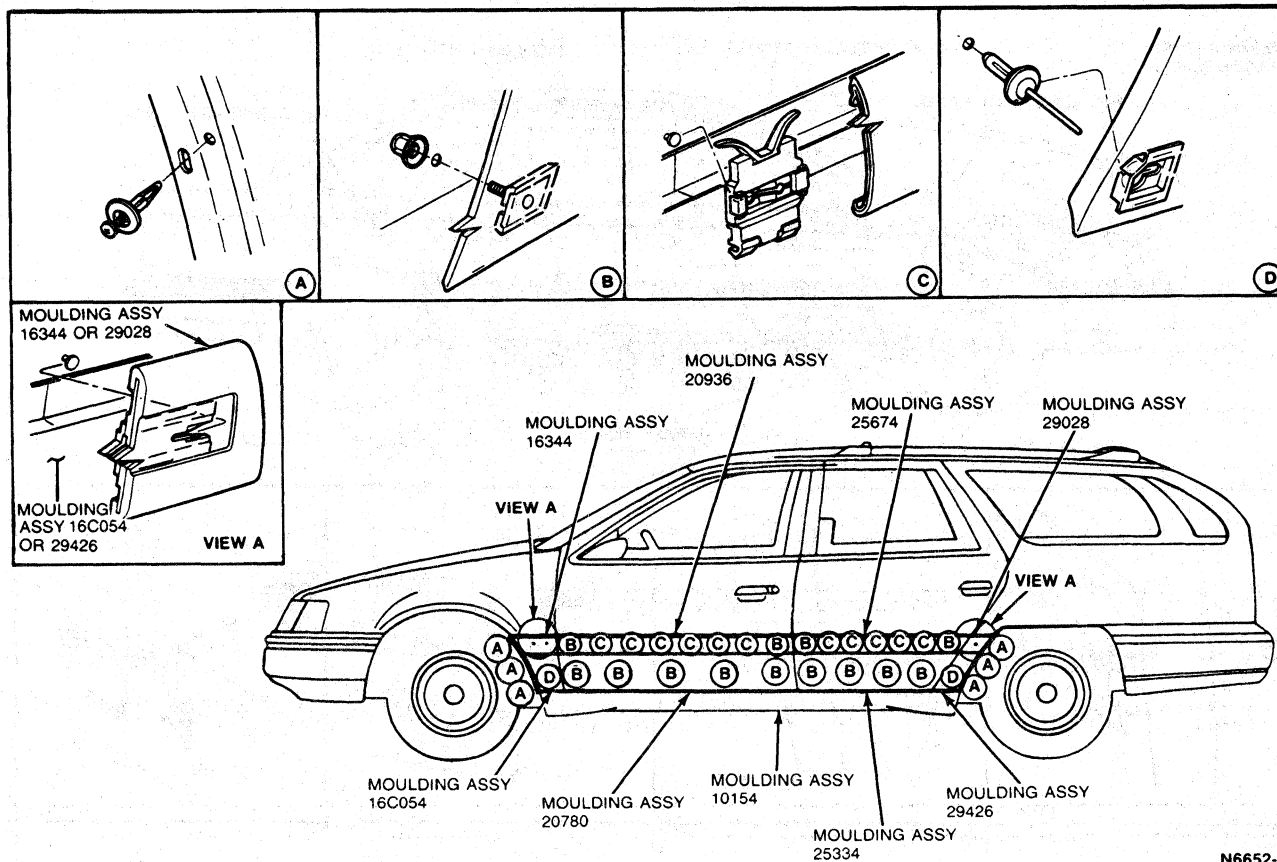


Sable—Sedan



## REMOVAL AND INSTALLATION (Continued)

## Sable—Wagon

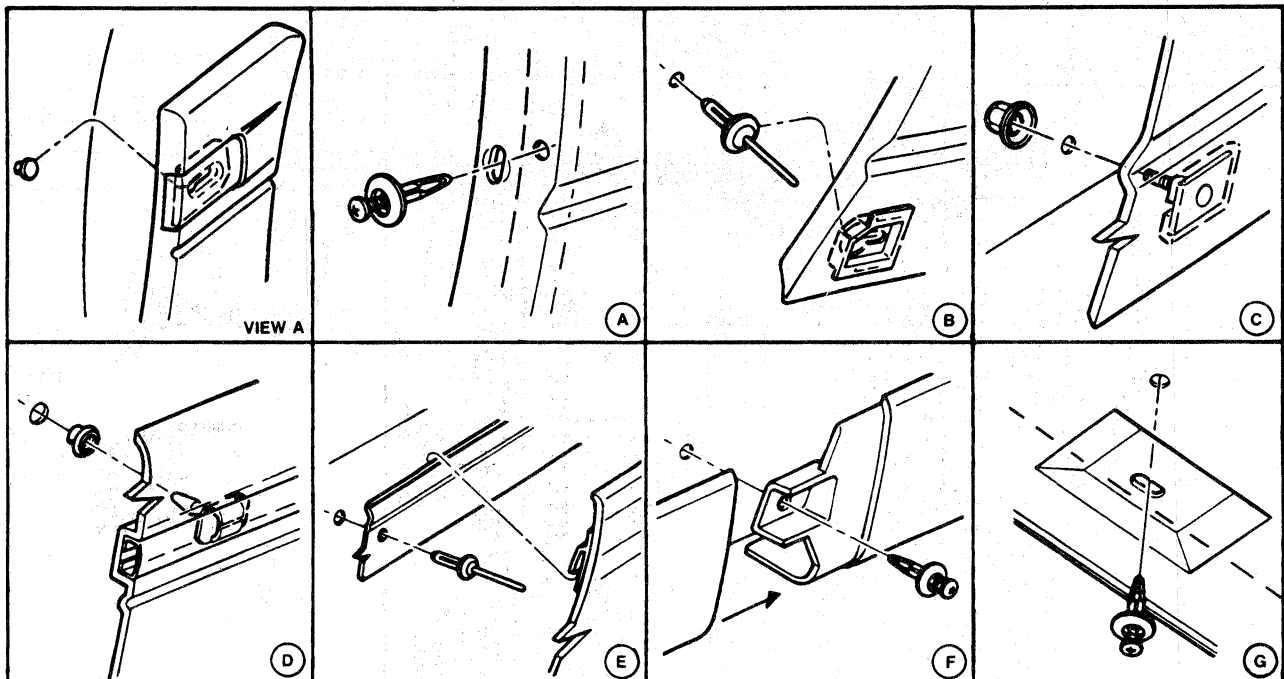
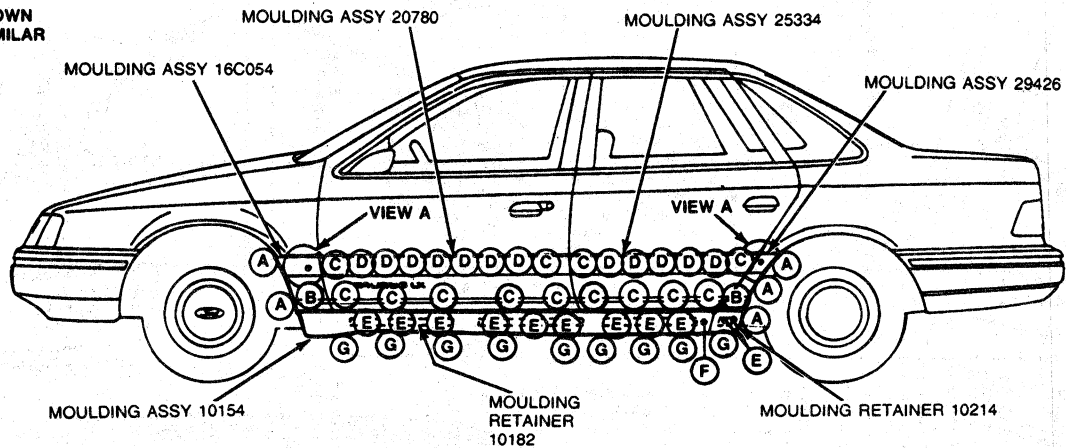


N6652-A

## REMOVAL AND INSTALLATION (Continued)

## Body, Side—Lower

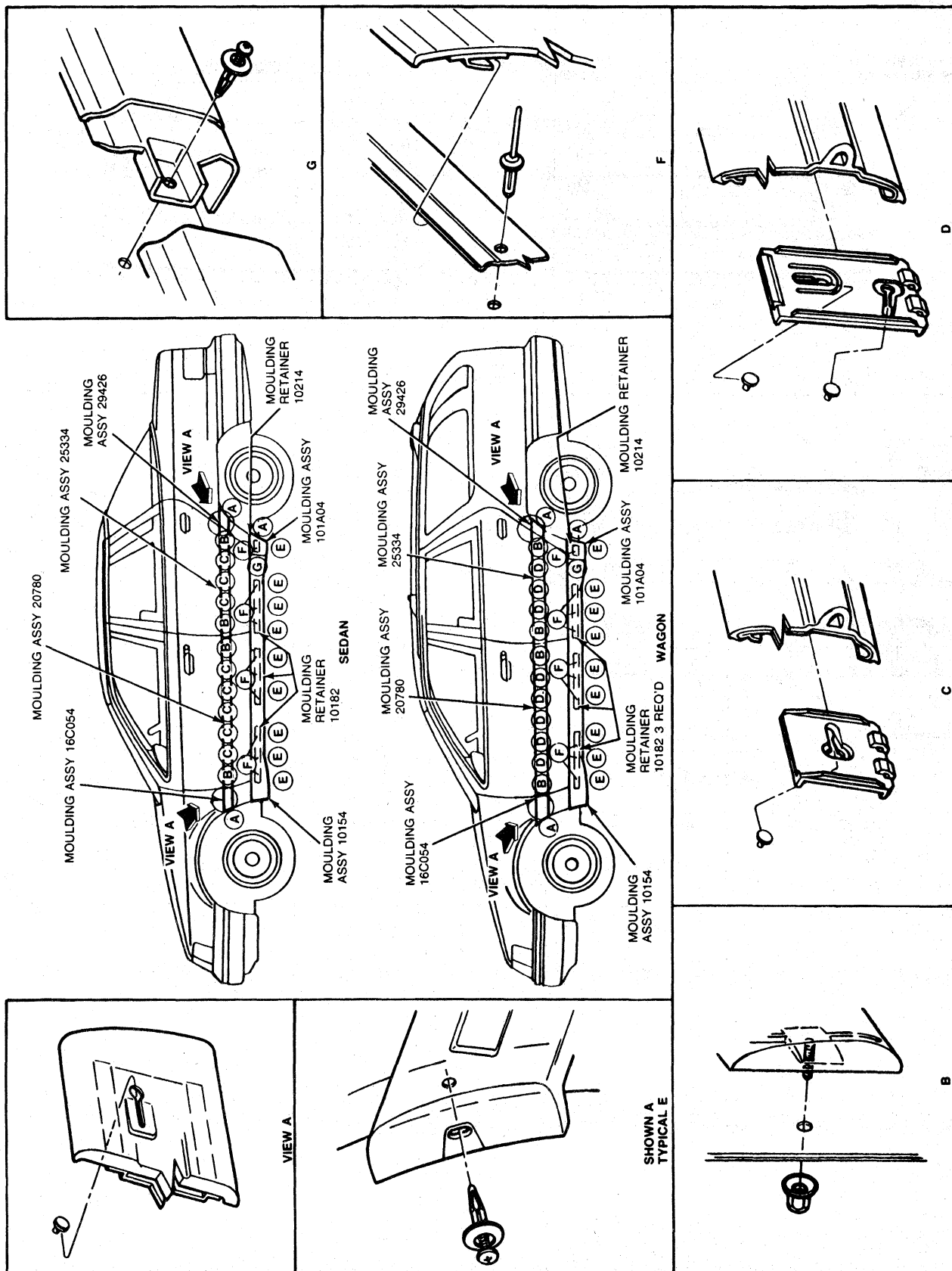
## Taurus

SEDAN SHOWN  
WAGON SIMILAR

N6653-A

## REMOVAL AND INSTALLATION (Continued)

## Sable

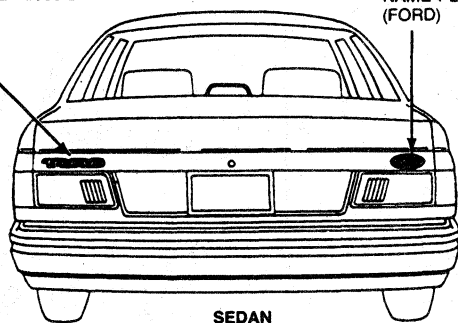


**N6654-A**

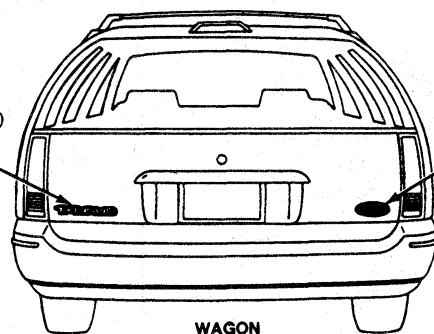
## REMOVAL AND INSTALLATION (Continued)

## Exterior Ornamentation, Rear

## Taurus

NAME PLATE 42550-B  
(TAURUS)NAME PLATE 42550  
(FORD)NAME PLATE  
42550-A (TAURUS)NAME PLATE  
42550-A (FORD)

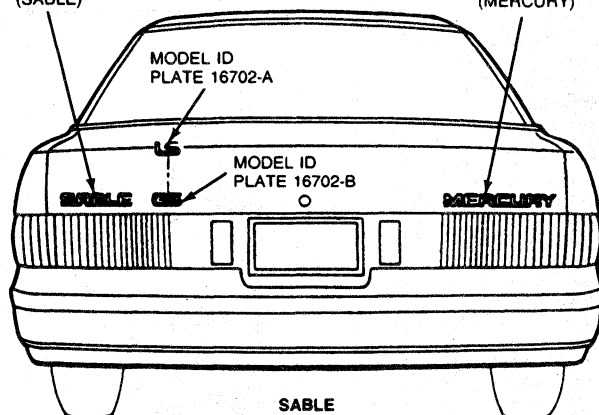
SEDAN



WAGON

N6647-A

## Sable

NAME PLATE  
ASSY 42550  
(SABLE)NAME PLATE  
ASSY 42550  
(MERCURY)MODEL ID  
PLATE 16702-AMODEL ID  
PLATE 16702-B

SABLE

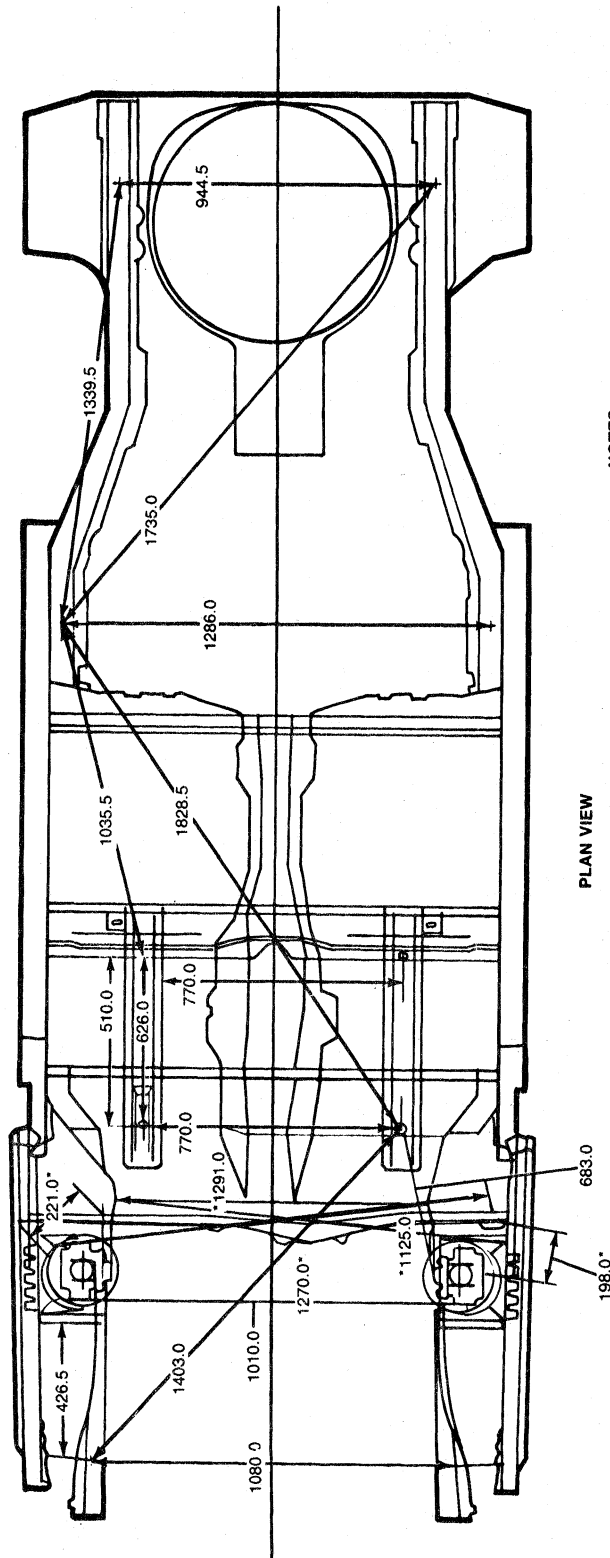
N6648-A



## REMOVAL AND INSTALLATION (Continued)

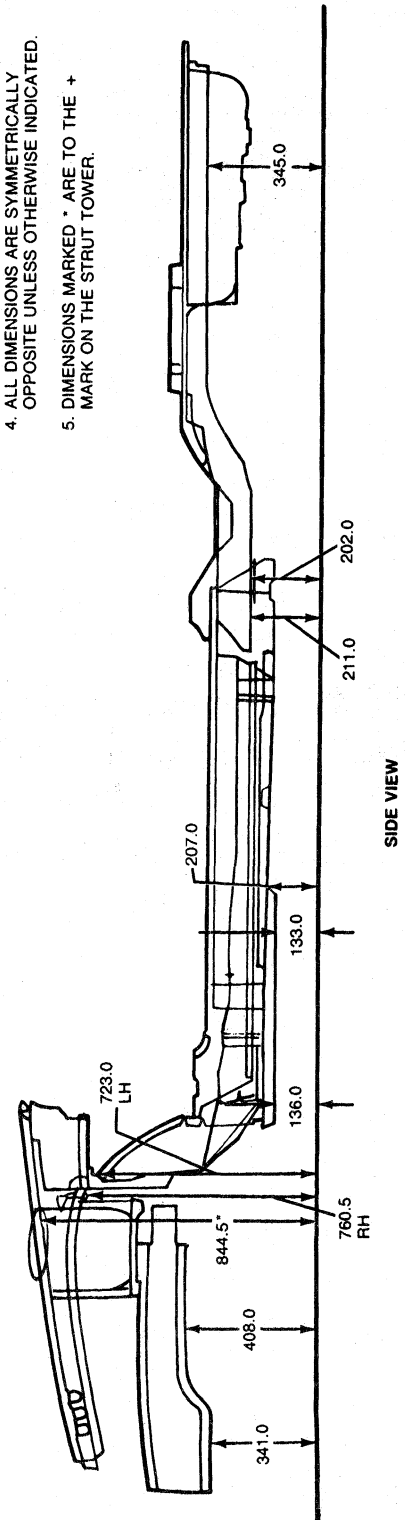
## Underbody Dimensions

All dimensions are point-to-point in millimeters.



## NOTES:

1. ALL DIMENSIONS ARE IN mm.
2. TOLERANCE IS  $\pm 3$ mm.
3. ALL DIMENSIONS ARE TRUE TO LENGTH, CENTER TO CENTER.
4. ALL DIMENSIONS ARE SYMMETRICALLY OPPOSITE UNLESS OTHERWISE INDICATED.
5. DIMENSIONS MARKED \* ARE TO THE + MARK ON THE STRUT TOWER.



N6990-A

1

2

3

# MAINTENANCE AND LUBRICATION

## GROUP 50

SECTION TITLE	PAGE	SECTION TITLE	PAGE
EMISSION SYSTEMS SCHEDULED MAINTENANCE .....	50-29-1	TOWING .....	50-05-1
LUBRICATION POINTS AND LUBRICANT SPECIFICATIONS .....	50-03-1		

## SECTION 50-03 Lubrication Points and Lubricant Specifications

SUBJECT	PAGE	SUBJECT	PAGE
LUBRICATION		SPECIAL SERVICE TOOLS .....	50-03-6
Chassis Lubrication Points .....	50-03-4	SPECIFICATIONS .....	50-03-6
Engine Lubrication Service Points .....	50-03-2	VEHICLE APPLICATION .....	50-03-1
Lubrication Charts .....	50-03-1		

### VEHICLE APPLICATION

Taurus/Sable.

### LUBRICATION

#### Lubrication Charts

The illustrations show typical chassis and engine lubrication points. Vehicles with optional or special equipment may have slightly different or additional lubrication points.

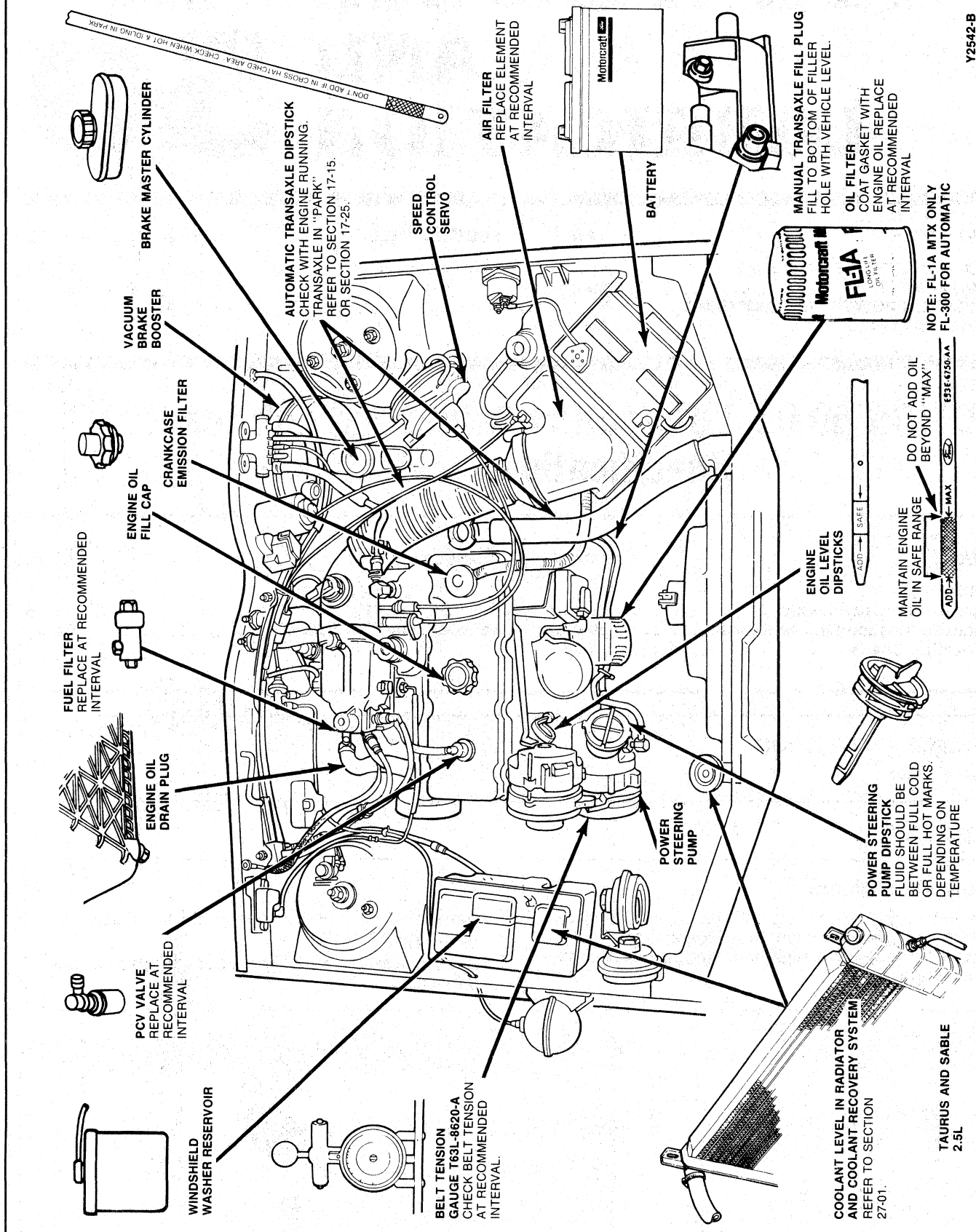
A table of recommended lubricants is included at the end of this Section.

Refer to Section 50-29 for recommended service intervals.

## LUBRICATION (Continued)

## Engine Lubrication Service Points

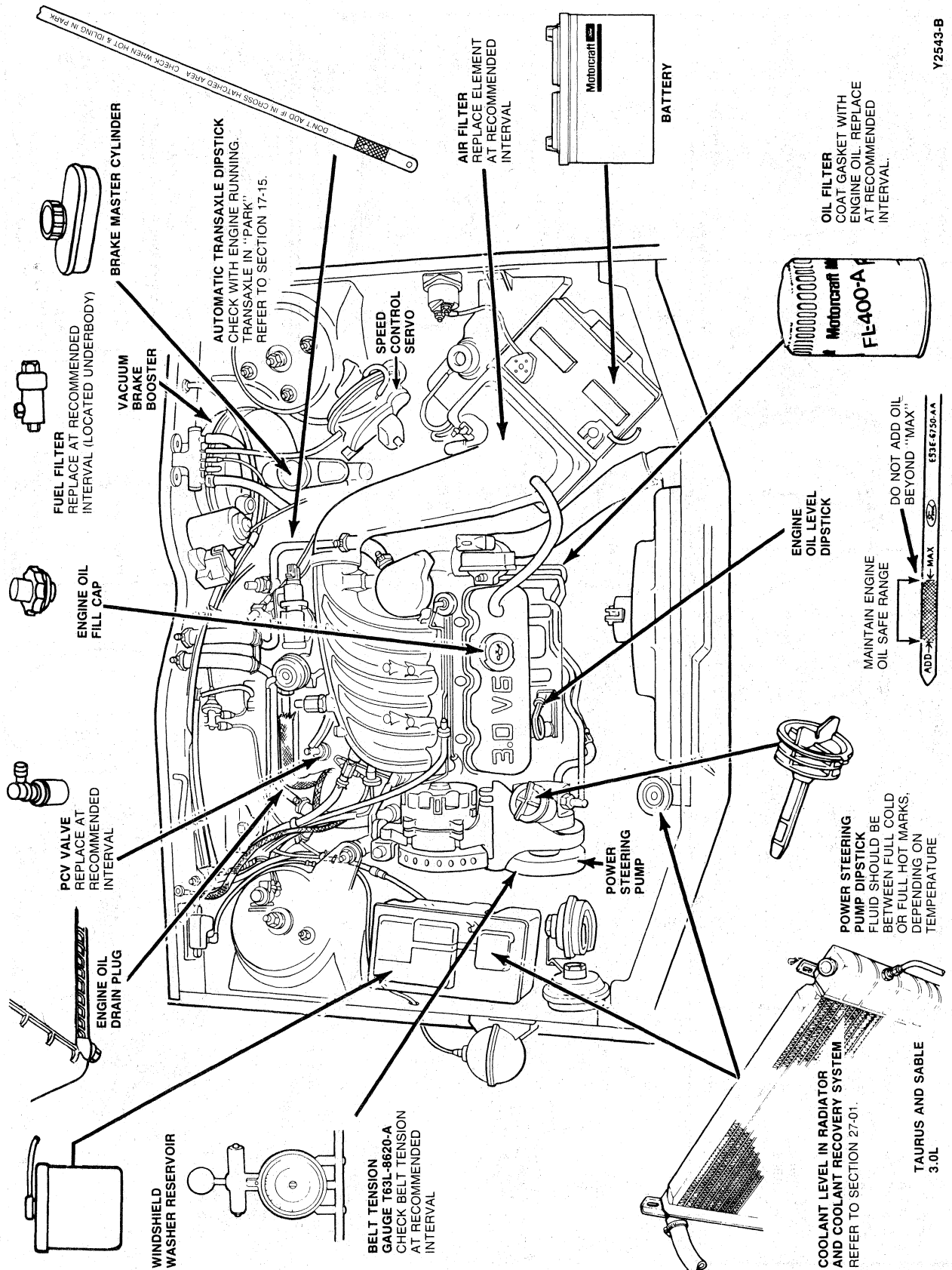
## 2.5L Engine



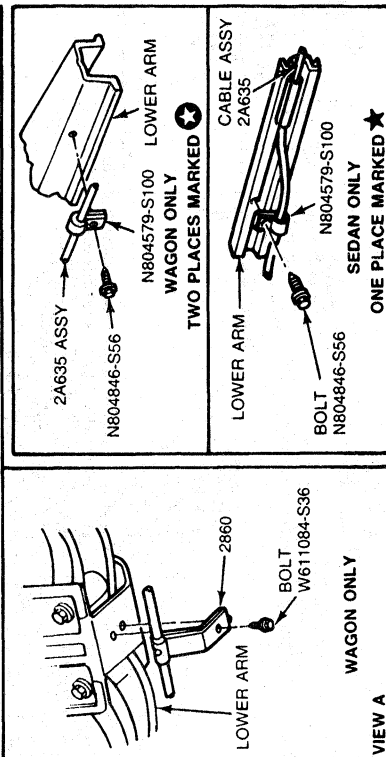
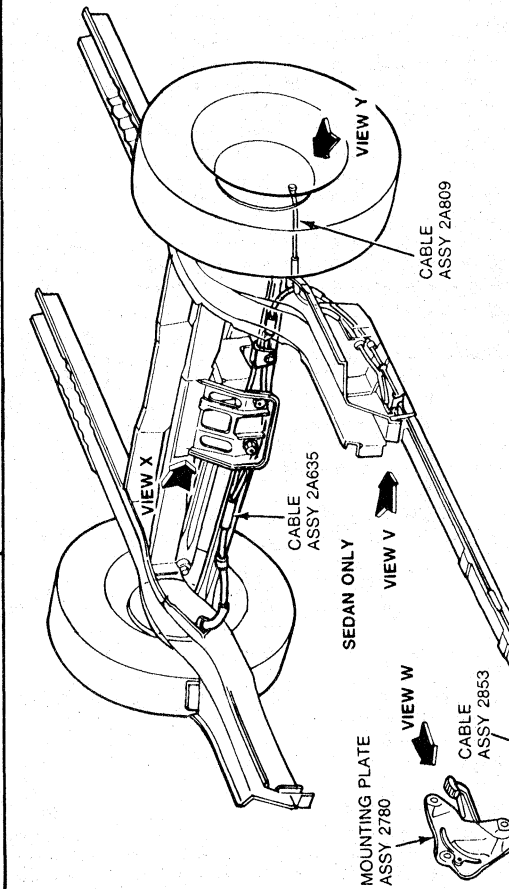
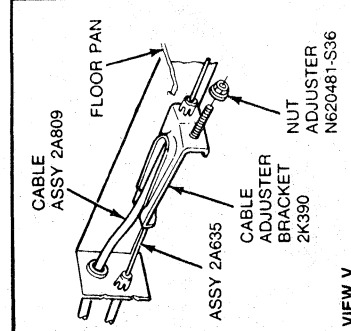
Y2542-B

## LUBRICATION (Continued)

## 3.0L Engine

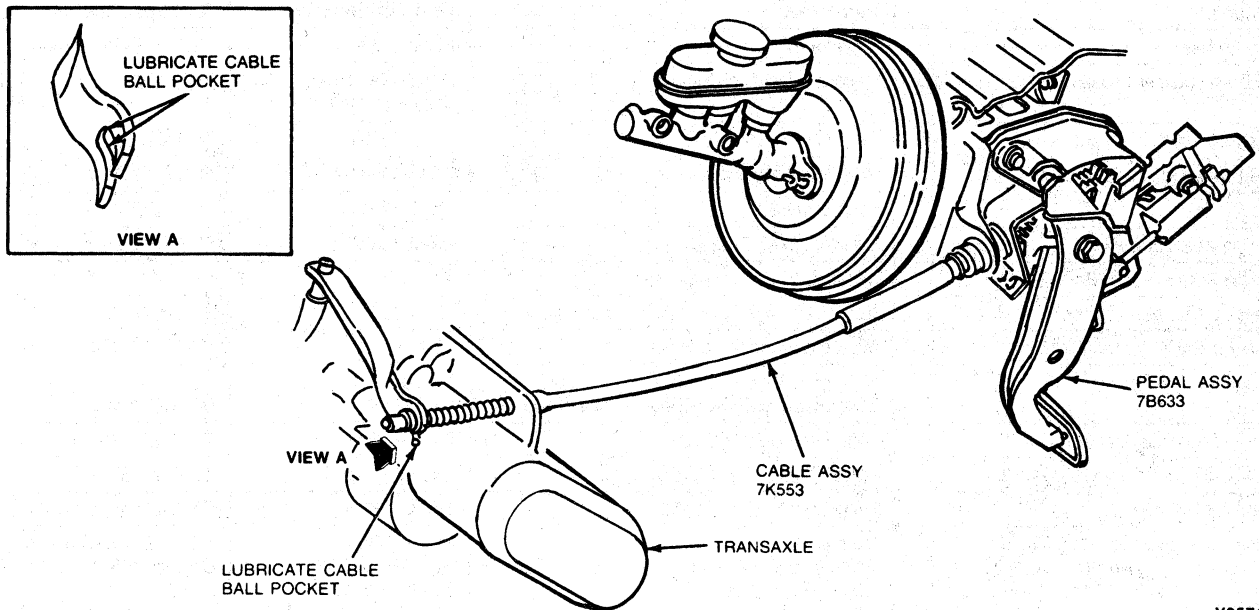


## Chassis Lubrication Points



H3310-B

## LUBRICATION (Continued)



Y2574-A

## SPECIFICATIONS

## LUBRICANT SPECIFICATIONS

Description	Part Name	Ford Part Number	Ford Specification
Door Latches	Polyethylene Grease	D7AZ-19584-A	ESR-M1C159-A
Disc Brake Caliper Locating Pin and Insulator	Silicone Dielectric Compound	D7AZ-19A331-A Motorcraft WA-10	ESE-M1C171-A
*Hinges, Hinge Checks and Pivots	Polyethylene Grease	D7AZ-19584-A	ESR-M1C159-A
Hood Latch and Auxiliary Catch	Polyethylene Grease	D7AZ-19584-A	ESR-M1C159-A
Lock Cylinders	Lock Lubricant	D8AZ-19587-A	ESB-M2C20-A
Steering Gear (Power)	Steering Gear Grease	C3AZ-19578-A	ESW-M1C87-A
Steering-Power (Pump Reservoir)	Motorcraft/Type F Auto. Trans. Fluid	XT-1-QF	ESW-M2C33-F
Transaxle ATX (Automatic)	Motorcraft Ford Type H Auto. Trans. Fluid	XT-2-QDX	DEXRON®-II
Transaxle AXOD (Automatic)	Motorcraft Ford Type H Auto. Trans. Fluid	XT-4-H	ESP-M2C166-H
Transaxle (Manual)	Motorcraft Type F Auto. Trans. Fluid or Motorcraft DEXRON®-II Auto. Trans. Fluid	XT-1-QF or XT-2-QDX	ESW-M2C33-F or DEXRON®-II
2.5L — Manual Transmission	Long-Life Oil Filter FL-1A	D9AZ-6731-A	ES-E1ZE-6714-AA
2.5L — Automatic Transmission	Long-Life Oil Filter FL-300	D4ZZ-6731-B	ES-E3ZE-6714-CA
Engine Oil Filter 3.0L	Long-Life Oil Filter FL-400A	E4FZ-6731-A	ES-E4EE-6714-AA
Engine Oil — Gasoline Engines	Motorcraft: 5W30 Super Premium 10W40 Super Premium 10W30 Premium 20W40 Premium SAE 30 Super Duty 15W40 Super Duty	XO-5W30-QSP XO-10W40-QSP XO-10W30-QP XO-20W40-QP XO-30-QSD XO-15W40-QSD	ESE-M2C153-C and API Category SF, SF/CC or SF/CD
Speedometer Cable	Speedometer Cable Lube	D2AZ-19581-A	ESF-M1C160-A
Engine Coolant	Cooling System Fluid	E2FZ-19549-A	ESE-M97B44-A
Rear Wheel Bearings	Long-Life Lubricant	C1AZ-19590-B	ESA-M1C75-B
Brake Master Cylinder	H.D. Brake Fluid	C6AZ-19542-A	ESA-M6C25-A
Brake Master Cylinder Push Rod and Bushing	Motorcraft SAE 10W30 Engine Oil	XO-10W30-QP	ESE-M2C153-B or -C
Drum Brake Shoe Ledges	Disc Brake Caliper Slide Grease	D7AZ-19590-A	ESA-M1C172-A
Parking Brake Cable	Polyethylene Grease	D0AZ-19584-A	ESR-M1C159-A
Brake Pedal Pivot Bushing	Motorcraft SAE 10W30 Engine Oil	XO-10W30-QP	ESE-M2C153-C
Tire Mounting Bead (of Tire)	Tire Mounting Lube	D9AZ-19583-A	ESA-M1B6-4
Clutch Cable Connection Transmission End	Long-Life Lubricant	C1AZ-19590-B	ESA-M1C75-B
Clutch Release Lever — At Fingers (Both Sides and Fulcrum)			
Clutch Release Bearing Retainer			
Outboard CV Joints	CV Joint Bearing Grease	E2FZ-19590-A	ESP-M1C187-A
Inboard CV Joints	CV Joint Bearing Grease	E43Z-19590-A	ESP-M1C207-A

DEXRON® is a registered trademark of General Motors Corporation.

CY2573-B

## SPECIAL SERVICE TOOLS

Tool Number	Description
T63L-8620-A	Belt Tension Gauge

CY2328-B



## SECTION 50-05 Towing

SUBJECT	PAGE	SUBJECT	PAGE
<b>TOWING</b>		<b>TOWING (Cont'd.)</b>	
Flatbed Towing .....	50-05-2	Towing Slings .....	50-05-1
Preparatory Steps .....	50-05-1	Towing Speeds .....	50-05-1
Taurus/Sable .....	50-05-3	VEHICLE APPLICATION .....	50-05-1

### VEHICLE APPLICATION

Taurus/Sable.

### TOWING

#### Preparatory Steps

Release the parking brake, and place transmission in NEUTRAL. As a general rule, towed vehicles should be pulled with the driving wheels off the ground. If the vehicle is to be towed on its drive wheels, the transmission and differential must be operable. If not place the wheels on a dolly, or disconnect the driveshaft (except front-wheel drive vehicles).

When a vehicle is on its front wheels, the steering wheel must be clamped in the straight ahead position with a steering wheel clamping device designed for towing service use, such as those provided by towing system manufacturers.

Do not use the vehicle's steering column lock to lock the wheels in a straight ahead position when pulled from the rear. If the ignition key is not available, place a dolly underneath the driving wheels of the vehicle and tow with the non-driving wheels raised.

#### Towing Slings

To avoid metal-to-metal contact and possible damage to bumpers or lower body panels, a wide belt sling should be used to lift and tow all vehicles. When attaching towing slings, take care to avoid damage to license plate and frame, fog lamps and air spoiler.

The suggested towing hookups are illustrated.

#### Towing Speeds

When it is necessary to tow the vehicle with the driving wheels on the ground, do not exceed 56 km/h (35 mph) and/or a distance of 80 km (50 miles) or transmission damage can result.

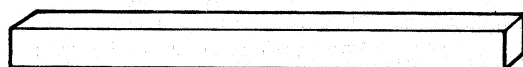
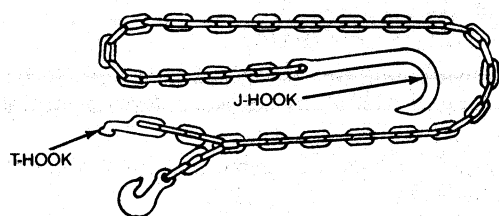
**Towing speed is to be limited to 80 km/h (50 mph) with the driving wheels off the ground. On rough pavement, the maximum towing speed is 56 km/h (35 mph). Maximum towing speed of 56 km/h (35 mph) should be used whenever the tow truck operator is not sure of road surface condition.**

## TOWING (Continued)

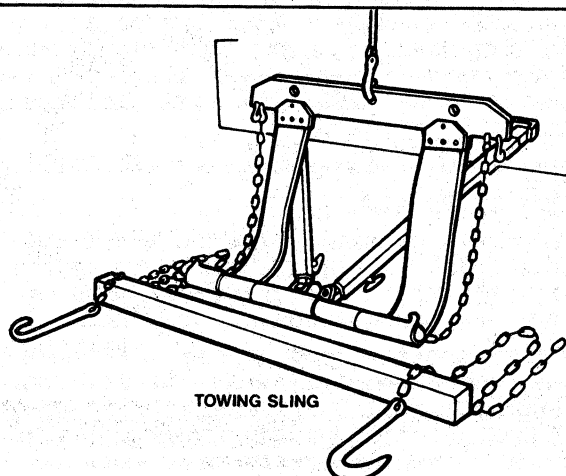
**Flatbed Towing**

Flatbed operators should use the vehicle T-hook slots when vehicle tiedown takes place.

**CAUTION:** Care should be taken when tightening the vehicle to the flatbed portion of the tow truck. Body damage such as buckled fenders etc., could occur if severely tightened.

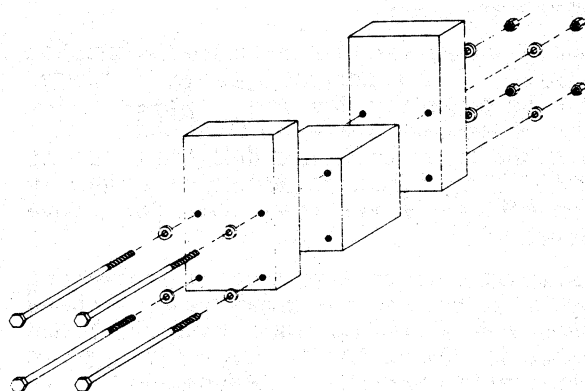
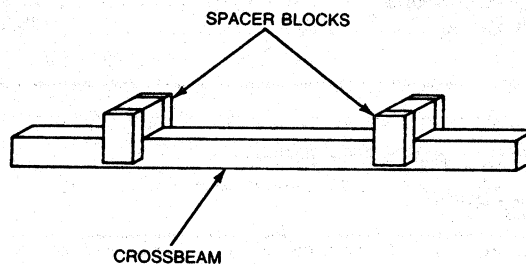


WOOD CROSSBEAM



MATERIAL CROSSBEAM

- 1 — 4 X 4 INCHES X 4 FT
- 1 — 4 X 4 INCHES X 5 FT
- 2 X 4 LUMBER ACTUALLY MEASURES 1-1/2 INCHES X 3-1/2 INCHES
- 4 X 4 LUMBER ACTUALLY MEASURES 3-1/2 INCHES X 3-1/2 INCHES



- SPACER BLOCKS  
MATERIAL:  
4- 2 x 4 x 6" LONG  
2- 4 x 4 x 3-1/2" LONG  
8- 1/4" x 7" CARRIAGE BOLT  
16- 1/4" WASHER

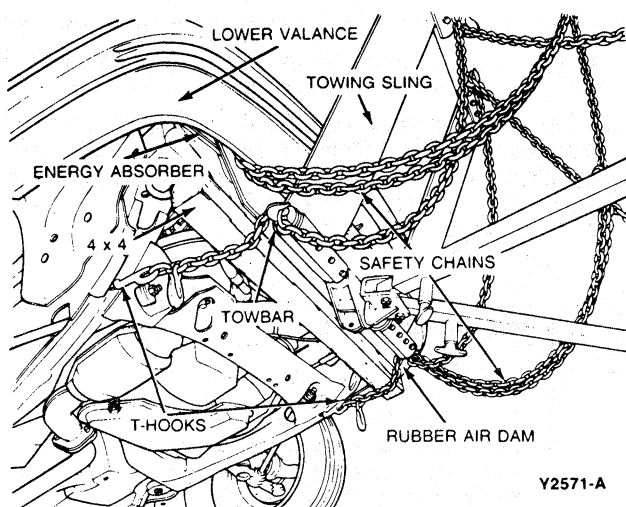
Y2319-F

**TOWING (Continued)****Taurus/Sable****Front—J-Hook Procedure**

**CAUTION:** Do not tow with J-Hooks under any circumstances. J-Hooks will damage driveshafts and control arms.

**Front—T-Hook Procedure**

1. Insert T-hooks in T-slots located on frame rail ahead of front wheels.
2. Position a 4-foot 4 X 4 under radiator support, just behind rubber air dam.
3. Position towbar behind lower valance panel but in front of air conditioner condenser brackets.
4. Position sling belts outboard of license plate brackets.
5. Attach safety chains around bumper energy absorbers.



Y2571-A

**Taurus/Sable****Rear—J-Hook Procedure**

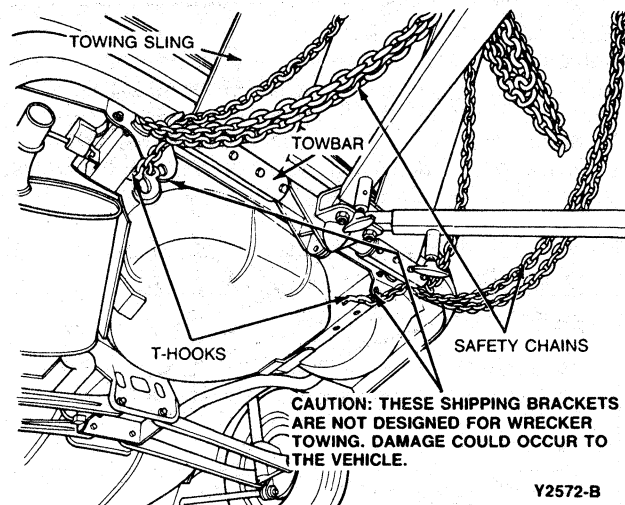
**CAUTION:** Do not tow with J-Hooks under any circumstances. J-Hooks will damage driveshafts and control arms.

**CAUTION:** Placing towing chains on the transverse suspension arms will result in vehicle damage.

**Rear—T-Hook Procedure**

**NOTE:** It is recommended that the Taurus/Sable be towed from the front unless conditions do not allow it.

1. Insert T-hooks in T-slots on frame rail, behind rear tires.
2. Position towbar directly underneath bumper.
3. Position straps of towing sling on either side of license plate.
4. Attach safety chains around bumper energy absorbers.



Y2572-B

# SECTION 50-29 Emission Systems Scheduled Maintenance

SUBJECT	PAGE	SUBJECT	PAGE
DESCRIPTION		VEHICLE APPLICATION .....	50-29-1
Maintenance Schedules .....	50-29-3		
Vehicle Emission Control Information			
Decal .....	50-29-2		

## VEHICLE APPLICATION

Taurus/Sable.

## DESCRIPTION

The Emission System Required Maintenance Schedule lists the items required to maintain the vehicle emission systems at levels determined by the Federal Government (Environmental Protection Agency). Directly before the schedule(s) is an index to a number of Maintenance Procedures, each of which is related to an item listed on the maintenance schedule. Use these procedures to perform the

required emission system maintenance items listed on the maintenance schedules.

Maintenance service adjustments must conform to specifications contained here, listed in the Specifications Manual or shown on the Vehicle Emission Control Information Decal, or the emissions system may become inoperative.

### MAINTENANCE PROCEDURE INDEX

PROCEDURE	MANUAL AND SECTION
I Engine Mechanical Sub-Systems <ul style="list-style-type: none"> <li>• Change Engine Oil and/or Filter</li> <li>• Coolant Condition and Protection</li> <li>• Cooling System Check and Coolant Replacement</li> <li>• Drive Belt Condition and Tension</li> <li>• Air Cleaner and/or Crankcase Filter</li> </ul>	Group 21, Gasoline Engines Section 27-01, Cooling System — Service Section 27-01, Cooling System — Service Section 27-02, Accessory Drive Belts Section 24-41, Air Cleaner and Duct Systems
II Ignition Sub-Systems <ul style="list-style-type: none"> <li>• Spark Plug Replacement</li> </ul>	Section 23-05, Ignition System — Service




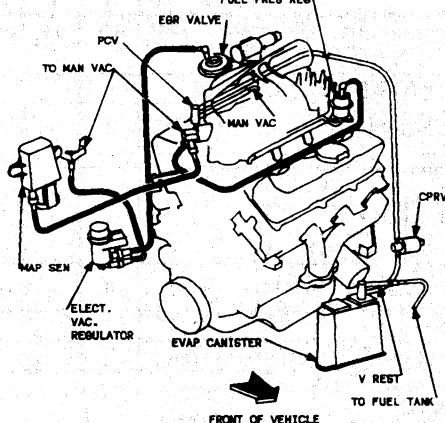
CA9897-A

As a safety precaution, before starting the engine to perform maintenance, ensure the transaxle selector is in PARK (automatic transaxle) or NEUTRAL (manual transaxle), the parking brake is set and the wheels are blocked.

## DESCRIPTION (Continued)

### Vehicle Emission Control Information Decal

Vacuum hoses on the engine use a color stripe to aid in hose routing checks. The stripe will usually be the same color as on the Vehicle Emission Control Information (VECI) label, but the correct vacuum hose routing must be verified by using the correct component connections shown on the VECI label.

	<b>FORD MOTOR COMPANY</b> <b>VEHICLE EMISSION CONTROL INFORMATION</b>	<b>VACUUM HOSE ROUTING</b>
<p>THIS VEHICLE IS EQUIPPED WITH EEC II/EFI SYSTEMS. IDLE SPEEDS AND IDLE MIXTURES ARE NOT ADJUSTABLE. SEE SHOP MANUAL FOR ADDITIONAL INFORMATION.</p> <p>ADJUST IGNITION TIMING WITH THE TRANSMISSION IN NEUTRAL, PARKING BRAKE SET AND THE WHEELS BLOCKED. ENGINE MUST BE AT NORMAL OPERATING TEMPERATURE.</p> <ol style="list-style-type: none"> <li>(1) TURN OFF ENGINE.</li> <li>(2) DISCONNECT SMALL IN-LINE SPOUT CONNECTOR (  OR  ) LOCATED NEAR THE DISTRIBUTOR.</li> <li>(3) RE-START PREVIOUSLY WARMED-UP ENGINE.</li> <li>(4) ADJUST IGNITION TIMING TO 10° BTDC.</li> <li>(5) TURN OFF ENGINE AND RESTORE ELECTRICAL CONNECTION.</li> </ol> <p>THIS VEHICLE CONFORMS TO U.S. EPA AND CALIFORNIA REGULATIONS APPLICABLE TO 1986 MODEL YEAR NEW MOTOR VEHICLES INTRODUCED INTO COMMERCE SOLELY FOR SALE IN CALIFORNIA.</p> <p style="text-align: center;">USE SAE 5W-30 OIL API CATAGORY SF, SF/CC OR SF/CD.</p>		
E6AE-9C485- <b>ACG</b>	<b>CATALYST</b>	SPARK PLUG-AWSF-32C      GAP-.042-.046 3.0L-6HM 8FM3.0V5FED2-F1/EOR/EGS/TWC

A9895-A

## DESCRIPTION (Continued)

## Maintenance Schedules

## CUSTOMER MAINTENANCE SCHEDULE 1 — UNIQUE DRIVING CONDITIONS — GASOLINE ENGINES

Follow this Schedule if your driving habits FREQUENTLY include:

- Operating when outside temperatures remain **below freezing** and most trips are less than 5 miles (8 km).
- Operating during **HOT WEATHER** (above 90°F, 32°C) and:
  - Driving continuously in excess of normal highway speeds;
  - Driving in stop-and-go "rush hour" traffic.
- Towing a trailer, using a camper or car-top carrier or otherwise carrying heavy loads.
- Operating in severe dust conditions.
- Extensive idling, such as police, taxi or door-to-door delivery use.

SERVICE INTERVALS Perform at the months or distances shown, whichever comes first.	Miles × 1000	3	6	9	12	15	18	21	24	27	30	33	36	39	42	45	48
	Kilometers × 1000	4.8	9.6	14.4	19.2	24	28.8	33.6	38.4	43.2	48	52.8	57.6	62.4	67.2	72	76.8
EMISSIONS CONTROL SERVICE																	
Change Engine Oil (every 3 months) or		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Change Engine Oil Filter (every 3 months) or		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Spark Plugs: Check/Regap			X		X		X		X				X		X		X
Replace											X						
Inspect Accessory Drive Belt(s)											X						
Replace Air Cleaner Filter (1)											X						
Replace Crankcase Emission Filter (1) (2.5L Engine)											X						
Replace Engine Coolant Every 36 Months											X						
Check Engine Coolant Protection, Hoses and Clamps		ANNUALLY															
GENERAL MAINTENANCE																	
Inspect Exhaust Heat Shields											X						
Change Automatic Transmission Fluid (2)											X						

(1) If operating in severe dust, ask your dealer for proper replacement intervals.

(2) If your vehicle accumulates 5,000 miles (8 000 km) or more per month or is used in CONTINUOUS stop and go service, change every 30,000 miles (48 000 km) — not necessary for severe dust, short trips or extensive idling.

(X) All items with either an "X" or an "(X)" code are required to be performed in all states except California. For cars sold in California, only "X" items are REQUIRED to be performed. However, Ford recommends that you also perform maintenance on items designated by an "(X)" in order to achieve best vehicle operation.

CA9896-A

## TAURUS/SABLE CUSTOMER MAINTENANCE SCHEDULE B — 2.5L ENGINES

Follow this Schedule if, generally, you drive your vehicle on a daily basis for several miles and NONE OF THE UNIQUE DRIVING CONDITIONS SHOWN IN SCHEDULE 1 APPLY TO YOUR DRIVING HABITS.

SERVICE INTERVALS	Miles x 1000	7.5	15	22.5	30	37.5	45	52.5	60
Perform at the months or distances shown, whichever comes first.	Kilometers x 1000	12	24	36	48	60	72	84	96
EMISSIONS CONTROL SERVICE									
Four Cylinder									
Change Engine Oil (Every 6 Months) or		X	X	X	X	X	X	X	X
Change Oil Filter (Every 6 Months) or		X	X	X	X	X	X	X	X
Replace Spark Plugs					X				X
Change crankcase emission filter (2.5L Engines)					X				
Inspect Accessory Drive Belt(s)					X				X
Replace Air Cleaner Filter					X				X
Change Engine Coolant Every 36 Months or					X				X
Check Engine Coolant Protection, Hoses and Clamps	ANNUALLY								
GENERAL MAINTENANCE									
Check Exhaust Heat Shields (If so equipped)					X				X

(X) All items with either an "X" or an "(X)" code are required to be performed in all states except California. For vehicles sold in California, only "X" items are REQUIRED to be performed. However, Ford recommends that you also perform maintenance on items designated by an "(X)" in order to achieve best vehicle operation.

CA9481-B

## INTRODUCTION

Most threaded fasteners are covered by specifications that define required mechanical properties, such as tensile strength, yield strength, proof load and hardness. These specifications are carefully considered in initial selection of fasteners for a given application. To assure continued satisfactory vehicle performance, replacement fasteners used should be of the correct strength, as well as the correct nominal diameter, thread pitch, length, and finish.

Most original equipment fasteners (English system or Metric) are identified with markings or numbers indicating the strength of the fastener. These markings are described in the pages that follow. Attention to these markings is important in assuring that the proper replacement fasteners are used.

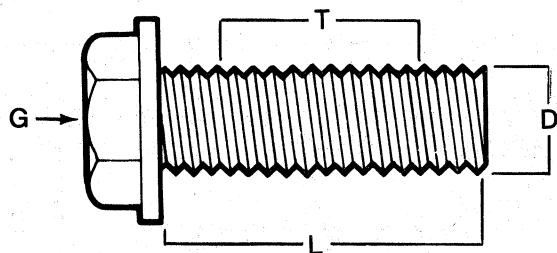
Further, some metric fasteners, especially nuts, are colored blue. This metric blue identification is in most cases a temporary aid for production start-up, and color will generally revert to normal black or bright after start-up.

English system and metric system fasteners are available through your Ford Parts and Service operation.

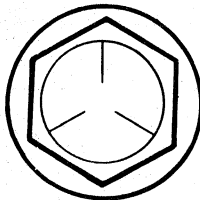
## NOMENCLATURE FOR BOLTS

### (ENGLISH) INCH SYSTEM

**Bolt, 1/2-13x1**

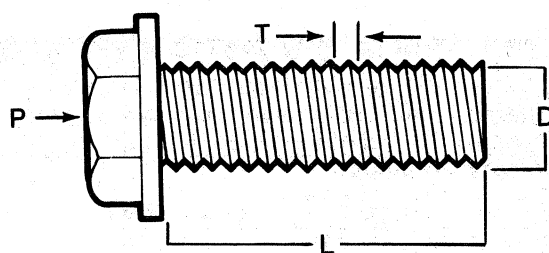


- G—Grade Marking  
(bolt strength)
- L—Length, (inches)\*\*
- T—Thread Pitch  
(thread/inch)
- D—Nominal Diameter  
(inches)

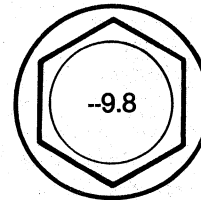


### METRIC SYSTEM

**Bolt M12-1.75x25**



- P—Property Class\*  
(bolt strength)
- L—Length (millimeters)\*\*
- T—Thread Pitch (thread width  
crest to crest mm)
- D—Nominal Diameter  
(millimeters)

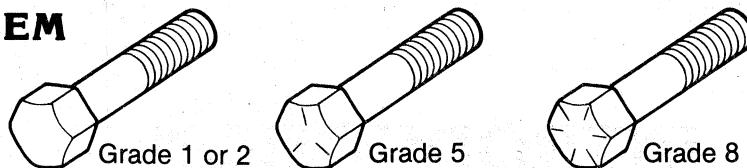


\*The property class is an Arabic numeral distinguishable from the slash SAE English grade system.

\*\*The length of all bolts is measured from the underside of the head to the end.

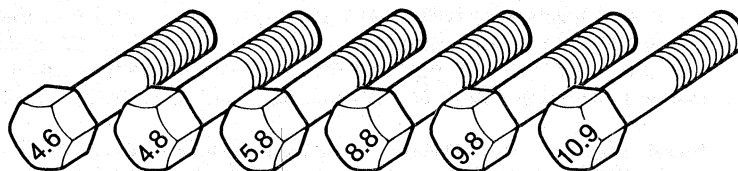
## BOLT STRENGTH IDENTIFICATION

### (ENGLISH) INCH SYSTEM



English (Inch) bolts—Identification marks correspond to bolt strength—increasing number of slashes represent increasing strength.

### METRIC SYSTEM



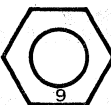
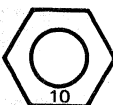


Metric bolts—Identification class numbers correspond to bolt strength—increasing numbers represent increasing strength. Common metric fastener bolt strength property are 9.8 and 10.9 with the class identification embossed on the bolt head.

## HEX NUT STRENGTH IDENTIFICATION

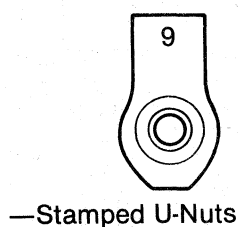
### (ENGLISH) INCH SYSTEM

### METRIC SYSTEM

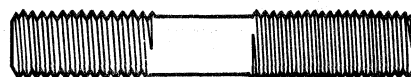
Grade	Hex Nut Grade 5	Hex Nut Grade 8	Class	Hex Nut Property Class 9	Hex Nut Property Class 10
Identification			Identification		
	3 Dots	6 Dots		Arabic 9	Arabic 10
Increasing dots represent increasing strength.			May also have blue finish or paint daub on hex flat. Increasing numbers represent increasing strength.		

## OTHER TYPES OF PARTS

Metric identification schemes vary by type of part, most often a variation of that used of bolts and nuts. Note that many types of English and metric fasteners carry no special identification if they are otherwise unique.



—Tapping, thread forming and certain other case hardened screws



CLASS  
10.9

CLASS  
9.8

CLASS  
8.8

—Studs, Large studs may carry the property class number. Smaller studs use a geometric code on the end.



## ENGLISH METRIC CONVERSION

Description	Multiply	By	For Metric Equivalent
ACCELERATION	Foot/sec <sup>2</sup>	0.304 8	metre/sec <sup>2</sup> (m/s <sup>2</sup> )
	Inch/sec <sup>2</sup>	0.025 4	metre/sec <sup>2</sup>
TORQUE	Pound-inch	0.112 98	newton-metres (N·m)
	Pound-foot	1.355 8	newton-metres
POWER	horsepower	0.746	kilowatts (kw)
PRESSURE or STRESS	inches of water	0.2488	kilopascals (kPa)
	pounds/sq. in.	6.895	kilopascals (kPa)
ENERGY or WORK	BTU	1 055.	joules (J)
	foot-pound	1.355 8	joules (J)
	kilowatt-hour	3 600 000. or $3.6 \times 10^6$	joules (J = one W's)
LIGHT	foot candle	10.76	lumens/metre <sup>2</sup> (lm/m <sup>2</sup> )
FUEL PERFORMANCE	miles/gal	0.425 1	kilometres/litre (km/l)
	gal/mile	2.352 7	litres/kilometre (l/km)
VELOCITY	miles/hour	1.609 3	kilometres/hr. (km/h)
LENGTH	inch	25.4	millimetres (mm)
	foot	0.304 8	metres (m)
	yard	0.914 4	metres (m)
	mile	1.609	kilometres (km)
AREA	inch <sup>2</sup>	645.2	millimetres <sup>2</sup> (mm <sup>2</sup> )
		6.45	centimetres <sup>2</sup> (cm <sup>2</sup> )
	foot <sup>2</sup>	0.092 9	metres <sup>2</sup> (m <sup>2</sup> )
	yard <sup>2</sup>	0.836 1	metres <sup>2</sup>
VOLUME	inch <sup>3</sup>	16 387.	mm <sup>3</sup>
	inch <sup>3</sup>	16.387	cm <sup>3</sup>
	quart	0.016 4	litres (l)
	quart	0.946 4	litres
	gallon	3.785 4	litres
	yard <sup>3</sup>	0.764 6	metres <sup>3</sup> (m <sup>3</sup> )
MASS	pound	0.453 6	kilograms (kg)
	ton	907.18	kilograms (kg)
	ton	0.90718	tonne
FORCE	kilogram	9.807	newtons (N)
	ounce	0.278 0	newtons
	pound	4.448	newtons
TEMPERATURE	degree fahrenheit	0.556 (°F -32)	degree Celsius (°C)

## DECIMAL AND METRIC EQUIVALENTS

Fractions	Decimal Inch	Metric mm
1/64	.015625	.397
1/32	.03125	.794
3/64	.046875	1.191
1/16	.0625	1.588
5/64	.078125	1.984
3/32	.09375	2.381
7/64	.109375	2.778
1/8	.125	3.175
9/64	.140625	3.572
5/32	.15625	3.969
11/64	.171875	4.366
3/16	.1875	4.763
13/64	.203125	5.159
7/32	.21875	5.556
15/64	.234375	5.953
1/4	.250	6.35
17/64	.265625	6.747
9/32	.28125	7.144
19/64	.296875	7.54
5/16	.3125	7.938
21/64	.328125	8.334
11/32	.34375	8.731
23/64	.359375	9.128
3/8	.375	9.525
25/64	.390625	9.922
13/32	.40625	10.319
27/64	.421875	10.716
7/16	.4375	11.113
29/64	.453125	11.509
15/32	.46875	11.906
31/64	.484375	12.303
1/2	.500	12.7

Fractions	Decimal Inch	Metric mm
33/64	.515625	13.097
17/32	.53125	13.494
35/64	.546875	13.891
9/16	.5625	14.288
37/64	.578125	14.684
19/32	.59375	15.081
39/64	.609375	15.478
5/8	.625	15.875
41/64	.640625	16.272
21/32	.65625	16.669
43/64	.671875	17.066
11/16	.6875	17.463
45/64	.703125	17.859
23/32	.71875	18.256
47/64	.734375	18.653
3/4	.750	19.05
49/64	.765625	19.447
25/32	.78125	19.844
51/64	.796875	20.241
13/16	.8125	20.638
53/64	.828125	21.034
27/32	.84375	21.431
55/64	.859375	21.828
7/8	.875	22.225
57/64	.890625	22.622
29/32	.90625	23.019
59/64	.921875	23.416
15/16	.9375	23.813
61/64	.953125	24.209
31/32	.96875	24.606
63/64	.984375	25.003
1	1.00	25.4

## TORQUE CONVERSION

NEWTON METRES (N·m)	POUND-FEET (LB·FT)
1	0.7376
2	1.5
3	2.2
4	3.0
5	3.7
6	4.4
7	5.2
8	5.9
9	6.6
10	7.4
15	11.1
20	14.8
25	18.4
30	22.1
35	25.8
40	29.5
50	36.9
60	44.3
70	51.6
80	59.0
90	66.4
100	73.8
110	81.1
120	88.5
130	95.9
140	103.3
150	110.6
160	118.0
170	125.4
180	132.8
190	140.1
200	147.5
225	166.0
250	184.4

POUND-FEET (LB·FT)	NEWTON METRES (N·m)
1	1.356
2	2.7
3	4.0
4	5.4
5	6.8
6	8.1
7	9.5
8	10.8
9	12.2
10	13.6
15	20.3
20	27.1
25	33.9
30	40.7
35	47.5
40	54.2
45	61.0
50	67.8
55	74.6
60	81.4
65	88.1
70	94.9
75	101.7
80	108.5
90	122.0
100	135.6
110	149.1
120	162.7
130	176.3
140	189.8
150	203.4
160	216.9
170	230.5
180	244.0



# Glossary

The glossary is a list of technical terms or acronyms and their definitions. It is not intended to be a dictionary of components and their functions. If you desire a detailed description of a specific component, please refer to Section 3, Emission Related Components, in this manual.

**A/C:** Air Conditioning.

**ACCS:** A/C Cycling Switch.

**ACL:** Automatic Adjustable Shock Controller.

**A/CL BIMET:** Air Cleaner Bimetal sensor.

**A/C DV:** Air Cleaner Duct and Valve motor.

**ACC:** A/C Clutch Compressor signal input to the EEC-IV processor relating status of the A/C clutch.

**ACD:** Air Conditioner Demand switch.

**ACT:** Air Charge Temperature sensor or its signal circuit.

**ACV:** (Thermactor) Air Control Valve.

**AHFSS:** Air Condition/Heater Function Select Switch input to the EEC-IV processor relating status of the A/C heater function select switch.

**AIR BPV:** (A Thermactor) Air Bypass Valve.

**AM1:** Thermactor Air Management 1 (TAB).

**AM2:** Thermactor Air Management 2 (TAD).

**AMBIENT TEMPERATURE:** Temperature of air surrounding an object e.g., temperature where vehicle is being worked on.

**ANTI-BFV:** Anti-Backfire Valve.

**AVOM:** Analog Volt-Ohm Meter.

**AXOD:** Automatic Transaxle Overdrive.

**AXOD-E:** Automatic Transaxle Overdrive, Electronically Controlled.

**BASE IDLE:** Idle RPM determined by throttle lever hardset on throttle body while Idle Speed Control is fully retracted and disconnected.

**BOB:** (Breakout Box) An EEC-IV test device which connects in series with the processor and the EEC-IV harness and permits measurements of processor inputs and outputs.

**BOO:** Brake On-Off input to the EEC-IV processor indicating a braking drive mode.

**BOOST:** Turbo charger boost solenoid or its control circuit.

**BP:** Barometric Pressure sensor or its signal circuit.

**BV:** Bowl Vent (Carburetor Fuel Bowl).

**CANP:** Canister Purge solenoid or its control circuit.

**CATALYST:** A muffler like device in the exhaust system containing a monolithic substrate (a ceramic honeycomb structure) that is coated with catalytic metals such as platinum or palladium. When hot exhaust gases come in contact with these metals a chemical reaction takes place to consume unburned hydrocarbon, carbon monoxide and nitrous oxides.

**CCO:** Converter Clutch Override output from the EEC-IV processor to the transmission.

**CFI:** (Central Fuel Injection) A computer controlled fuel metering system which sprays atomized fuel into a throttle body mounted atop the intake manifold.

**CLUTCH:** Clutch engagement switch or its control circuit.

**COC:** Conventional Oxidation Catalyst.

**COMPUTER TIMING:** The total spark advance in degrees before top dead center. Calculated by the EEC-IV processor based on input from a number of sensors.

**CURB IDLE:** Computer controlled Idle RPM.

**CWM:** Cold Weather Modulator.

**DFS:** Decel Fuel Shut-off.

**DOL:** (Data Output Link) Fuel calculation data from the EEC-IV processor to the electronic trip minder.

**DV:** Delay Valve.

**DVOM:** Digital Volt-Ohm Multimeter that displays voltage or resistance measurements in digital form on a liquid crystal display (LCD).

**DV TW:** Delay Valve Two Way.

# Glossary

**ECA:** Electronic Control Assembly.

**ECT:** Engine Coolant Temperature sensor or its signal circuit.

**EDF:** Electro-Drive Fan relay or its control circuit.

**EEC:** (Electronic Engine Control) A computer controlled system of engine control.

**EEGR:** Electronic EGR Valve (Sonic).

**EFI:** (Electronic Fuel Injection) A computer controlled fuel system that distributes atomized fuel through an injector located in each intake port of the engine.

**EGO:** Exhaust Gas Oxygen sensor or its signal circuit.

**EGOG:** EGO Ground.

**EGR:** Exhaust Gas Recirculation system designed to allow the flow of inert exhaust gases into the combustion chamber to cool the combustion and thus reduce nitrous oxides in the exhaust.

**EGR S/O:** EGR Shut Off.

**EGRC:** EGR Control vacuum solenoid valve or its control circuit.

**EGRV:** EGR Vent vacuum solenoid valve or its control circuit.

**EHC:** Exhaust Heat Control vacuum solenoid valve or its control circuit.

**EVP:** EGR Valve Position sensor or its signal circuit.

**EVR:** EGR Valve Regulator vacuum solenoid valve or its control circuit.

**FBC:** (Feedback Carburetor) An MCU or EEC-IV controlled fuel system employing a stepper motor or a dithering solenoid that controls fuel/air mixture by bleeding air into the main and idle systems of the carburetor.

**FCS:** Fuel Control Solenoid or its control circuit.

**FI:** Fuel Injector or its control circuit.

**FP:** Fuel Pump relay or its control circuit.

**FUEL RICH/LEAN:** A qualitative evaluation of air/fuel ratio based on an A/F value known as

stoichiometry or 14.7. In the EEC-IV system rich/lean is determined by a voltage signal from the EGO sensor. An excess of oxygen (lean) is an EGO voltage of less than .4 volts, a rich condition is indicated by an EGO voltage of greater than .6 volts.

**GND or GRND:** A common ground circuit for all vehicle power.

**HALL EFFECT:** A process where current is passed through a small slice of semi-conductor material at the same time as a magnetic field to produce a small voltage in the semi-conductor.

**HBV:** Heater Blower Voltage input to the EEC-IV processor reflecting heater blower voltage demand.

**HEDF:** High speed Electro-Drive Fan relay or its control circuit.

**HEGO:** Heated EGO sensor or its signal circuit.

**HEGOG:** Heated EGO Ground.

**HIC:** Hot Idle Compensator.

**HO:** High Output.

**HSC:** High Swirl Combustion.

**IBP:** Integral Backpressure.

**IAS:** Inlet Air Solenoid valve or its control circuit.

**IDLE LIMITER:** A device to control minimum and maximum idle fuel richness. The idle limiter is intended to prevent unauthorized persons from making overly rich idle adjustments.

**IDM:** (Ignition Diagnostics Monitor) A continuous monitor of the ignition input to the EEC-IV processor used to detect intermittent ignition faults.

**IMS:** (Inferred Mileage Sensor) A circuit using a E-cell which deflates its state with the application of a current. As the vehicle ages (in terms of key on time) the EEC-IV processor compensates for aging of the vehicle by changing calibration parameters.

**INJ:** Injector (Fuel).

**INJ GND:** Injector Ground (Fuel).

**ISC:** (Idle Speed Control) Currently there are three types of computer controlled idle speed control: D.C. motor ISC, air bypass ISC, and throttle kicker ISC.

# Glossary

**ITS:** Idle Tracking Switch.

**KAM:** (Keep Alive Memory) A series of vehicle battery powered memory locations in the microprocessor which allows the microprocessor to store input failures identified during normal operation for use in later diagnostic routines and adopts some calibration parameters to compensate for changes in the vehicle system.

**KAPWR:** Keep Alive Power.

**KS:** Knock Sensor or its signal circuit.

**L:** Liters.

**LOS:** (Limited Operation Strategy) Certain types of computer malfunction will place the EEC-IV processor into LOS mode. Output commands are replaced with fixed valves.

**LUS:** Lock Up Solenoid.

**MAP:** Manifold Absolute Pressure sensor or its signal circuit.

**MCU:** Microprocessor Control Unit.

**NDS:** Neutral Drive Switch and its signal circuit.

**NGS:** Neutral Gear Switch or its signal circuit.

**NPS:** Neutral Pressure Switch.

**OCC:** Output Circuit Check.

**OCT:** Octane Switch.

**OPEN CIRCUIT:** A circuit which does not provide a complete path for the flow of current.

**OSC:** Output State Check.

**PCV:** (Positive Crankcase Ventilation) A system which controls the flow of crankcase vapors into the engine intake manifold where they are burned in combustion rather than being discharged into the atmosphere.

**PFE:** Pressure Feedback EGR sensor or its signal.

**PIP:** (Profile Ignition Pickup) a "hall effect" vane switch that furnishes crankshaft position data to the EEC-IV processor.

**PSPS:** (Power Steering Pressure Switch) An EEC-IV processor input to regulate idle speed based on power steering load demand.

**PULSE AIR SYSTEM:** Part of the emission control system that utilizes a reed-type check valve which allows air to be drawn into the exhaust system as a result of exhaust pulses.

**PVS:** Ported Vacuum Switch.

**PWR GND:** Power Ground.

**QUICK TEST:** A functional diagnostic test of the EEC system consisting of vehicle preparation and hookup, key on engine off, engine running and continuous self-tests.

**RELAY:** A switching device operated by a low current circuit which controls the opening and closing of another circuit of higher current capacity.

**RELIEF VALVE:** A pressure limiting valve located in the exhaust chamber of the thermactor air pump. It functions to relieve part of the exhaust airflow if the pressure exceeds a calibrated value.

**SEFI:** (Sequential Electronic Fuel Injection) Port fuel injection triggered off ignition timing that fires each injector separately.

**SDV:** Spark Delay Valve.

**SHED:** Sealed Housing Evaporative Determination System.

**SIG RTN:** Signal Return circuit for all sensor signals except EGO.

**SIL:** (Shift Indicator Light) A system that provides a visual indication to the driver of a vehicle when to shift to the next higher gear to obtain optimum fuel economy.

**SOLENOID:** A wire coil with a moveable core that changes position by means of electro-magnetism when current flows through the coil.

**SPOUT:** Spark Output Signal from the EEC-IV processor that triggers the TFI-IV module to fire the ignition coil.

**SS 3/4-4/3:** (Shift Solenoid 3/4-4/3) Output from the EEC-IV processor to the transmission that selects 3rd and 4th gears.

# Glossary

**STAR:** (Self Test Automatic Readout) A testing device in which the EEC and MCU systems output service codes in a digital format.

**STI:** Self Test Input circuit in the EEC and MCU systems used to initiate self test.

**STO:** Self Test Output circuit in the EEC and MCU systems that transmits service codes (pulses) to either a VOM or star tester.

**SVO:** Special Vehicle Operations.

**TAB/TAD:** Thermactor Air Bypass/Thermactor Air Diverter vacuum solenoid valves or their control circuits.

**TCP:** Temperature Compensated (Acceleration) Pump.

**TFI:** (Thick Film Ignition) Distributor mounted module comprised of a custom integrated circuit, Darlington output device and associated thick film integrated components.

**TGS:** (Top Gear Switch) A lock out mechanism that prevents the SIL from lighting when the vehicle is in top gear.

**THERMACTOR:** A system for injection of air into the exhaust system to aid in the control of hydrocarbon and carbon monoxides in the exhaust.

**THERMACTOR II:** See Pulse Air System.

**THS:** Transmission Hydraulic Switch.

**THS 3/2:** Transmission Hydraulic Switch - 3rd/2nd gear.

**THS 4/3:** Transmission Hydraulic Switch - 4th/3rd gear.

**TIMING:** Relationship between spark plug firing and piston position usually expressed in crank shaft degrees before (BTDC) or after (ATDC) top dead center of the compression stroke.

**TIV:** Thermactor Idle Vacuum Valve.

**TK:** Throttle Kicker vacuum solenoid valve or its control circuit.

**TP:** Throttle Position sensor or its signal circuit.

**TSP:** Throttle Solenoid Positioner.

**TVS:** Temperature Vacuum Switch.

**TVV:** Thermal Vent Valve.

**TWC:** Three Way Catalyst.

**VAF:** Vane Air Flow sensor or its signal circuit.

**VAT:** Vane Air Temperature sensor or its signal circuit.

**VBATT:** Vehicle Battery voltage.

**VCV:** Vacuum Check Valve.

**VDV:** Vacuum Delay Valve.

**VM:** Vane Meter.

**VOM:** Volt-Ohm Meter used to measure voltage and resistance. Readings are indicated by sweep hand on a printed scale rather than a digital display.

**VOTM:** Vacuum Operated Throttle Modulator.

**VPWR:** Vehicle Power supply voltage regulated to 10-14 volts.

**VR/S:** Vacuum Regulator/Solenoid.

**VRDV:** Vacuum Retard Delay Valve.

**VREF:** Reference voltage supplied by the EEC-IV processor to some sensors and regulated to 4-6 volts.

**VRESER:** Vacuum Reservoir.

**VREST:** Vacuum Restrictor.

**VRV:** Vacuum Regulator Valve.

**VSC:** Vehicle Speed Control sensor or its signal circuit.

**VSS:** Vehicle Speed Sensor or its signal circuit.

**VVA:** Venturi Vacuum Amplifier.

**VVC:** Variable Voltage Choke relay or its control circuit.

**VVV:** Vacuum Vent Valve.

**WAC:** Wide (open throttle) A/C Cutoff.

**WOT:** Wide Open Throttle.



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